



pravahini

Monthly Compendium

SUCCESS MANTRA (GTB Nagar)

PREFACE

It gives us great pleasure to release the monthly edition of the PRAVAHINI – Monthly e-Compendium & Weekly e-Periodicals of Current Affairs. The magazine's members have shown considerable cooperation as well as devotion. We at successmantra.in work tirelessly to create this magazine and bring it to you with a great sense of gratitude.

The PRAVAHINI April-2022 eBook covers the current events that happened in the month of April. Current Affairs is a crucial component of any competitive exams including CLAT, AILET, DU-LLB, HM, CAT, IAS, PCS, SSC, Banking, MBA and various other competitive examinations.

Current Affairs play the bigger role in many competitive and government exams. It holds the power of making or breaking your chance of success. Therefore, the candidates should cover the Current Affairs thoroughly and smartly.

The PRAVAHINI April-2022 eBook is divided into different sections keeping in mind the need of various exams. The sections covered namely International, National, Economy, Ecology and Environment, Science & Technology, Legal Affairs, Sports, States News Makers and few others.

We would also be pleased to receive any suggestion that could assist us with the upcoming editions.

Success Mantra (GTB Nagar, Delhi)

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Our Goal

Our goal at Success Mantra is to provide Quality education at rational price and thereby to create an environment that guides students towards the path of the success. Along with designing the curriculum and delivering the lectures, we work upon the ways the students think and approach problems asked.

B. S. Shanti



Success Mantra (Delhi) is the sum of small efforts, repeated day in and day out, for your accomplishment. Delhi, GTB Nagar, branch of SUCCESS MANTRA Coaching is considered as the paramount choice of Law and Management aspirants, across country. Because, at the end of the day, it is our results which speak !

Since a decade, we have delivered thousands of 'Gems Students' to the nation and persistent in doing so. It is the platform where student's ideology is developed and their dreams take the face of reality. This act is splendidly demonstrable on our result chart of applicable courses. Students from numerous junctions of India come to GTB Nagar to avail best coaching classes at rational price. The vision, of making the quality education accessible to all, is furthermore augmented by the launch of EASE VIDYA Mobile application.

While Success Mantra (GTB Nagar) is the epitome to the classroom coaching program, EASE VIDYA Mobile Application (available on Android) is an online podium, available on the web and mobile application both. It is familiarized to ease up the high growing pressure of competition among students preparing for CLAT | AILET | DU-LLB | MHCET | SLAT | BHU | AMU | and other Major Law Entrance Examinations in India. Just in a couple of months of its launch, EASE VIDYA App has been proven to be the best solution for students who are preparing for various academic and competitive entrance examinations.

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SCIENCE & TECHNOLOGY

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PRAVAHINI



#PARKER SOLAR PROBE ENTERED SUN'S CORONA

- **NASA's spacecraft** has done what was once imaginable. **Parker Solar Probe** by NASA on April 28, 2021 successfully entered the Corona of the Sun which is an extreme environment that's roughly 2 million degrees Fahrenheit.
- A historic moment of touching the sun for the very first time was achieved because of a large collaboration of scientists and the engineers, including the members of the Center for Astrophysics I Harvard & Smithsonian who had built and monitor a key instrument on the board the probe- **the Solar Probe Cup.**



Why the solar mission is significant?

- The **goal of NASA's Parker Solar Probe Mission** is to learn how the Sun works and as per the scientists it can be accomplished by flying into the solar atmosphere.
- The only way to learn more about the workings of the Sun is through the spacecraft to cross the outer boundary which is also called the Alfven point. **A basic part of the solar mission was to be able to measure whether or not this critical point can be crossed.**

NASA's spacecraft enters Corona of the sun: What is Corona?

- The **Corona is the outermost layer of the Sun's atmosphere** where the strong magnetic fields bind the plasma and prevents the turbulent solar winds from escaping.
- The Alfven Point is when the solar winds go beyond a critical speed and break free of the Corona as well as the magnetic fields of the Sun. Before April 28, a spacecraft had been flying just beyond this point.
- That's the region that the Parker Solar Probe has flown into- an area where the atmosphere, plasma and wind are magnetically stuck and are interacting with the Sun.

Parker Solar Probe Mission: What do we know about Solar Probe Cup?

- As per the data collected by **Solar Probe Cup of Parker Solar Probe Mission**, the spacecraft had entered the Corona three times on April 28, 2021, at one point for up to five hours.
- The amount of light hitting the Parker Solar Probe determined how hot the spacecraft will get. While much of the solar probe is protected by a heat shield, solar probe cup is one of the only two instruments that had stick out and have no protection.
- The **solar probe cup of NASA is directly exposed to the sunlight**. It has the capacity of operating at a very high temperature while also making the measurements.
- In order to avoid degradation, a solar probe cup has been developed of materials that are capable of high melting points like niobium, tungsten, sapphire, and molybdenum.

NASA creates history by touching solar atmosphere for the first time

- The **success of NASA's Parker Solar Probe** represents much more than technological innovation. There

are still various mysteries around Sun and the scientists through the probe are expecting to solve them.

- While giving the reference, scientists explained that no one still actually **knows why the outer atmosphere of the Sun is so much hotter than the Sun itself**.
- It is known that the energy comes from the churning magnetic fields bubbling through the surface of the sun; however, it is still unknown how the Sun's atmosphere absorbs this energy.
- In addition, the outbursts from the Sun can also have a direct impact on the Earth. The **Parker Solar Probe helps in the better understanding of all these phenomena**. The solar probe will continue to orbit the Sun and take measurements.

#DRDO TEST-FIRED BRAHMOS SUPERSONIC MISSILE

- India successfully **test-fired an air version of BrahMos Supersonic Cruise Missile** from the integrated test range of Chandipur, off Odisha Coast.
- The mission by DRDO has been described as a 'major milestone' in the development of BrahMos. The air version of the BrahMos missile was test-fired from the supersonic fighter aircraft Sukhoi 30 MK.
- The **test-firing of the BrahMos missile** has been described as a major milestone in the development of BrahMos.
- As per DRDO, the launch of the supersonic missile also met all the objectives and has also cleared the way for the serial production of the **air-version BrahMos Missile**.
- Air version of BrahMos supersonic cruise missile was successfully test-fired from supersonic fighter aircraft Sukhoi 30 MK-I **from Integrated Test Range, Chandipur off Odisha coast**.



Significance of BrahMos Supersonic Missile test firing

- **The launch of the BrahMos Supersonic Missile will be a major milestone in BrahMos development.** The launch has cleared the system for the serial production of BrahMos missiles in India.
- **Major airframe assemblies** that are responsible for forming an integral part of the Ramjet Engine are indigenously developed including the non-metallic airframe sections.

About BrahMos

- **BrahMos is a product of collaboration between India (DRDO) and Russia (NPOM)** for the production, development and marketing of the supersonic cruise missile.
- The offensive missile weapon system has also been inducted into the Indian Armed Forces. The air version of BrahMos supersonic **missile was last flight tested by DRDO in July 2021**.

Short Range Surface to air Missile flight tested

- The **Defence Research and Development Organisation** on December 7, 2021, also flight-tested the Vertical Launch Short Range Surface to Air Missile. The latest launch by India will further facilitate the Indian Navy in targeting aerial threats.

#NASA LAUNCHED NEW MISSION 'IXPE'

Recently, **National Aeronautics and Space Administration (NASA)** launched a new mission named **Imaging X-ray Polarimetry Explorer (IXPE)**.



- **IXPE observatory is a joint effort of NASA and the Italian Space Agency.**
- It will study **"the most extreme and mysterious objects in the universe – supernova remnants, supermassive black holes, and dozens of other high-energy objects."**
- Its primary length is **two years and the observatory will be at 600 kilometers altitude**, orbiting around Earth's equator.
- It is expected to **study about 40 celestial objects** in its first year in space.
- It will complement other X-ray telescopes such as the Chandra X-ray Observatory and the European Space Agency's X-ray observatory, XMM-Newton.

Significance:

- It will help observe **polarized X-rays from neutron stars and supermassive black holes**. By measuring the polarization of these X-rays, we can study where the light came from and understand the geometry and inner workings of the light source.
- It will help scientists understand how black holes spin and their location in the past. It will help unravel how **pulsars** shine so brightly in X-rays.
- It will help learn what powers the jets of energetic particles that are ejected from the region around the supermassive black holes at the centers of galaxies.

NASA's Other Recent Missions:

- **Double Asteroid Redirection Test (DART).**
- **Mission Lucy** (Jupiter Trojan Asteroids).
- **Near-Earth Asteroid Scout**
- **Supernova:** A supernova is an extremely powerful explosion that accompanies the death of a massive star.
- **Black Hole:** A black hole is a **place in space where gravity pulls so much that even light can not get out**. The gravity is so strong because matter has been squeezed into a tiny space.
- **Gravitational waves are created** when two black holes orbit each other and merge.
- **Neutron Stars:** Neutron stars **comprise one of the possible evolutionary end-points of high mass stars**.
- Once the core of the star has completely burned to iron, energy production stops and the core rapidly collapses, squeezing electrons and protons together to form neutrons and neutrinos.
- **A star supported by neutron degeneracy pressure is known as a 'neutron star'**, which may be seen as a pulsar if its magnetic field is favourably aligned with its spin axis.

#DRDO SUCCESSFULLY TEST-FIRED AGNI-P MISSILE

Recently, the **Defence Research and Development Organization (DRDO)** successfully test-fired the new generation nuclear-capable ballistic missile '**Agni Prime**'.



- This is the second test of the missile; the **first test took place in June 2021**.
- The Agni-P missile aims to **further strengthen India's credible deterrence capabilities**.

About:

- Agni-P is a **two-stage canisterised solid propellant missile** with dual redundant navigation and guidance system.
- It has been termed as a **new generation advanced variant of Agni class of missiles** with improved parameters, including manoeuvring and accuracy.
- **Canisterisation of missiles reduces the time required to launch the missile while improving the storage and ease of handling.**
- The surface-to-surface ballistic missile has a **range of 1,000 to 2,000 km**.
- **Agni Class of Missiles:**
- Agni class of missiles are the **mainstay of India's nuclear launch capability**, which also includes the **Prithvi short-range ballistic missiles**, submarine launched ballistic missiles and fighter aircraft.
- **Agni-V, an Inter-Continental Ballistic Missile (ICBM)** with a range of over 5,000 km, had been tested several times and validated for induction.
- The **Agni-P and Agni-5 ballistic missiles** trace their origins back to the **Integrated Guided Missile Development Programme (IGMDP)**, which was spearheaded by former DRDO chief and ex-Indian president Dr APJ Abdul Kalam in the early 1980s.

Other Ranges of Agni Missiles:

- **Agni I:** Range of 700-800 km.
- **Agni II:** Range more than 2000 km.
- **Agni III:** Range of more than 2,500 Km
- **Agni IV:** Range is more than 3,500 km and can fire from a road mobile launcher.
- **Agni-V:** The **longest of the Agni series**, an Inter-Continental Ballistic Missile (ICBM) with a range of over 5,000 km.
- **Recently Tested Missile:**
- **BrahMos supersonic cruise missile (air version)**
- **Vertical Launch Short Range Surface to Air Missile (VL-SRSAM)**

IGMDP (Integrated Guided Missile Development Program)

- It was **conceived by Dr. A.P.J. Abdul Kalam** to enable India attain self-sufficiency in the field of missile technology. It was approved by the **Government of India in 1983 and completed in March 2012**.
- The 5 missiles (P-A-T-N-A) developed under this program are:
 - **Prithvi:** Short range surface to surface ballistic missile.

- Agni: Ballistic missiles with different ranges, i.e. Agni (1,2,3,4,5)
- Trishul: Short range low level surface to air missile.
- Nag: 3rd generation anti-tank missile.
- Akash: Medium range surface to air missile.

History of Missile Technology in India

- **About:** Before Independence, several kingdoms in India were using **rockets as part of their warfare technologies**.
- **Mysore ruler Hyder Ali** started inducting iron-cased rockets in his army in the mid-18th century.
- At the time of Independence, **India did not have any indigenous missile capabilities**.
- The government created the **Special Weapon Development Team in 1958**.
- This was later expanded and called the **Defence Research and Development Laboratory (DRDL)**, which moved from Delhi to Hyderabad by 1962.
- In 1972, Project Devil, for the development of a **medium range Surface-to-Surface Missile** was initiated.
- By 1982, **DRDL was working on several missile technologies** under the Integrated Guided Missiles Development Programme (IGMDP).
- **Most Important India's Missile:**
- **Agni (range around 5,000):** It is India's only contender for an Inter-Continental Ballistic Missile (ICBM), which is available with only a few countries.
- **Prithvi:** It is a short-range surface-to-surface missile with a 350 km range and has strategic uses.
- India also tested a anti-satellite system in April 2019.
- A modified anti-ballistic missile named **Prithvi Defence Vehicle Mk 2** was used to hit a low-orbit satellite.
- It put India only behind the US, Russia and China in this capability.
- **Hypersonic Technology:** India is just behind the US, Russia and China.
- DRDO successfully tested a **Hypersonic Technology Demonstrated Vehicle (HSTDV)** in September 2020, and demonstrated its hypersonic air-breathing scramjet technology.
- **Missile technology of India in Comparison to (Pakistan and China):**
- **India:** Under the Integrated Guided Missile Development Programme (IGMP) first came Prithvi, then Agni.
- BrahMos, at 2.5-3 times the speed of sound, was among the fastest in the world when developed.
- India is working on **Agni VI and Agni VII**, which should have a much longer range.

