Beidou Goes Global

Syllabus: Science and Technology- developments and their applications and effects in everyday life

In News

- China's home grown satellite navigation system Beidou, has launched its global service ahead of the previous roll-out target of 2020 as the country looks to challenge the dominance of America's Global Positioning System (GPS).
- Beidou, the Chinese name for the **seven stars** that make up the Big Dipper, offers a worldwide location service with an **accuracy of 5 metres within the Asia-Pacific region and 10 metres in other parts of the world**. Its velocity accuracy is 0.2 metres per second, while its timing accuracy stands at 20 nanoseconds.
- It started serving China in 2000 and the Asia-Pacific region in 2012, while outside of China, **Pakistan is the first country** to use the BeiDou system.
- The US GPS offers accuracy to within centimetres, but concerns over Washington's ability to shut off service during wartime, prompted China, Russia and other nations to develop their own system.
- Similar to the origins of GPS, Beidou started in 1994 as an air defence system with the goal of boosting the country's space programme, while freeing up the People's Liberation Army from its reliance on the American-built system.
- By the end of 2018, there were a total of 33 BDS satellites operating in orbit for BeiDou. This included 15 BDS-2 satellites and 18 BDS-3 satellites.
- The navigation system now serves not only China's civil aviation and maritime needs, but is also used in global search and rescue, telecommunications and mass consumer applications for navigation.
- China plans to launch another 11 BDS-3 satellites and one BDS-2 satellite in the coming two years to form a complete global network, which will further enhance the global service performance.

Floating Nuclear Power Plant

Syllabus: Science and Technology- developments and their applications and effects in everyday life

In News

Science and Technology- developments and their applications and effects in everyday life

- Russia's state-run Atomic Energy Corporation, ROSATOM has developed the **world's first floating nuclear power plant**.
- Named after 18th-century Russian scientist Mikhail Lomonosov, it is called **Akademik Lomonosov** and will primarily be used to power oil rigs as Russia pushes further north into the Arctic to drill for oil and gas.
- The ship holds two reactors with two 35 megawatt nuclear reactors that are similar to those used to power icebreaker ships.
- It will replace a coal-fired power plant and an aging nuclear power plant Bilibino, supplying over 50,000 people with electricity and reducing carbon footprint in the Arctic by around 50,000 tonnes of carbon dioxide emissions each year.

- It will also make it possible to supply electricity to hard-to-reach areas, regardless of transport infrastructure, landscape, and cost of fuel delivery.
- For fossil fuel-based