China and Pakistan:

- While China is ahead of India, a "lot of things about China are psychological".
- China has given Pakistan the technology, "but getting a technology and really using it, and thereafter evolving and adopting a policy is totally different".
- India does not call BrahMos nuclear, it can be used.
- India's only nuclear missiles are **Prithvi and Agni**, but beyond those, tactical nuclear weapons can be fired from some **Indian Air Force** fighter jets or from Army guns, which have a low range, around 50 km.

#DRDO SUCCESSFULLY TEST-FIRED PRALAY MISSILE

Recently, the **Defence Research and Development Organisation (DRDO)** has successfully conducted maiden flight test of a new **indigenously developed surface-to-surface missile 'Pralay'**.

- The missile was tested from the **Dr A.P.J. Abdul Kalam Island** off the **coast of Odisha**.



About:

- Pralay' is India's **first conventional quasi-ballistic missile** and is an answer to any conventional missile attack from northern or western borders.
- A quasi-ballistic missile has a **low trajectory**, and while it is **largely ballistic**, it can **maneuver in flight**.
- The missile has been developed in a way that it is able to **defeat the interceptor missiles** and also has the ability to **change its path after covering a certain range mid-air**.
- It is powered with a **solid propellant rocket motor** and many new technologies.
- The missile guidance system includes **state-of-the-art navigation system** and integrated **avionics**.

Background:

- It is a derivative of the **Prahaar missile programme**, which was first tested in 2011.
- Prahaar is a surface-to-surface missile with a **range of 150 km**.
- Primary objective is to bridge the gap between the **unguided Pinaka multi-barrel rocket launcher** and the **guided Prithvi missile variants**.
- **Range:** The missile has a range of 150-500 kilometre and can be launched from a mobile launcher.
- Pralay will be the **longest-range surface-to-surface missile** in the inventory of the Army.
- The Army also has the **BrahMos supersonic cruise missile** in its arsenal, with a stated range of **290-plus kilometres**.
- **Significance:** It will completely change the **tactical battlefield dynamics** and India will have two conventional missiles with long range.
- The BrahMos will be a **cruise option** and **this one will be the ballistic option**.

#JAMES WEBB SPACE TELESCOPE

- The **James Webb Space Telescope**, the world's largest and most powerful space telescope, was launched on December 25, 2021 beginning a one-million-mile journey to see 13.5 billion years into the past.

- The **James Webb Space Telescope** was launched aboard Ariane 5 rocket from the Guiana Space Center in Kourou, French Guiana. The 14,000-pound instrument was released into space after a 26-minute ride.



- **James Webb Space Telescope Goal:**
- The **James Webb Space Telescope** will aim to find the first galaxies that formed in the early universe and look through dusty clouds to see stars forming planetary systems.
- The space telescope will be a **giant leap forward in the quest to understand the Universe and its origins**.

- The powerful space telescope will aim to examine every phase of cosmic history, starting from the first luminous glows after the Big Bang to the formation of galaxies, stars and planets and the evolution of our solar system.

Mission Objectives

- **Find first galaxies formed after Big Bang:** The James Webb Space Telescope will be like a powerful time machine with infrared vision that will look back over 13.5 billion years to see the formation of the first stars and galaxies in the early universe.
- **Learn how galaxies evolved:** Its unprecedented infrared sensitivity will help astronomers compare the faintest, earliest galaxies to today's grand spirals and ellipticals. It will help deepen the understanding of how galaxies assemble over billions of years.
- **Observe the formation of stars:** The telescope will be able to see right through massive clouds of dust that are opaque to visible-light observatories like Hubble and see how stars and planetary systems are born.
- **Look for the potential for life in other planetary systems:** The telescope will also be able to tell more about the atmospheres of extrasolar planets. It could even find the building blocks of life elsewhere in the universe.

James Webb Space Telescope Instruments

- Near-Infrared Camera (NIRCam)
- Near-Infrared Spectrograph (NIRSpec)
- Mid Infrared Instrument (MIRI)
- Fine Guidance Sensors/Near-Infrared Imager and Slitless Spectrograph (FGS/NIRISS)
- **James Webb Space Telescope major innovations**

The world's most powerful, most expensive and largest telescope comprises following innovations-

- Lightweight optics
- Deployable sun shield
- Folding segmented mirror
- Improved Detectors
- Cryogenic actuators & mirror control
- Micro-shutters

James Webb Space Telescope vs Hubble

- **The James Webb Space Telescope will aim to replace its 30-year-old predecessor, the Hubble Space Telescope.** The Hubble orbits the Earth from 340 miles away, passing in and out of the planet's shadow every 90 minutes.
- The **James Webb Telescope is named after James Edwin Webb**, who was an American government official who served as Undersecretary of State from 1949–1952.
- He was appointed as the second administrator of NASA from February 14, 1961, to October 7, 1968. James Webb oversaw NASA during most of its formative decade of the 1960s.
- The James Webb Telescope is expected to be about 100 times more sensitive than the **Hubble telescope**. It is expected to transform scientists' understanding of the universe.

#NASA LAUNCHED PSYCHE MISSION

- **NASA's Psyche mission** is going to be launched in August 2022. It will be the first launch to explore a giant metal asteroid known as Psyche in the main asteroid belt.
- The asteroid Psyche is in **between Mars & Jupiter** and is orbiting the Sun.
- The Psyche mission is one among the two missions of NASA to explore early Solar System. The Lucy mission is another mission to explore Jupiter's Trojan asteroids in order to study early Solar System.



NASA's Psyche mission

- **NASA's Psyche Mission** is the first mission that will be launched to explore a unique giant metal asteroid called Psyche. The mission is being led by Arizona State University.
- Mission management, navigation and its operations will be looked upon by NASA's Jet Propulsion Laboratory. Mission was selected as one of the two missions to explore early Solar System on in 2017.
- Mission will be launched in August 2022 from **Kennedy Space Center, Florida and will arrive on Psyche asteroid in 2026.**

Observation Period of Psyche asteroid

- Mission will spend 21 months for studying and mapping the asteroid Psyche.
- **Instruments on Psyche mission**
- The Psyche asteroid is carrying following scientific instruments:
 - X-band Gravity Science Investigation
 - Gamma Ray and Neutron Spectrometer
 - Multispectral Imager
 - Magnetometer

What is the Objectives mission?

- To understand how planets and other bodies separated into layers such as cores, mantles, and crusts.
- To examine an asteroid made of metal.
- To **explore early eras of solar system**
- **About Asteroid Psyche:** Italian astronomer Annibale de Gasparis had discovered the Psyche as 16th asteroid in 1852. He named the asteroid after the Goddess of Soul in ancient Greek mythology. It is 210 kilometers in diameter. The asteroid is made up of mostly metallic iron and nickel, similar to Earth's core.

#NASA'S HERMES MISSION

- On January 27, 2022, **NASA's HERMES mission** passed a critical mission review. HERMES mission is a four-instrument suite, which will be mounted outside **NASA's Moon-orbiting Gateway**.
- The review, **called Key Decision Point C**, evaluated the preliminary design and program plan of the mission, in a bid to achieve launch by its target launch readiness date of November 2024.
- With the successful review, the mission now moves into Phase C, which includes final design of HERMES mission.



About HERMES Mission

- HERMES Mission will be a critical part of Artemis mission** as well as NASA's goals of creating a permanent presence on the Moon.
- HERMES stands for "**Heliophysics Environmental and Radiation Measurement Experiment Suite**".
- It will be mounted outside the "Habitation and Logistics Outpost module" of Gateway outpost of NASA.

Purpose of HERMES Mission

- The **HERMES Mission** will help in monitoring space weather and fluctuating conditions in space driven by the Sun. Space weather comprise of:
 - Continuous stream of particles and magnetic fields, called as solar wind.
 - Blasts of billion-ton gas clouds, called as coronal mass ejections.
 - Flashes of ultra-bright light from solar flares and
 - Disturbances each of these create in near-Earth environment.
- Some of these space weather events pose dangers to astronauts and robotic missions. HERMES will study these weather events, in an especially variable environment.
- HERMES will be flooded by magnetic fields and particles, which have interacted with Earth.

#CHINA'S FIRST SOLAR OBSERVATION SATELLITE

- China launched its **first solar observation satellite** by a **Long March 2D rocket** from the Taiyuan Satellite Launch Centre in northern Shanxi province into a 571-km altitude orbit.
- The 550-kg **Xihe satellite will monitor the Sun for three years**. Until now, China has had a solar monitoring network on the ground however it did not access to the optical data outside the atmosphere.
- The Xihe satellite, the first solar observation satellite by China will aid the country to fill that gap.



About China's first solar observation satellite

- The **Xihe satellite** is China's first solar observation satellite.
- It is equipped with an imaging spectrometer known as the **Chinese H-alpha Solar Explorer (CHASE)** that will enable observation of the deep-red H-Alpha line of the solar spectrum thereby providing data for scientists to study solar flares or eruptions on the surface of the Sun.
- The Xihe satellite is **developed by the China Aerospace Science and Technology Corporation (CASC)**.
- The model of the satellite was put up for a showcase at the Zhuhai Air Show in September 2021.

Xihe Satellite: Naming, Weight, Lifespan, Orbit

- The satellite has been **named after a Chinese mythological figure Xihe**, the Mother Goddess of the Gods of the Sun. The Xihe satellite **weighing 550-kg (110 lbs)** has been designed for a **lifespan of three years**.
- It will observe the Sun until the solar maximum in 2025. It will be in a **Sun-synchronous orbit** around the Earth.
- The **Xihe satellite will record the changes in speed and atmospheric temperature** during solar eruptions; provide data for studying the dynamics and physical mechanism of eruptions. **Ultra-stability and ultra-high accuracy** are some of the key salient features of the Xihe satellite.

How will it benefit China's space solar exploration?

- The first solar observation satellite Xihe satellite by China is expected to increase the international influence of China in the area of solar physics.
- The **satellite will enable China to conduct space solar exploration** which will benefit China's basic science research, accelerate the progress of international solar physics research, and boost the development of related hi-tech industries.
- China has been investing heavily in space exploration. It is regarded as the strong challenger in the space race. **It has pushed several major programmes for outer space including the Moon and Mars.**
- China's Moon craft Chang'e 5 is now expected to reach the **L5 Lagrange point which is a gravity balance spot between the Sun and Earth.**

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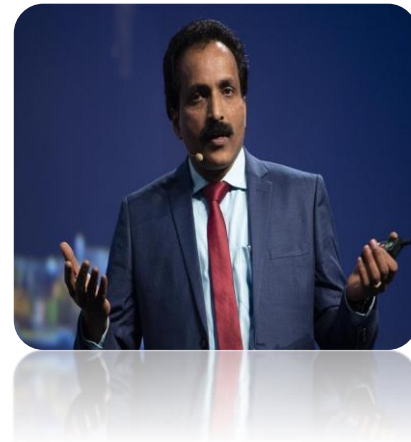
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#S. SOMANATH AS NEW CHAIRMAN OF ISRO

Recently, S. Somanath, an eminent rocket scientist has been appointed as the **Chairman of the Indian Space Research Organisation (ISRO)** and the Space Secretary.

Major Contribution of Dr. Somanath

- He has played a major role in the development of the **Polar Satellite Launch Vehicle (PSLV)** and the **Geosynchronous Satellite Launch Vehicle Mk-III (GSLV Mk-III)**.
- He joined the **GSLV Mk-III** project in 2003, and served as Project Director from 2010 to 2014.
- He is an expert in the area of system engineering of launch vehicles.
- Later on, he contributed to the development of the indigenous **cryogenic stages for the GSLV**.



ISRO:

- It is the pioneer space exploration agency of India, headquartered at Bengaluru.
- ISRO was formed in 1969 with a vision to develop and harness space technology in national development, while pursuing planetary exploration and space science research.
- ISRO replaced its predecessor, **INCOSPAR (Indian National Committee for Space Research)**, established in 1962 by India's first Prime Minister Pt. Jawaharlal Nehru and scientist Vikram Sarabhai, considered amongst the founding fathers of the Indian space program.

Achievements of ISRO:

- The **first Indian satellite, Aryabhata**, was built by the ISRO and launched with the help of the Soviet Union on 19th April 1975.
- The **year 1980** marked the **launch of Rohini**, which was the first satellite to be successfully placed in orbit by **SLV-3, an Indian made launch vehicle**.
- Subsequently with more efforts, two other rockets were developed by ISRO: the **PSLV (Polar Satellite Launch Vehicle)** for placing satellites into polar orbits and the **GSLV (Geosynchronous Satellite Launch Vehicle)** for placing satellites into geostationary orbits.
- Both the rockets have successfully launched several earth observation and communication satellites for India as well as other countries.
- Indigenous satellite navigation systems like **IRNSS** and **GAGAN** have also been deployed.
- **Indian Regional Navigation Satellite System** is designed to provide accurate position information service to assist in the navigation of ships in the Indian Ocean waters.
- **GAGAN** is India's **first satellite-based global positioning system** that relies on ISRO's GSAT satellites.
- In January 2014, ISRO used an **indigenously built cryogenic engine** for a GSLV-D5 launch of the GSAT-14 satellite making it one of the only six countries in the world to develop a cryogenic technology.
- Some remarkable space probes of ISRO include **Chandrayaan-1** lunar orbiter, **Mars Orbiter Mission (Mangalyaan-1)** and **ASTROSAT space observatory**.

- The success of the **Mars Orbiter Mission** made India **only the fourth country in the world** to reach Martian orbit.
- India launched **Chandrayaan-2**, its second lunar exploration mission after Chandrayaan-1 on 22nd July 2019.

Major ISRO achievements of 2021:

- **Amazonia-1:** The 53rd flight of PSLV-C51 marked the first dedicated mission for **New Space India Ltd (NSIL)**, the commercial arm of ISRO.
- Amazonia-1, the optical **earth observation satellite** of National Institute for Space Research (INPE), would provide remote sensing data to users for monitoring deforestation in the Amazon region and analysis of diversified agriculture across the Brazilian territory.
- **UNITYsat (three satellites):** They have been deployed to provide **Radio relay services**.
- **SDSAT:** Satish Dhawan Satellite (SDSAT) is a **nano satellite** intended to study the radiation levels/space weather and demonstrate long range communication technologies.

Upcoming Missions:

- **Gaganyaan Mission:** India's maiden space mission, Gaganyaan, will be launched in 2023.
- **Chandrayaan-3 Mission:** Chandrayaan-3 is likely to be launched during the third quarter of 2022.
- **Three Earth Observation Satellites (EOSs):**
- **EOS-4 (Risat-1A) and EOS-6 (Oceansat-3)** — will be launched using Isro's workhorse PSLV, the third one, **EOS-2 (Microsat)**, will be launched in the first developmental flight of the **Small Satellite Launch Vehicle (SSLV)**.
- These satellites will be launched in the **first quarter of 2022**.

Other:

- **Shukrayaan Mission:** The ISRO is also planning a mission to Venus, tentatively called Shukrayaan.
- **Own Space Station:** India is planning to **launch its own space station by 2030**, joining the league of US, Russia, and China to an elite space club.

Challenges for ISRO:

- **Mere contribution in Global Space Economy:** India accounts for **only 2% of the global space economy**.
- The two key reasons for the same are **lack of space specific laws and effective monopoly enjoyed by ISRO** over all space-related activities.

International Treaties:

- India's current space activities are currently governed by a few international treaties along with two national policies which are **Satellite Communication Policy (SATCOM)** and **Remote Sensing Data Policy (RSDP)**.
- SATCOM policy was introduced in 1997 and is aimed at developing the space and satellite communications industry within India.
- In 2000, norms for the implementation of the 1997 policy were introduced.
- The RSDP was introduced in 2001 and revised in 2011.

- It lays down clear guidelines for the distribution of satellite remote sensing data within India and states that the GOI is the exclusive owner of all data received from Indian Remote Sensing Satellites (IRS) to which private entities can only acquire a license through the nodal agency.

Not having Domestic Space Law:

- Up until recently, the **need for a domestic space law was not felt** as space was seen more of an international issue rather than a domestic one.
- Furthermore, the **private sector has only recently shown willingness** to invest and play a bigger role in India's space sector after realising the potential of commercial space activity.

Steps taken for Space Revolution:

- **National Space Transportation Policy (NSTP)**
- **IN-SPACE**
- **NewSpace India Limited (NSIL)**
- **Indian Space Association (ISpA)**

#CHANDRAYAAN-3 MISSION OF ISRO

- Recently, the Department of Science has stated that India plans to execute the **Chandrayaan-3** mission in August 2022.

Chandrayaan 3 Mission

- The Chandrayaan 3 mission is the **third planned lunar exploration mission** by the Indian Space Research Organisation (ISRO).
- It follows ISRO's Chandrayaan 2 mission, which though successfully deployed its orbiter around the Moon but failed to soft-land its lander and deploys its rover after a last-minute glitch in soft landing guidance software.
- **Similar to Chandrayaan 2 mission, Chandrayaan-3 will also include a modified lander and rover.**
- **The mission will not include an orbiter**, due to the success of the **Chandrayaan 2 orbiter**. It will use the Chandrayaan 2 orbiter to communicate with the earth.



What is GSLV-Mk 3?

- Geosynchronous Satellite Launch Vehicle Mark-III was developed by **Indian Space Research Organisation (ISRO)**, is a three-stage vehicle, designed to launch communication **satellites into geostationary orbit**.
- It has a mass of 640 tonnes that can accommodate up to 8,000 kg payload to **Low Earth Orbit (LEO)** and 4000 kg payload to GTO (Geo-Synchronous Transfer Orbit).

Geosynchronous Orbit

- **Geosynchronous satellites are launched into orbit in the same direction the Earth is spinning and can have any inclination.**

- When the satellite is in orbit at a specific altitude (approximately 36,000km above the Earth's surface), **it will exactly match the rotation of the Earth.**
- While, **Geostationary** orbits fall in the same category as geosynchronous orbits, but with that one special quality of being **parked over the equator.**
- In the case of geostationary satellites, **the Earth's force of gravity is exactly enough to provide acceleration** required for circular motion.
- **Geosynchronous Transfer Orbit(GTO):** To attain geostationary or geosynchronous earth orbits, a spacecraft is first launched into a Geosynchronous Transfer Orbit.
- From the GTO the spacecraft uses its engines to shift to geostationary or geosynchronous orbit.

ISRO's Moon Exploration:

- **Chandrayaan 1:** The **Chandrayaan project** began in 2007 with an agreement between India's space agency ISRO and Russia's ROSCOSMOS for mutual cooperation.
- However, the mission was postponed in January 2013 and rescheduled to 2016 as Russia was unable to develop the lander on time.
- **Findings:** Confirmed presence of **lunar water.**
- Evidence of lunar caves formed by an ancient lunar lava flow.
- Past tectonic activity was found on the lunar surface.
- The faults and fractures discovered could be features of past interior tectonic activity coupled with meteorite impacts.
- **Chandrayaan-2** is India's 2nd mission to the moon and comprises a fully indigenous Orbiter, **Lander (Vikram) and Rover (Pragyan).**
- The Rover Pragyan is housed inside Vikram lander.

LUNAR MISSION OR EXPLORATIONS BY DIFFERENT NATIONS

#ARTEMIS PROGRAM OF NASA

- With **the Artemis program**, NASA wishes to demonstrate new technologies, capabilities and **business approaches** that will ultimately be needed for the future exploration of Mars.
- It stands for Acceleration, Reconnection, Turbulence, and Electrodynamics of the Moon's Interaction with the Sun.
- The program is divided into **three parts:**
- **Artemis I** is most likely to be launched 2021 and involves an uncrewed flight to test the **Space Launch System (SLS) and Orion spacecraft.**
- **Artemis II** will be the first crewed flight test and is targeted for 2023.
- **Artemis III** will land astronauts on the Moon's South Pole in 2024.

NASA and the Moon

- The US began trying to put people in space as early as **1961.** Eight years later, on 20th July, **1969, Neil Armstrong** along with Edwin "Buzz" Aldrin became the first human to step on the Moon as part of the **Apollo 11 mission.**
- Apart from the purpose of **space exploration**, NASA's endeavour to send Americans to the Moon again is to demonstrate American **leadership in space** and to establish a strategic presence on the Moon, while expanding the US global economic impact.

#UAE'S MISSION TO MOON

- Recently, the **United Arab Emirates (UAE)** has decided to send an **unmanned spacecraft to the moon in 2024**.
- **Name:** The rover would be named **Rashid** after **Sheikh Rashid bin Saeed Al Maktoum**, one of the original founding rulers of the UAE.
- **Rover** is a vehicle for exploring the surface of a planet or moon.
- The rover will **explore the surface of the moon in areas that have not been explored** previously by human missions such as **NASA's Apollo**.
- Participating in the moon exploration is part of the **UAE's space strategy** to build new knowledge capabilities and advance the country's scientific, technical and research environment.
- **Fourth Nation:** If successful in 2024, the **UAE could become the fourth nation to land a spacecraft on the moon** after the **USA, the former Soviet Union and China**.
- **India, Israel and Japan have tried but failed** in landing a spacecraft on the moon.

UAE's Space Mission

- **In July 2020, the UAE launched a Mars probe named Amal (Hope) from Japan, marking the Arab world's first interplanetary mission.**
- **Amal is set to reach Mars in February 2021, the year UAE will celebrate 50 years of its formation.**
- **UAE has also set a goal to build a human colony on Mars by 2117.**
- **UAE is a federation of seven sheikhdoms on the Arabian Peninsula.**
- **In 2019, the UAE sent its first astronaut to the International Space Station**

#CHINA'S MOON MISSION: CHANG'E

- China made its **first lunar landing** in 2013.
- In January 2019, the **Chang'e-4 probe** touched down on the far side of the moon, the **first by any nation's** space probe.
- Chang'e is a series of lunar probes launched by China National Space administration.
- It aims to have a **permanent manned space station in service by around 2022**.
- Within the next decade, China **plans to establish a robotic base station** to conduct unmanned exploration in the **south polar region of the moon**.
- It is to be developed through the Chang'e-6, 7 and 8 missions through the 2020s.

#BRAHMOS MISSILES EXPORT TO PHILIPPINES

Recently, **Philippines** have signed a deal with BrahMos Aerospace Private Ltd. for the supply of a **shore-based anti-ship variant of the BrahMos supersonic cruise missile**. This is the **first export order for the missile**, a joint product of India and Russia.



- The Philippines wants to induct this missile amid **tensions with China over the disputed islands in the South China Sea**.
- Several countries have shown interest in acquiring the BrahMos missile.
- For example, discussions are in advanced stages with **Indonesia and Thailand**.

What are the features of BrahMos Missile?

- BrahMos is a joint venture between the **Defence Research and Development Organisation of India (DRDO) and the NPOM of Russia**.
- BrahMos is named on the **rivers Brahmaputra and Moskva**.
- It is a **two-stage (solid propellant engine in the first stage and liquid ramjet in second)** missile.
- It is a **multiplatform missile** i.e it can be launched from land, air, and sea and multi capability missile with pinpoint accuracy that works in both day and night irrespective of the weather conditions.
- It operates on the **"Fire and Forgets" principle** i.e it does not require further guidance after launch.
- Brahmos is one of the **fastest cruise missiles** currently operationally deployed with speed of **Mach 2.8**, which is nearly **3 times more than the speed of sound**.
- Recently, an **Advance Version of BrahMos** (extended range sea-to-sea variant) was test fired.
- Following **India's entry into the MTCR (Missile Technology Control Regime) club in June 2016**, the range is planned to be extended to 450 km and to 600km at a later stage.
- The BrahMos missile was **initially developed with a range capped at 290 km**.

What is Missile Technology Control Regime (MTCR)?

- It is an **informal and voluntary partnership among 35 countries** to prevent the proliferation of missile and unmanned aerial vehicle technology capable of carrying greater than **500 kg payload for more than 300 km**.
- The members are thus **prohibited from supplying such missiles and UAV systems that are controlled by the MTCR to non-members**.
- The decisions are taken by **consensus of all the members**.
- This is a non-treaty association of member countries with certain guidelines about the information sharing, national control laws and export policies for missile systems and a rule-based regulation mechanism to limit the transfer of such critical technologies of these missile systems.
- It was established in **April 1987 by G-7 countries** – USA, UK, France, Germany, Canada, Italy, and Japan.

What is the Status of India's Defence Exports?

- Defence exports are a **pillar of the government's drive to attain self-sufficiency** in defence production.

- Over 30 Indian defence companies have **exported arms and equipment to countries** like Italy, Maldives, Sri Lanka, Russia, France, Nepal, Mauritius, Sri Lanka, Israel, Egypt, UAE, Bhutan, Ethiopia, Saudi Arabia, Philippines, Poland, Spain and Chile.
- The **exports include** personal protective items, defence electronics systems, engineering mechanical equipment, offshore patrol vessels, advanced light helicopters, avionics suits, radio systems and radar systems.
- However, India's defense exports are **still not upto the expected lines**.
- The **Stockholm International Peace Research Institute (SIPRI)** ranked India at **number 23** in the list of major arms exporters for 2015-2019.
- India still accounts for only **0.17%** of global arms exports.
- Reason for dismal performance in India's Defense exports is that, India's Ministry of Defense so far has **no dedicated agency to drive exports**.
- Exports are left to individual corporations, like BrahMos or the defence public shipyards and undertakings.
- In this context, the **KPMG report titled 'Defence Exports: Untapped Potential** recommends the first step of setting up of an exclusive **"defence export help desk"**.
- On the basis of inputs from the help-desk, the report says, Indian companies could work with government machinery to realise exports.
- If India is successful in providing big-ticket military systems to countries in the neighbourhood, it won't just be a boost for defence exports but will also be a **strategic step to counter China's influence** as it provides defence products in Asia, including Pakistan, Bangladesh and Myanmar.

#PSLV-C52 SCHEDULED TO LAUNCH BY ISRO

- Indian Space Research Organisation (ISRO)** is set to launch its first mission of 2022 is slated on February 14, 2022.
- The Polar Satellite Launch Vehicle (PSLV-C52) is scheduled to launch on February 14, from first launch pad of Satish Dhawan Space Centre, Sriharikota.
- It will orbit an **earth observation satellite (EOS-04)**.



About PSLV-C52

- PSLV-C52 has weight of 1710 kg. It will orbit around **EOS-04 into a sun synchronous polar orbit of 529 km**. This mission will carry two small satellites as co-passengers, namely,
- Student satellite (INSPIRESat-1)** – This satellite has been developed by Indian Institute of Space Science & Technology (IIST) in collaboration with Laboratory of Atmospheric & Space Physics at University of Colorado, Boulder.
- Technology demonstrator satellite (INS-2TD)** – This satellite has been developed by ISRO. It is precursor to India-Bhutan Joint Satellite (INS-2B).
- The satellite aims to improve understanding of ionosphere dynamics as well as sun's coronal heating process. Its operational lifetime has been set for a year.

What is EOS-04?

- EOS-04 is a Radar Imaging Satellite (RISAT)** that has been designed to provide high quality images under all weather conditions.

- It will provide images for applications like forestry & plantations, agriculture, flood mapping and soil moisture & hydrology.
- It will collect observation data in C-Band, completing the observations done by **Cartosat, Resourcesat, and RISAT-2B series**.

Disposal of INSAT-4B

- **INSAT-4B satellite undergone post mission disposal (PMD)** at the end of its life, followed by its decommissioning on January 24, 2022, in a bid to comply with the UN and space debris mitigation guidelines, recommended by Inter Agency Space Debris Coordination Committee.
- It is the 21st Indian GEO satellite to undergo post-mission disposal.

#INS VISAKHAPATNAM TEST-FIRED BRAHMOS SUPERSONIC MISSILE

- Indian Naval warship INS Visakhapatnam test-fired **naval variant of BrahMos supersonic cruise missile** off the western seaboard on February 18, 2022.
- The **warship has now reached Visakhapatnam** to participate in the President's Fleet Review on February 21, 2022. INS Visakhapatnam is the Indian Navy's newest indigenously built stealth guided-missile destroyer.



BrahMos Supersonic Missile

- **BrahMos missile system** is the main weapon system of the Indian Navy warships. **It has been deployed on almost all of its surface platforms.**
- An underwater version is also being developed that will be used by the submarines of India. The underwater version of the missile system will also be offered for export to friendly foreign nation.

BrahMos Missile Tests

- India had successfully test-fired a new version of **BrahMos supersonic cruise missile** off the coast of Odisha on January 20, 2022.
- Prior to that, the Indian Navy had successfully **test-fired BrahMos Supersonic Cruise Missile** from INS Vishakhapatnam warship on January 11, 2022. The missile had hit the target with pinpoint accuracy.
- Before this, India had test-fired an air **version of BrahMos Supersonic Cruise Missile** on December 8, 2021. The missile test was carried out from the integrated test range of Chandipur, off the coast of Odisha.
- The Indian Air Force had also successfully test-fired an **air version of BrahMos supersonic cruise missile from a Sukhoi fighter aircraft** on October 30, 2020. The IAF is integrating the BrahMos missile on over 40 Sukhoi fighter jets.

Background

- The **BrahMos Supersonic Cruise Missile** is a multi-platform missile that can be launched from different platforms including ground, air and sea.
- It has been deployed in all three arms of the **Indian Armed Forces- Indian Army, Indian Air Force and Indian Navy.**
- The Brahmos supersonic cruise missile is **produced by BrahMos Aerospace** which is a joint venture **between India and Russia.**
- The missiles have been deployed by India at strategic locations along **India's border with China in**

Ladakh and Arunachal Pradesh.

#FIRST TAIWAN PRESENCE IN ISRO: INSPIRESat-1

- On February 14, 2022, **Indian Space Research Organisation (ISRO)** launched a satellite called "INSPIRESat-1".

Who developed INSPIRESat-1?

- INSPIRESat-1 has jointly been developed by team of international researchers including from universities of **India, US, Taiwan, and Singapore**.
- The universities include:**
 - University of Colorado's Laboratory for Atmospheric & Space Physics (LASP)
 - Indian Institute of Space Science and Technology (IIST)
 - Taiwan's National Central University (NCU) and
 - Singapore' Nanyang Technological University.



About INSPIRESat-1

- INSPIRESat-1** stands for International Research & Teaching Satellite Project satellite one.
- This satellite has been developed by Indian Institute of Space Science & Technology (IIST) in association with Laboratory of Atmospheric & Space Physics at University of Colorado, Boulder. It was launched onboard **Polar Satellite Launch Vehicle PSLV-C52**.
- INSPIRESat-1 is a student satellite. Mission life of the satellite is one year. It will study orbital heating of the sun and about dynamics of ionosphere.
- PSLV-C52** placed another satellite called "technology **demonstrator (INS-2TD)**" from ISRO. It is a precursor to India-Bhutan Joint Satellite (INS-2B).
- Both the satellite will provide information on Sun's corona as well as its impact on Earth's ionosphere.
- It also injected Earth Observation Satellite EOS-04.**
- It will provide high-quality images under all weather conditions for applications like Forestry & Plantations, Agriculture, Flood mapping and Soil Moisture & Hydrology.

About INS-2TD

- INS-2TD is a technology demonstrator.** It is a precursor to INS - 2B satellite, which was **jointly developed by India and Bhutan**. INS - 2TD comprise of a thermal imaging camera. It will assess the land surface temperature, water surface temperature, and delineation of vegetation. Weight of INS - 2TD is 17.5 kg.

About EOS-04

- EOS-04** is a radar imaging satellite, which was designed to provide quality image of agriculture, forestry, soil moisture, flood mapping, plantations and hydrology. The mission life of EOS-04 is ten years.

#NASA TO RETIRE ISS IN 2031

- The National Aeronautics and Space Administration have announced that the **International Space Station (ISS)** will cease its functioning by 2031.
- At the end of the year 2030, the **low-Earth orbit** will see the last of the International Space Station as the floating laboratory will cease the operations and swoop down the Earth.



International Space Station: What is the significance?

- The International Space Station has been hovering in the low Earth orbit for more than two decades, zooming across the periphery of the Earth at the speed of 8 km per second.
- International Space Station is one of its kind laboratories that has helped human civilization research and achieves some cutting-edge scientific and technological developments.
- International Space Station also hosts the groundbreaking work by NASA of sending the first humans to Mars.

ISS to retire in Pacific Ocean

- As per the **National Aeronautics and Space Administration**, the operators of ISS in 2031 will direct the station to fall in the South Pacific Oceanic Uninhabited area which is commonly known as Point Nemo.
- **Point Nemo in the Pacific Ocean** is considered to be the remotest location on Earth.
- With this, the **International Space Station** will no longer be a cosmic entity but will return to the ground, and all that is left behind will be its legacy.

International Space Station (ISS)

- ISS is a habitable artificial satellite - the single largest man-made structure in low earth orbit. Its first component was launched into orbit in 1998.
- It circles the Earth in roughly 92 minutes and completes 15.5 orbits per day.
- The ISS programme is a joint project between **five** participating space agencies: **NASA (United States), Roscosmos (Russia), JAXA (Japan), ESA (Europe), and CSA (Canada)** but its ownership and use has been established by intergovernmental treaties and agreements.
- It serves as a microgravity and space environment research laboratory in which crew members conduct experiments in biology, human biology, physics, astronomy, meteorology, and other fields.
- Continuous presence at ISS has resulted in the longest continuous human presence in the low earth orbit.

#RELATED: CHINA'S PERMANENT SPACE STATIONS

Recently, China **launched an unmanned module of its permanent space station that it plans to complete by the end of 2022.**

- The module, named "**Tianhe**", or "**Harmony of the Heavens**", was launched on the **Long March 5B**, China's largest carrier rocket.
- **India** has also set its **eye on building its own space station in low earth orbit** to conduct microgravity experiments in space in 5 to 7 years.

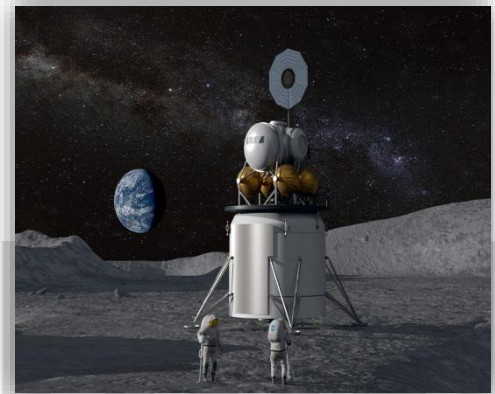
Background:

- The **only space station** currently in orbit is the **International Space Station (ISS)**, from which **China is excluded**.
- A **space station is a spacecraft** capable of supporting crew members, designed to remain in space for an extended period of time and for other spacecraft to dock.
- The **ISS is backed by** the United States, Russia, Europe, Japan and Canada.
- **China has been a late starter** when it comes to space exploration. It was only in 2003 that it sent its first astronaut into orbit, making it the third country to do so, after the Soviet Union and the US.
- So far, China has sent two previous space stations into orbit. The **Tiangong-1** and **Tiangong-2** were **trial stations** though, simple modules that allowed only relatively short stays by astronauts.

#WHAT IS NASA'S ARTEMIS PROGRAMME?

Recently, the **National Aeronautics and Space Administration (NASA)** rolled out its **Artemis I moon mission** to the launchpad for testing at the **Kennedy Space Centre in Florida, United States**.

What is Artemis Mission?



- NASA's Artemis mission is touted as the **next generation of lunar exploration**, and is named after the **twin sister of Apollo** from Greek mythology.
- **Artemis is also the goddess of the moon.**
- It is the **first in a series of increasingly complex missions** that will enable **human exploration to the Moon and Mars**.
- With the Artemis programme, **NASA aims to land humans on the moon by 2024**, and it also plans to land the **first woman and first person of colour on the moon**.
- NASA will establish an **Artemis Base Camp** on the surface and a **gateway (the lunar outpost around the Moon)** in lunar orbit to aid exploration by robots and astronauts.
- The gateway is a critical component of **NASA's sustainable lunar operations and will serve as a multi-purpose outpost orbiting the moon**.
- **Other space agencies** are also involved in the Artemis programme.
- **Canadian Space Agency** has committed to providing **advanced robotics** for the gateway,
- **The European Space Agency** will provide the **International Habitat and the ESPRIT module**, which will deliver additional communications capabilities among other things.
- The **Japan Aerospace Exploration Agency** plans to contribute **habitation components and logistics resupply**.

What are Key Points of Artemis I Mission?

- **Artemis I, formerly Exploration Mission-1**, will be the first integrated flight test of NASA's **Deep Space Exploration Systems**:

- **Orion spacecraft:** Orion spacecraft is going to remain in space without docking to a space station, longer than any ship for astronauts has ever done before.
- **Space Launch System (SLS) rocket:** It is the most powerful rocket in the world — and travels 2,80,000 miles from the earth for over four to six weeks during the course of the mission.
- **Newly upgraded Exploration Ground Systems** at Kennedy Space Centre in Cape Canaveral, Florida.
- It is an **uncrewed space mission** where the spacecraft will launch on an SLS rocket.
- The primary operating goal of the mission is to assure a safe crew module entry, descent, splashdown, and recovery.
- **SLS and Orion under Artemis I** will be launched from the Kennedy Space Centre in Florida, U.S. in the summer of 2022.
- The mission will end with the Orion spacecraft's ability to return safely to the earth.

What are the future missions in the Artemis programme?

- The second flight under the programme will **have crew on board and will test Orion's critical systems with humans onboard.**
- Eventually, the learnings from the **Artemis programme will be utilised to send the first astronauts to Mars.**
- NASA plans on using the lunar orbit to gain the necessary experience to extend human exploration of space farther into the solar system.

What is the History of Moon Exploration?

- In 1959, the **Soviet Union's uncrewed Luna 1 and 2** became the first rover to visit the Moon.
- The US began trying to put people in space as early as **1961.**
- Eight years later, on 20th July, 1969, **Neil Armstrong along with Edwin "Buzz" Aldrin became the first human to step on the Moon** as part of the Apollo 11 mission.
- Before the USA sent the **Apollo 11 mission to the Moon**, it sent three classes of robotic missions between **1961 and 1968.**
- After July 1969, **12 American astronauts walked on the surface of the Moon until 1972.**
- In the 1990s, the USA resumed **lunar exploration with robotic missions Clementine and Lunar Prospector.**
- In 2009, it began a new series of robotic lunar missions with the launch of the **Lunar Reconnaissance Orbiter (LRO) and the Lunar Crater Observation and Sensing Satellite (LCROSS).**
- In 2011, NASA began the ARTEMIS.
- In 2012, the **Gravity Recovery and Interior Laboratory (GRAIL)** spacecraft studied the Moon's gravity.
- Apart from the USA, the European Space Agency, Japan, China, and India have sent missions to explore the Moon.
- China landed two rovers on the surface, which includes the **first-ever landing on the Moon's far side in 2019.**

What are ISRO's Moon Exploration Efforts?

- **Chandrayaan 1:**
- The **Chandrayaan project** began in 2007 with an agreement between **India's space agency ISRO and Russia's ROSCOSMOS for mutual cooperation.**

- However, the mission was postponed in January 2013 and rescheduled to 2016 as Russia was unable to develop the lander on time.
- **Findings:** Confirmed presence of lunar water.
- Evidence of lunar caves formed by an ancient lunar lava flow.
- Past tectonic activity was found on the lunar surface.
- The faults and fractures discovered could be features of past interior **tectonic activity** coupled with **meteorite** impacts.
- **Chandrayaan-2** is India's second mission to the moon and comprises a **fully indigenous Orbiter, Lander (Vikram) and Rover (Pragyan)**.
- The Rover Pragyan is housed inside **Vikram lander**. The **Indian Space Research Organisation (ISRO)** recently announced India's third lunar mission **Chandrayaan-3**, which will comprise a lander and a rover.

#NASA LAUNCHED PSYCHE MISSION

- **NASA's Psyche mission** is going to be launched in August 2022. It will be the first launch to explore a giant metal asteroid known as Psyche in the main asteroid belt.
- The asteroid Psyche is in **between Mars & Jupiter** and is orbiting the Sun.
- The Psyche mission is one among the two missions of NASA to explore early Solar System. The Lucy mission is another mission to explore Jupiter's Trojan asteroids in order to study early Solar System.



NASA's Psyche mission

- **NASA's Psyche Mission** is the first mission that will be launched to explore a unique giant metal asteroid called Psyche. The mission is being led by Arizona State University.
- Mission management, navigation and its operations will be looked upon by NASA's Jet Propulsion Laboratory. Mission was selected as one of the two missions to explore early Solar System on in 2017.
- Mission will be launched in August 2022 from **Kennedy Space Center, Florida and will arrive on Psyche asteroid in 2026.**

Observation Period of Psyche asteroid

- Mission will spend 21 months for studying and mapping the asteroid Psyche.
- **Instruments on Psyche mission**
- The Psyche asteroid is carrying following scientific instruments:
- X-band Gravity Science Investigation
- Gamma Ray and Neutron Spectrometer
- Multispectral Imager
- Magnetometer

What is the Objectives mission?

- To understand how planets and other bodies separated into layers such as cores, mantles, and crusts.
 - To examine an asteroid made of metal.
 - To **explore early eras of solar system**
- **About Asteroid Psyche:** Italian astronomer Annibale de Gasparis had discovered the Psyche as 16th asteroid in 1852. He named the asteroid after the Goddess of Soul in ancient Greek mythology. It is 210 kilometers in diameter. The asteroid is made up of mostly metallic iron and nickel, similar to Earth's core.

Reason for Choosing Dimorphos:

- **Didymos is a perfect system** for the test mission because it is an **eclipsing binary** which means it has a **moonlet that regularly orbits the asteroid** and which can be seen when it passes in front of the main asteroid.
- **Earth-based telescopes can study this variation in brightness** to understand how long it takes Dimorphos to orbit Didymos.

SpaceX Falcon 9 rocket.

- SpaceX has launched its Falcon Heavy rocket carrying 24 experimental satellites on boosters that are being reused.
- The payloads have been assembled from several partners, including the National Oceanic and Atmospheric Administration, NASA and university research projects.
- **The Falcon Heavy**, which the company SpaceX considers to be **the most powerful operational rocket in the world** by a factor of two, will carry the two dozen spacecraft into **three distinct orbits**.
- The company also will attempt to land the Falcon Heavy's **two boosters back on earth simultaneously**, then land the first stage of the rocket on a drone ship in the ocean about 770 miles away from where it initially takes off.
- SpaceX **first** demonstrated the 230-foot-tall (70-meter) **Falcon Heavy** in February **2018**. In April 2019, it launched Falcon Heavy for its first paying customer, Saudi Arabia's commercial satellite operator Arabsat.
- SpaceX is a **private company** founded in 2002 by Elon Musk.
- Its **headquarters** is located in Hawthorne, **California (U.S.A)**.

#NASA TO LAUNCH 'LUCY' MISSION

- **NASA is set to launch Lucy, the first spacecraft to study Jupiter's Trojan asteroids.**
- The **Lucy spacecraft** is scheduled to be launched on an **Atlas V rocket from Cape Canaveral Space Force Station in Florida**.
- **NASA's Juno spacecraft** has been orbiting Jupiter since 2016 but the Lucy spacecraft will be the first expedition by **NASA to study the Trojan asteroids** that orbit the Sun in two swarms, one leading ahead of Jupiter and other trailing behind the planet.

NASA's Lucy mission to study Jupiter's asteroids

- The **Lucy spacecraft** which is NASA's first spacecraft to study Jupiter's Trojan asteroids will be launched on October 16, 2021.
- The spacecraft will be launched on a 12-year mission to help scientists gain an up-close view of the Trojan asteroids.
- The **study of Jupiter's Trojan asteroids** will help scientists to understand how the Solar System and its planets were formed approximately 4.5 billion years ago and why did they end up in the current sequence.

What is the goal of NASA Lucy mission?

- The Lucy spacecraft is designed to travel nearly 4 billion miles. The Lucy spacecraft and a remote-sensing instrument will study geology, physical properties, and **surface composition of the Trojan asteroids**.
- The **first asteroid flyby of the Lucy spacecraft** will happen in 2025. The seven other Trojan asteroids encounters are expected to happen between 2027 and 2033.

Naming of Lucy Mission – Background

- The **Lucy mission has been named after the discovered partial skeleton** from a human ancestor that is believed to have lived more than 3 million years ago.
- The fossilized remains were named Lucy. Just as the fossil remains named Lucy offered insights into human evolution, the Lucy mission to Trojan asteroids is expected to help in understanding the planetary origins and the formation of the Solar System, including Earth, said NASA.

About Trojan asteroids

- The Trojan asteroids have been **named after characters in Greek mythology**.
- They orbit the Sun in two swarms, one ahead of Jupiter and the other trailing behind it. These asteroids were formed in the aftermaths of the leftovers of the primordial material from which Jupiter and the other outer planets were formed.

#JAMES WEBB SPACE TELESCOPE

- The **James Webb Space Telescope**, the world's largest and most powerful space telescope, was launched on December 25, 2021 beginning a one-million-mile journey to see 13.5 billion years into the past.
- The **James Webb Space Telescope** was launched aboard Ariane 5 rocket from the Guiana Space Center in Kourou, French Guiana. The 14,000-pound instrument was released into space after a 26-minute ride.



- **James Webb Space Telescope Goal:**
- The **James Webb Space Telescope** will aim to find the first galaxies that formed in the early universe and look through dusty clouds to see stars forming planetary systems.
- The space telescope will be a **giant leap forward in the quest to understand the Universe and its**

origins.

- The powerful space telescope will aim to examine every phase of cosmic history, starting from the first luminous glows after the Big Bang to the formation of galaxies, stars and planets and the evolution of our solar system.

Mission Objectives

- **Find first galaxies formed after Big Bang:** The James Webb Space Telescope will be like a powerful time machine with infrared vision that will look back over 13.5 billion years to see the formation of the first stars and galaxies in the early universe.
- **Learn how galaxies evolved:** Its unprecedented infrared sensitivity will help astronomers compare the faintest, earliest galaxies to today's grand spirals and ellipticals. It will help deepen the understanding of how galaxies assemble over billions of years.
- **Observe the formation of stars:** The telescope will be able to see right through massive clouds of dust that are opaque to visible-light observatories like Hubble and see how stars and planetary systems are born.
- **Look for the potential for life in other planetary systems:** The telescope will also be able to tell more about the atmospheres of extrasolar planets. It could even find the building blocks of life elsewhere in the universe.

James Webb Space Telescope v. Hubble

- **The James Webb Space Telescope will aim to replace its 30-year-old predecessor, the Hubble Space Telescope.** The Hubble orbits the Earth from 340 miles away, passing in and out of the planet's shadow every 90 minutes.
- The **James Webb Telescope is named after James Edwin Webb**, who was an American government official who served as Undersecretary of State from 1949–1952.
- He was appointed as the second administrator of NASA from February 14, 1961, to October 7, 1968. James Webb oversaw NASA during most of its formative decade of the 1960s.
- The James Webb Telescope is expected to be about 100 times more sensitive than the **Hubble telescope**. It is expected to transform scientists' understanding of the universe.

#IRAN NUCLEAR DEAL & JCPOA

Recently, the **diplomats from Iran and world powers reconvened in Vienna (Austria) to seek a deal reviving Iran's (Tehran's) 2015 Nuclear Accord.**

- The **2015 Iran nuclear deal, signed under President Barack Obama, and dismantled in 2018 by President Donald Trump.**
- The US said it will rejoin the agreement if Iran complies with the terms of the original deal, and if it addresses other issues related to alleged ballistic missile stockpiles and the proxy conflicts that it backs across the region.

What was the 2015 Iran nuclear deal?

- The deal, formally known as **Joint Comprehensive Plan of Action (JCPOA).**

- The JCPOA was the result of **prolonged negotiations from 2013 and 2015 between Iran and P5+1** (China, France, Russia, the United Kingdom, the United States + Germany).
- Under the deal, **Iran agreed to significantly cut its stores of centrifuges, enriched uranium and heavy-water**, all key components for nuclear weapons.
- Iran also agreed to implement a protocol that would allow inspectors from the **International Atomic Energy Agency (IAEA) to access its nuclear sites** to ensure Iran would not be able to develop nuclear weapons in secret.



What happened after the US pulled out of the deal?

- In April 2020 the US announced **its intention to snap back sanctions**. However, the **other partners objected to the move**, stating that since the US was no longer part of the deal, it could not unilaterally reimpose sanctions.
- Initially following the withdrawal, several countries continued to import Iranian oil under waivers granted by the Trump administration. **A year later, the US ended the waivers to much international criticism** and, by doing so, significantly **curbed Iran's oil exports**.
- The other powers, in an attempt to keep the deal alive, **launched a barter system known as INSTEX** to facilitate transactions with Iran outside the US banking system. **However, INSTEX only covered food and medicine**, which were already exempt from US sanctions.
- In January 2020, after the **US assassinated the top Iranian general Qasem Soleimani**, Iran announced that it would no longer limit its uranium enrichment.

What is the Timeline & Background of JCPOA?

- The JCPOA was the **result of prolonged negotiations from 2013 and 2015 between Iran and P5+1** (China, France, Germany, Russia, the United Kingdom, the United States).
- It happened **due to the backchannel talks between the US (President Barack Obama) and Iran, quietly brokered by Oman**, in an attempt to repair the accumulated mistrust since the 1979 Islamic revolution.

- Islamic Revolution, also called Iranian Revolution, popular uprising in Iran in 1978–79 that resulted in the toppling of the monarchy on 11th February, 1979, and led to the establishment of an Islamic republic.
- The JCPOA **obliged Iran to accept constraints on its uranium enrichment program** verified by an intrusive inspection regime in return for a partial lifting of economic sanctions.
- However, faced with a **hostile Republican Senate, President Obama was unable to get the nuclear deal ratified** but implemented it on the basis of periodic Executive Orders to keep sanction waivers going.
- When **Donald Trump** became president, he **withdrew from the deal** and called it a **“horrible, one-sided deal that should have never, ever been made”**.
- The US decision was **criticized by all other parties to the JCPOA** (including the European allies) because Iran was in compliance with its obligations, as certified by the **International Atomic Energy Agency (IAEA)**.
- Tensions rose as the US pushed ahead with its unilateral sanctions, widening its scope to cover nearly all Iranian banks connected to the global financial system, industries related to **metallurgy, energy, and shipping, individuals related to the defence, intelligence, and nuclear establishments**.
- For the first year after the US withdrawal, Iran’s response was muted as the **E-3 (France, Germany, the U.K.)** and the **European Union (EU)** promised to find ways to mitigate the US decision.
- The E-3’s promised relief Instrument in **Support of Trade Exchanges (INSTEX)**, created in 2019 to facilitate limited trade with Iran.
- However, by May 2019, **Iran’s strategic patience** ran out as the anticipated economic relief from the E-3/EU failed to materialize.
- As the sanctions began to hurt, Iran shifted to a strategy of ‘maximum resistance’.

International Atomic Energy Agency

- Widely known as the world’s **“Atoms for Peace and Development”** organization within the **United Nations** family, the IAEA is the international centre for cooperation in the nuclear field.
- **Establishment:** The IAEA was created in 1957 in response to the deep fears and expectations generated by the discoveries and diverse uses of nuclear technology.
- **Headquarter:** Vienna, Austria.
- **Objective:** The Agency works with its Member States and multiple partners worldwide to promote safe, secure and peaceful use of nuclear technologies.
- In 2005, it was awarded the **Nobel Peace Prize** for their work for a safe and peaceful world.
- **Functions:** It is an **independent international organization** that reports annually to the **United Nation General Assembly**.
- When necessary, the IAEA also reports to the UN Security Council in regards to instances of members’ non-compliance with safeguards and security obligations.

#INDIA-PAK MOST VULNERABLE TO CLIMATE CHANGE: IPCC

- The latest **Intergovernmental Panel on Climate Change (IPCC)** report has cautioned that the **extreme climatic conditions are threatening the food security in South Asia** with escalated droughts and floods making India and Pakistan the most vulnerable to climate change.
- The **second installment of the IPCC Report** titled '**Climate Change 2022: Impacts, Adaptations, and Vulnerability**' was released on February 28, 2022.
- The report stated that the climate-related risks to the agriculture and food systems in **Asia will intensify with the changing climate, with differentiated impacts across the region.**
- It also further mentioned that the temperatures enhance not only the **ozone production but also the ozone uptake by plants, exacerbating yield and quality damage.**



- **Extreme climatic condition threatens food security in South Asia**
- IPCC Report has explained that the differential human vulnerability to environmental hazards results from a range of economic, social, political, and historical factors, all of which operate at multiple scales.
- As the **report highlighted that the climate-related risk** to agriculture and food systems in Asia will intensify, it added that climate change is expected to have serious impacts on the people living within these hotspot areas, as observed from the loss of food crop yields to disasters such as fluctuations in seasonal water availability, floods or other systematic effects.

Climate change threatens India and Pakistan

- IPCC report further explained that in South Asia, extreme climatic conditions are threatening food security, thus agro-based economies such as India and Pakistan have become the most vulnerable to climate change.
- The report warned that the major projected impacts of climate change in the food and agriculture sector will include a decline in **fisheries, crop production, aquaculture, particularly in South and Southeast Asia.**

Impact on India

- Due to the **extreme climatic condition** and its impact, the rice production in India can decrease from 10 percent to 30 percent, whereas the maize production can decrease from 25 percent to 70 per cent, assuming the range of temperature **increases from 1 degree to 4 degree Celsius.**

- **As per the IPCC Report climate change mentions** that the international food supplies are also under threat and the risks, it further highlighted that the threats to water and food supply, because of the continues climate change, can increase the risk of social unrest and armed conflict, particularly in the poorer countries, although the other factors are also significant.

Intergovernmental Panel on Climate Change

- It is the **international body for assessing the science related to climate change**.
- It was **set up in 1988** by the **World Meteorological Organization (WMO)** and **United Nations Environment Programme (UNEP)** to provide policymakers with regular assessments of the scientific basis of climate change, its impacts and future risks, and options for adaptation and mitigation.
- IPCC assessments **provide a scientific basis for governments at all levels to develop climate related policies**, and they underlie negotiations at the UN Climate Conference – the **United Nations Framework Convention on Climate Change (UNFCCC)**.

IPCC Assessment Reports

- Every few years the IPCC produces assessment reports that are the most **comprehensive scientific evaluations of the state of earth's climate**.
- So far, five assessment reports have been produced, the **first one being released in 1990**. The **fifth assessment report had come out in 2014** in the run up to the **climate change conference in Paris**.
- The Assessment Reports - by **three working groups of scientists**.
- **Working Group-I** - Deals with the scientific basis for climate change.
- **Working Group-II** - Looks at the likely impacts, vulnerabilities and adaptation issues.
- **Working Group-III** - Deals with actions that can be taken to combat climate change.

United Nations Environment Programme

- **About:** The UNEP is a leading global environmental authority established on 5th June 1972.
- **Functions:** It sets the global environmental agenda, promotes the sustainable development within the **United Nations** system, and serves as an authoritative advocate for global environment protection.
- **Major Reports:** **Emission Gap Report, Adaptation Gap Report, Global Environment Outlook, Frontiers, Invest into Healthy Planet.**
- **Major Campaigns:** Beat Pollution, UN75, World Environment Day, Wild for Life.
- **Headquarters:** Nairobi, Kenya.

About UNFCCC:

- The **United Nations Framework Convention on Climate Change (UNFCCC)**, signed in **1992** at the **United Nations Conference on Environment and Development** also known as the **Earth Summit, the Rio Summit or the Rio Conference**.
- **India** is among the select few countries to have **hosted the COP of all three Rio conventions on climate change (UNFCCC), biodiversity (Convention on Biological Diversity) and land (United Nations Convention to Combat Desertification)**.

The UNFCCC entered into force on **21st March 1994**, and has been **ratified by 197 countries**.

- It is the **parent treaty of the 2015 Paris Agreement**. It is also the **parent treaty of the 1997 Kyoto Protocol**.
- The **UNFCCC secretariat** (UN Climate Change) is the **United Nations entity** tasked with supporting the global response to the threat of climate change. It is **located in Bonn, Germany**.
- **Objective:** To achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous repercussions within a time frame so as to allow ecosystems to adapt naturally and enable sustainable development.

#EUROPE'S LARGEST NUCLEAR POWER PLANT CAPTURED BY RUSSIA

- The **Zaporizhzhia Nuclear Power Station** is located near the city of Enerhodar, Southeastern Ukraine, on the Kakhovka Reservoir's southern shore on the River Dnieper. **It is Europe's largest nuclear power plant and is among the world's top 10 largest.**
- This nuclear power plant consists of 6 VVER-1000 pressurized light-water nuclear reactors (PWR) and all of them are fuelled with U235 (LEU) and generate 950 MWe, which gives a total of 5700 MWe power output.
- **Between 1985 and 1989**, the first five were brought online, and the sixth was added in 1995.
- Nearly half of the **country's electricity is derived from nuclear power from this plant.**
- **Zaporizhzhia thermal power station** is located nearby.
- After a modernization work was completed on unit 3, in 2017, it enabled a 10-year life extension till 2027
- Unit 5's modernization was finished in 2021, allowing for a 10-year life extension.

Effect of Russian Invasion of Ukraine on this Nuclear Power Plant

- During the **ongoing Russian-Ukraine crisis**, Units 1 to 4 remained active, but Units 5 and 6 were shut down. Russia claimed to have captured Enerhodar as well as the nuclear power plant but Dmitri Orlov, the mayor of Enerhodar denied this.
- **Russian soldiers attempted to take control of the power plant recently**, with Orlov announcing that parts of the building were burning due to artillery strikes from the Russian forces. A fire broke out near one of the six units, reportedly in a training building outside the security perimeter.
- Although the reactor is undergoing renovations and is not operational, it still holds nuclear fuel. According to initial assessments, **radiation levels remained normal as the fire** did not cause any significant damage, and workers prevented further damage.
- Dmytro Kuleba, Ukraine's foreign minister, warned that if the plant were to explode, the fallout could be ten times larger than what happened at Chernobyl.
- Following an intense battle, and confirming there were no changes to radiation levels, Russian troops were able to occupy the plant.

#IRAN'S MILITARY SATELLITE NOOR-2

- A military satellite, Noor-2, has been launched into orbit at an altitude of 500 kilometres or 311 miles from the earth by **Iran's Islamic Revolutionary Guard Corps (IRGC)**.
- This is the **Islamic Republic's second military satellite launch**.
- In April 2020, the first Noor military satellite was launched at an orbit of 425km or 265 miles above the surface of the earth.
- **In the Persian language Noor means light.**
- The Noor 2 was launched from the Shahroud spaceport by the three-stage Qased, or "Messenger" launcher.
- The launch of Iran's second satellite into orbit would be a significant step forward for the country's military. This will also increase concerns about the country's nuclear and missile programs.
- The weight of the satellite is less than 45 kgs or 100 pounds. Details regarding the Noor-2 satellite were not released by the officials of the country.



About Noor Satellite

- The **Noor Spacecraft, also known as "NOUR 01,"** is an Iranian military satellite that was put into orbit on April 22, 2020.
- The launch of the Noor satellite took place from Iran's central desert. The Noor Satellite was launched by Qased, a **three-stage rocket propelled by a mix of solid and liquid fuels.**
- **Noor is Iran's first military satellite.**

#RUSSIA WITHDRAWN SUPPORT FROM ISS

Recently, after **Russia invaded Ukraine**, the **US imposed sanctions on Russia** including a ban on transfer of **technology and on Russian banks**.

- Following this, the **Russian space agency Roscosmos** held that the State Corporation will not cooperate with Germany on joint experiments in the Russian segment of the **International Space Station (ISS)**.

What is Russia's role in maintaining the ISS?

- The ISS is built with the cooperation of scientists from **five international space agencies — NASA of the US, Roscosmos of Russia, JAXA of Japan, Canadian Space Agency and the European Space Agency.**
- **Each agency has a role to play and a share in the upkeep of the ISS.** Both in terms of expense and effort, it is not a feat that a single country can support.
- Russia's part in the collaboration is the **module responsible for making course corrections to the orbit of the ISS.**
- Further, the Russian segment ensures that the **space station's orbit is corrected to keep it away from space debris, roughly 11 times a year.**



- It also ferry astronauts to the ISS from the Earth and back.

What could be the impact of Russia's Withdrawal?

- Due to its enormous weight and the ensuing drag, the ISS **tends to sink from its orbit at a height of about 250 miles above the Earth.**
- It has to be **pushed up to its original line of motion every now and then.**
- Russia's withdrawing from its segment of the ISS cooperation spacecraft **could affect correcting the orbit of the ISS.**
- This meant the ISS could fall into the sea or on the land.
- ISS would likely **crash down on some country, but most probably not Russia itself.** The orbit of the ISS does not fly over Russian territory mostly.
- However, dropping of ISS poses a **greater risk to regions that are closer to the equator.** But this is only a probability, as it can move or disintegrate.
- In case of this eventuality, people in the ISS will be brought back, modules can be detached thereby making it much smaller which will ensure that it disintegrates before touching the earth.

What is the International Space Station (ISS)?

- The ISS is the most **complex international scientific and engineering project** in history and the largest structure humans have ever put into space.
- This **high-flying satellite** is a laboratory for new technologies and an **observation platform for astronomical, environmental and geological research.**
- As a permanently **occupied outpost in outer space**, it serves as a stepping stone for further space exploration.
- The space station flies at an **average altitude of 400 kilometers above Earth.** It circles the globe every 90 min. at a speed of about 28,000 kph.
- In one day, the **station travels about the distance it would take to go from Earth to the moon and back.**
- The space station can rival the **brilliant planet Venus in brightness** and appears as a **bright moving light across the night sky.**
- It can be seen from Earth without the use of a telescope by night sky observers who know when and where to look.
- Five different space agencies representing 15 countries built the **USD 100-billion International Space Station and continue to operate it today.**
- The International Space Station was taken into space piece-by-piece and gradually built in orbit.
- It consists of modules and connecting nodes that contain living **quarters and laboratories, as well as exterior trusses that provide structural support, and solar panels that provide power.**
- The first module, **Russia's Zarya module**, launched in 1998.
- The first space station crews were three-person teams, though after the **tragic Columbia shuttle disaster** the crew size temporarily dropped to two-person teams.
- The space station reached its full six-person crew size in 2009 as new modules, laboratories and facilities were brought online.

- Current plans call for the space station to be operated through at least 2020. NASA has **requested an extension until 2024**.

Are there any substitutes for Russia?

- There are right now two possibilities. **SpaceX's dragon module and Boeing's Starliner** can dock with the ISS.
- Until SpaceX's dragon spacecraft came into the picture the Russian spacecrafts were the only way of reaching the ISS and returning.

#RELATED: NASA TO RETIRE ISS IN 2031

- The National Aeronautics and Space Administration have announced that the **International Space Station (ISS)** will cease its functioning by 2031.
- At the end of the year 2030, the **low-Earth orbit** will see the last of the International Space Station as the floating laboratory will cease the operations and swoop down the Earth.



International Space Station: What is the significance?

- The International Space Station has been hovering in the low Earth orbit for more than two decades, zooming across the periphery of the Earth at the speed of 8 km per second.
- International Space Station is one of its kind laboratories that has helped human civilization research and achieves some cutting-edge scientific and technological developments.
- International Space Station also hosts the groundbreaking work by NASA of sending the first humans to Mars.

ISS to retire in Pacific Ocean

- As per the **National Aeronautics and Space Administration**, the operators of ISS in 2031 will direct the station to fall in the South Pacific Oceanic Uninhabited area which is commonly known as Point Nemo.
- **Point Nemo in the Pacific Ocean** is considered to be the remotest location on Earth.
- With this, the **International Space Station** will no longer be a cosmic entity but will return to the ground, and all that is left behind will be its legacy.

International Space Station (ISS)

- ISS is a habitable artificial satellite - the single largest man-made structure in low earth orbit. Its first component was launched into orbit in 1998.
- It circles the Earth in roughly 92 minutes and completes 15.5 orbits per day.
- The ISS programme is a joint project between **five** participating space agencies: **NASA (United States), Roscosmos (Russia), JAXA (Japan), ESA (Europe), and CSA (Canada)** but its ownership and use has been established by intergovernmental treaties and agreements.
- It serves as a microgravity and space environment research laboratory in which crew members conduct experiments in biology, human biology, physics, astronomy, meteorology, and other fields.
- Continuous presence at ISS has resulted in the longest continuous human presence in the low earth orbit.

#RELATED: CHINA'S PERMANENT SPACE STATIONS

Recently, China launched an unmanned module of its permanent space station that it plans to complete by the end of 2022.

- The module, named "**Tianhe**", or "**Harmony of the Heavens**", was launched on the **Long March 5B**, China's largest carrier rocket.
- **India** has also set its **eye on building its own space station in low earth orbit** to conduct microgravity experiments in space in 5 to 7 years.

Background:

- The **only space station** currently in orbit is the **International Space Station (ISS)**, from which **China is excluded**.
- A **space station is a spacecraft** capable of supporting crew members, designed to remain in space for an extended period of time and for other spacecraft to dock.
- The **ISS is backed by** the United States, Russia, Europe, Japan and Canada.
- **China has been a late starter** when it comes to space exploration. It was only in 2003 that it sent its first astronaut into orbit, making it the third country to do so, after the Soviet Union and the US.
- So far, China has sent two previous space stations into orbit. The **Tiangong-1** and **Tiangong-2** were **trial stations** though, simple modules that allowed only relatively short stays by astronauts.

#WHAT IS SUPER-COMPUTER PARAM GANGA?

- A super computer made in India, '**PARAM Ganga**' was installed at IIT Roorkee on March 7, 2022.
- The installation of the super computer was done by B.V.R. Mohan Reddy, Chairman of IIT Roorkee.
- The **Petascale Super Computer** has been made in India under the National Supercomputing Mission (NSM). The key focus is to provide computational power to the **user community of IIT Roorkee and neighbouring academic institutions**.



Param Super Computer

- **IIT Roorkee** had signed a Memorandum of Understanding (MoU) with the **Centre for Development of Advanced Computing (CDAC)** to establish a state-of-the-art Supercomputing facility involving critical components.
- **PARAM Ganga** has a supercomputing capacity of 1.66 **Petaflops (Peta Floating-Point Operations per Second)**.
- The super computer has been designed and commissioned by C-DAC under Phase 2 of the build approach of the NSM.
- The substantial components utilized to build the super computer were manufactured and assembled in India along with an indigenous software stack developed by C-DAC.

Significance

- The establishment of Param, made in India super computer is a major step towards the **Make in**

India initiative of the Indian Government.

- Overall, the installation of supercomputer infrastructure at various Institutes has helped the R&D community to achieve major objectives and milestones and thousands of computing jobs have also been created.

What is a Supercomputer?

- A supercomputer is a computer **that performs at or near the currently highest operational rate** for computers.
- **Generally, PETA FLOP** is a measure of a Supercomputer's processing speed and can be expressed as a thousand trillion floating point operations per second.
- FLOPS (floating point operations per second) are typically used to measure the performance of a computer's processor. Using floating-point encoding, extremely long numbers can be handled relatively easily.
- Supercomputers are **primarily designed to be used in enterprises and organizations** that require massive computing power.
- For example: weather forecasting, scientific research, intelligence gathering and analysis, data mining etc.
- Globally, **China has the maximum number of supercomputers** and maintains the top position in the world, followed by the US, Japan, France, Germany, Netherlands, Ireland and the United Kingdom.
- India's **first supercomputer was PARAM 8000**.
- **PARAM Shivay, the first supercomputer assembled indigenously**, was installed in IIT (BHU), followed by **PARAM Shakti, PARAM Brahma, PARAM Yukti, PARAM Sanganak** at IIT-Kharagpur, IISER, Pune, JNCASR, Bengaluru and IIT Kanpur respectively.
- In 2020, **PARAM Siddhi, the High-Performance Computing-Artificial Intelligence (HPC-AI) supercomputer**, achieved global ranking of 62nd in Top 500 most powerful supercomputer systems in the world.

• National Supercomputing Mission

- The **National Supercomputing Mission (NSM)** is a joint initiative of the Department of Science and Technology (DST) and the **Ministry of Electronics and Information Technology (MeitY)**.
- It is being implemented by the Centre for Development of Advanced Computing (C-DAC) and Indian Institute of Science (IISc), Bangalore.

The four major pillars of the National Supercomputing Mission include:

- **Infrastructure**
- **Applications**
- **Research and Development**
- **HRD**
- The **C-DAC has been entrusted** with the responsibility to design, develop, deploy and commission supercomputing systems in India.
- The NSM mission plans to build and deploy 24 supercomputing facilities in India with cumulative compute power of more than 64 Petaflops.

- C-DAC has till now deployed 11 such systems at IISc, IITs, IISER Pune, JNCASR, NABI-Mohali and C-DAC under NSM Phase-1 and Phase-2. These systems have a cumulative compute power of more than 20 Petaflops.

Digital India programme

- Vision Areas
- Digital infrastructure as Utility to Every Citizen
- Governance and services on demand
- Digital empowerment of citizens
- *Objectives*
- To prepare India for a knowledge future.
- For being transformative that is to realize **IT (Indian Talent) + IT (Information Technology) = IT (India Tomorrow)**.
- Making technology central to enabling change.
- On being an Umbrella Programme – covering many departments.
- The programme weaves together a large number of ideas and thoughts into a single, comprehensive vision so that each of them is seen as part of a larger goal.
- The Digital India Programme will pull together many existing schemes which would be restructured and re-focused and implemented in a synchronized manner.

Make in India campaign

- **Make in India campaign** was launched by the Prime Minister of India on September 25, 2014.
- *Objectives*
- To **attract foreign investment for new industrialisation** and develop the already existing industry base in India to surpass that of China.
- Target of an **increase in manufacturing sector growth to 12-14% per annum** over the medium term.
- To **increase the share of manufacturing sector in the country's Gross Domestic Product from 16% to 25% by 2022**.
- To **create 100 million additional jobs by 2022**.
- To **promote export-led growth**.

#CHINA'S EARTH OBSERVATION SATELLITE: GAOFEN-03

- China has launched a new Earth observation satellite on 7th April 2022. This satellite will become a part of the country's land-sea radar satellite constellation. It will capture images to help China safeguard its maritime interests.
- The satellite has been named Gaofen-3 03.
- It was from the Jiuquan Satellite Launch Centre with the use of a Long March-4C rocket.
- The satellite has been successfully inserted into the planned orbit.
- This newly launched satellite will be networked with the already orbiting Gaofen-3 and Gaofen-3 02 satellites.
- These 3 satellites will form a land-sea radar satellite constellation and will be capturing stable, reliable, synthetic aperture radar (SAR) images.



About SAR Images

- A lot of SAR images are captured by Earth Observation (EO) satellites every day. SAR images have the capabilities to process images during all-weather operations.
- The images produced have a high spatial resolution. These images boast a 1-meter resolution thus, improving China's monitoring capabilities.

Use of the Satellite

- The images that will be captured by the satellite will help in the mitigation and prevention of marine disasters, help in the monitoring of the dynamic marine environment, environmental protection, marine research, agriculture, water conservancy, and meteorology. It will also help in safeguarding the maritime rights and interests of the country.

China's Shenzhou-12 Manned Mission

- The Shenzhou-12 craft connected with the Tianhe space station module about six hours after takeoff from the Jiuquan launch center in Gobi Desert.
- The three-man crew will spend three months on the Tianhe module, which is orbiting at some 340km to 380km above the earth.
- China is the third country after the former Soviet Union and the United States to carry out a manned mission on its own.
- This is the first of two manned space missions planned for this year, part of an intense schedule of launches aimed at completing the Chinese space station in 2022.
- At least five more missions are planned for the year, with the Shenzhou-13 manned mission, also carrying three astronauts, set for later this year.
- The three astronauts are the first to take up residency in the main living module and will carry out experiments, test equipment, conduct maintenance and prepare the station for receiving two laboratory modules next year.

- It was **China's seventh crewed mission to space** but marked **a number of firsts for the country** – the first manned one during the construction of China's space station, the first in nearly five years after the country's **last manned mission in 2016** and China's **longest crewed space mission** to date.

China's Permanent Space Station

- Recently, China **launched an unmanned module of its permanent space station that it plans to complete by the end of 2022.**
- The module, named "**Tianhe**", or "**Harmony of the Heavens**", was launched on the **Long March 5B**, China's largest carrier rocket.
- **India** has also set its **eye on building its own space station in low earth orbit** to conduct microgravity experiments in space in 5 to 7 years.

China's Space Station:

- The **new, 66-tonne, multi-module Tiangong station** is set to be **operational for at least 10 years.**
- **Tianhe is one of three main components** of what would be **China's first self-developed space station**, rivalling the only other station in service – the ISS.
- It **forms the main living quarters for three crew members** in the Chinese space station.
- The Tianhe launch is the **first of 11 missions** needed to complete the space station, which will **orbit Earth at an altitude of 340 to 450 km.** In the later missions, China will launch the **two other core modules, four manned spacecraft and four cargo spacecraft.**

#INDIA SUCCESSFULLY FLIGHT TESTED 'SFDR MISSILE SYSTEM'

Recently, India successfully flight tested **Solid Fuel Ducted Ramjet (SFDR) Booster**, a missile system, at the Integrated Test Range (ITR) in Chandipur off the Odisha coast.

- The **Defence Research and Development Organisation (DRDO)** began developing SFDR first in 2017 and had conducted successful tests in 2018 and 2019 as well.



What is SFDR?

- It is a missile propulsion technology jointly developed by **India and Russia.**
- SFDR technology is a missile propulsion system based on the concept of **Ramjet Engine** principle.
- A ramjet is **a form of air-breathing jet engine that uses the vehicle's forward motion to compress incoming air** for combustion without a rotating compressor.
- In a ramjet, the **high pressure is produced by "ramming" external air into the combustor** using the forward speed of the vehicle. The external air that is brought into the propulsion system becomes the working fluid.
- The SFDR has been developed by **Defence Research and Development Laboratory, Hyderabad** in collaboration with other **DRDO laboratories** such as Research Centre Imarat, Hyderabad and **High Energy Materials Research Laboratory, Pune**

What is the Defence Research and Development Organisation?

- DRDO works under the administrative control of the Ministry of Defence, Government of India.
- It is **working to establish a world class science and technology base for India** and provides Defence Services decisive edge by equipping them with internationally competitive systems and solutions.
- It was **established in 1958** after combining the Technical Development Establishment (TDEs) of the Indian Army and the Directorate of Technical Development & Production (DTDP) with the Defence Science Organisation (DSO).
- It is **responsible for carrying out the Integrated Guided Missile Development Programme (IGMDP)**.

Some of the recent tests conducted by DRDO:

- **Helina and Dhruvastra: Anti-tank Guided Missile**
- **Smart Anti Airfield Weapon**
- **Army Variant of MRSAM**
- **Land-attack Version of BrahMos Missile**
- **Quick Reaction Surface-to-Air Missile System**
- **Enhanced Version of Pinaka Mk-1 Missile**
- **NAG Missile: Anti Tank Guided Missile**

#ENHANCED PINAKA MK-1 ROCKET SYSTEM

The **Enhanced Pinaka Mk-I Rocket System (EPRS)** was successfully test fired in the Pokhran range in Rajasthan.

- As part of the same set of trials, the **Area Denial Munition (ADM)** was also successfully tested.
- The tests also **validated the performance of different variants of munitions and fuzes** that can be **used in the Pinaka rocket system**.
- ADMs are a **category of ammunition used to prohibit the adversary from occupying or passing through a particular area**



What is EPRS?

- The EPRS is the upgraded version of the **Pinaka variant** that has been in service with the Indian Army for the last decade.
- The design and development has been carried out by Pune-based **DRDO (Defence Research and Development Organisation)** laboratories - **Armament Research and Development Establishment (ARDE)** and **High Energy Materials Research Laboratory (HEMRL)**.
- The upgrades include advanced technologies enhancing the range to meet the emerging requirements of the battlefield.
- The new incarnation of **pinaka represents one of the few examples of an evolutionary process** being followed with an indigenous Indian weapon system.

What is Pinaka?

- The Pinaka rocket system is a **multi-barrel rocket system, which is** named after Lord Shiva's bow.

- It is developed by Pune-based Armament Research and Development Establishment (ARDE) and High Energy Materials Research Laboratory (HEMRL).
- The development of the Pinaka was started by the DRDO in the late 1980s as an alternative to the Multi Barrel Rocket Launcher systems of **Russian make called the 'Grad', which are still in use by some regiments.**
- After successful tests of Pinaka Mark-1 in late 1990, it was **first used in the battlefield during the Kargil war of 1999, quite successfully. Subsequently, multiple regiments of the system came up in the 2000s.**

Multiple Variants:

- DRDO has also developed and **successfully tested the Mk-II and guided variants of the Pinaka, which has a range of around 60 km**, while the Guided Pinaka system has a range of 75 km and has integrated navigation, control and guidance system to improve the end accuracy and enhance the range.
- The navigation system of the Guided Pinaka missile is also aided by the **Indian Regional Navigation Satellite System (IRNSS).**

RELATED: ANTI-TANK GUIDED MISSILE: HELINA

- India has successfully flight-tested **Helina, an Anti-Tank Guided Missile (ATGM)**, in Pokhran.
- According to the **Defence Research and Development Organisation (DRDO)**, it is **one of the most advanced Anti-Tank Weapons in the world.**
- The test was **part of user validation trials of the third generation 'fire and forget' class missiles** developed by the DRDO.

What is Helina?

- **About:** Helina has been **developed by the Defence Research and Development Laboratory (DRDL), Hyderabad** under the **Missiles and Strategic Systems (MSS)** cluster of the DRDO.
- Successful user trials of the missile have been conducted **since 2018.**
- **Features:** It has a **maximum range of seven kilometers** and has been **designed and developed for integration on the weaponized version of the ALH (Advanced Light Helicopter).**
- The **Air Force version** of Helina is sometimes referred to as **Dhruvastra.**
- Helina can **engage targets both in direct hit mode as well as top attack mode.**

Other Anti-tank Missiles:

- The DRDO has designed and developed a range of anti-tank missile technologies that include:
- **The Nag:** It is a **third-generation fire-and-forget missile** developed for mechanized formations to engage heavily fortified enemy tanks.
- **MPATGM:** It stands for **Man-Portable Anti-Tank Guided Missile** which has a range of 2.5 kilometers, with fire-and-forget and top attack capabilities for infantry use.
- **SANT:** It is a **Smart Stand-off Anti-Tank Missile** being developed for launch from the Mi-35 Helicopter for the Air Force's anti-tank operations.
- **ATGM for MBT Arjun:** ATGM for MBT Arjun is a **laser-guided, precision-guided munition** that is launched from the 120mm rifled gun of the Arjun tank to engage and defeat Explosive Reactive Armour-protected armoured targets.

#RUSSIA'S NUCLEAR CAPABLE BALLISTIC MISSILE

- Russia successfully tested **Sarmat, a nuclear-capable intercontinental ballistic missile** that can reportedly strike any target in the world on April 20, 2022.
- Russian President Vladimir Putin congratulated the army on the successful launch of the missile and warned that the **weapon, which is capable of carrying nuclear charges, will make Russia's enemies "think twice."**
- The missile delivered training warheads to the Kura test range of the Kamchatka peninsula, nearly 6,000 km (3,700 miles) away in Russia's Far East. The missile test comes as Russia has increased its military aggression in Ukraine.



Sarmat Missile: World's Most Powerful Missile?

- **Russia's Defence Ministry called Sarmat as the most powerful missile with the longest range of destruction of targets in the world**, which will significantly increase the combat power of Russia's strategic nuclear forces.
- The intercontinental ballistic missile has been designed to elude **anti-missile defence systems with a short initial boost phase. It will give enemy surveillance systems only a small window to track it.**
- The missile is also super heavy, weighing more than 200 tonnes and it is capable of transporting multiple warheads.
- According to Russian President Vladimir Putin, the missile can hit any target on Earth. He also dubbed the missile as invincible, while the western analysts have called the missile as '**Satan**'.

Will Russia use the missile in its military assault against Ukraine?

- The Sarmat Intercontinental Ballistic missile is among Russia's next-generation missiles, **which also include Kinzhal and Avangard hypersonic missiles.**
- Russia had used the Kinzhal missile for the **first time to strike a target in Ukraine last month.**
- The delivery of the missile is expected to start in autumn of this year after the completion of testing. The testing does not come as a surprise for the West, as the missile had been under development for years.
- This **will though raise fears of a nuclear attack on Ukraine**, as Russia is yet to capture any major cities since it launched its military invasion on February 24, 2022.

Background

- **Russian President Vladimir Putin recently ordered Russia's nuclear forces** to be put on high alert. UN Secretary-General Antonio Guterres also said last month, "The prospect of nuclear conflict, once unthinkable, is now back within the realm of possibility."
- The United States had recently cancelled its planned test-launch of its Minuteman III intercontinental ballistic missile (ICBM) over fears of escalating tensions with Russia amid the ongoing military conflict in Ukraine.

#WHAT IS JUPITER'S MOON EUROPA

A team of researchers from Stanford University found the possibility of **water on one of Jupiter's moons Europa**, a prime candidate for life in the solar system.

- Earlier, NASA's Dawn spacecraft, dwarf planet Ceres reportedly found **salty water underground**.
- Earlier, Scientists also found signatures of water vapor in the atmosphere of K2-18b.



What is Europa?

- Europa is **slightly smaller than Earth's moon** and its diameter is about one-quarter that of the Earth.
- Even though Europa has a **very thin oxygen atmosphere**, it is considered **one of the most promising places in the solar system** to find present-day environments that are suitable for life beyond the Earth.
- It is also believed that underneath **Europa's icy surface the amount of water is twice that on Earth**.
- Scientists believe **Europa's ice shell is 15-25 km thick and is floating on an ocean, which is estimated to be between 60-150 km deep**.
- Interestingly, while its diameter is less than the Earth's, **Europa probably contains twice the amount of the water in all of the Earth's oceans**.
- NASA is expected to launch its **Europa Clipper in 2024**.
- The module will **orbit Jupiter and conduct multiple close flybys to Europa to gather data on the moon's atmosphere**, surface and its interior.

What are the Findings?

- Europa's surface is mostly solid water ice and **contains water beneath it**.
- The double ridges – the **formations which are most common on Europa's surface and are like those seen on Earth's Greenland ice sheet**.
- Double Ridges of the moon **are formed over shallow pockets of water**.

What is Jupiter?

- Fifth in line from the Sun, Jupiter is, by far, the **largest planet in the solar system** – more than twice as massive as all the other planets combined.
- Jupiter, Saturn, Uranus and Neptune are called **Jovian or Gas Giant Planets**. These have thick atmosphere, **mostly of helium and hydrogen**.
- Jupiter's iconic **Great Red Spot** is a giant storm bigger than Earth that has raged for hundreds of years.
- Jupiter **rotates once about every 10 hours** (a Jovian day), but takes about **12 Earth years** to complete **one orbit of the Sun** (a Jovian year).
- Jupiter has **more than 75 moons**.
- The planet Jupiter's **four largest moons are called the Galilean satellites** after Italian astronomer Galileo Galilei, who first observed them in 1610.
- These large moons, named **Io, Europa, Ganymede, and Callisto**, are each distinctive world.
- In 1979, the **Voyager mission** discovered Jupiter's faint **ring system**.

- **Nine spacecraft** have visited Jupiter. Seven flew by and two have orbited the gas giant. **Juno**, the most recent, arrived at Jupiter in 2016.

#WHAT IS GAGAN-SATELLITE TECHNOLOGY?

- India has achieved a major landmark after the **Airports Authority of India (AAI)** successfully conducted a trial by applying the latest indigenous satellite-based augmentation system (SBAS) technology named GAGAN (GPS Aided GEO Augmented Navigation).
- IndiGo became the first airline in Asia that used the indigenously developed satellite-based navigation system while **landing at the Kishangarh airport, Rajasthan**.
- India is the first country in the Asia Pacific region that has achieved this.



Development of GAGAN

- GAGAN has been jointly developed by the **Indian Space Research Organization (ISRO)** and the **Airports Authority of India (AAI)**.
- By using uplink and reference stations, this system provides corrections to the global positioning system (GPS) signal so as to improve the management of air traffic.

About GAGAN

- It is a **Satellite-Based Augmentation System** that provides Satellite-based Navigation services with integrity and accuracy that is required for civil aviation applications.
- Through the usage of this system better Air Traffic Management can be provided over the Indian Airspace. This system is interoperable with the other international SBAS systems that are being used across the world and will be able to provide seamless navigation across the regional boundaries.
- The **GAGAN Signal-In-Space (SIS)** is available via the **GSAT-10 and GSAT-8**. Aircraft have to rely on radio navigation aids for the purpose of precision landing. However, the smaller airports have a shortage of modern navigation aids.
- Hence, the visibility requirements in such airports are much higher. Such as the visibility requirement for all regular passenger flights at Kishangarh airport is 5,000 metres, but using the GAGAN technology, an aircraft can operate with a visibility of about 800 m.

- **Extremely accurate information** is provided by GAGAN regarding an aircraft's location, covering various parameters like longitude, latitude, and height.

#RELATED: GSAT-7B SATELLITE DEDICATED TO INDIAN ARMY

Recently, the **Ministry of Defense** has given the Acceptance of Necessity for the GSAT-7B satellite. This satellite will be a **dedicated satellite for the Indian Army**.

- The satellite would help the **Indian Army enhance its surveillance in border areas**.
- Currently, India has only two dedicated military satellites — the **GSAT-7 (Rukmini)** and **GSAT-7A (Angry Bird)** — used by the **Indian Navy and Air Force** respectively.

What will be the role of the GSAT 7B satellite?

- Till date, the Indian Army has been dependent on **GSAT-7A and other satellites**, but with this new state-of-the-art technology, the Army will have **new eyes in the sky**.
- The military-grade satellite will be a **force multiplier in providing fail-safe communication support**.
- The GSAT 7B will primarily fulfil the **communication needs of the Army**.
- While many features of this satellite are still a **closely guarded secret**, it is expected that the **state of the art, multi-band, military-grade satellite** shall be a shot in the arm for the communication and **surveillance needs of the Army**.
- Such a satellite would be of **utmost importance for the Indian Army** as it currently faces a double threat of **China and Pakistan lurking at its borders**.
- The use of such a satellite would also mean that the **Army's vast array of radio communication equipment** could come under a single platform.

What is the role of GSAT 7 Satellite?

- GSAT 7 series satellites are advanced satellites developed by the **Indian Space Research Organisation (ISRO)** to meet the communication needs of the defence services.
- The **GSAT 7 (Rukmini)** provides a gamut of services for military communication needs, which includes low bit voice rate to **high bit rate data facilities, including multi-band communications**.
- It is **India's first military satellite**.
- The GSAT 7 satellite was launched in **August 2013 from an Ariane 5 ECA rocket from Kourou in French Guiana**.
- It is a **2,650 kg satellite** which has a footprint of nearly **2,000 nautical miles in the Indian Ocean region**.

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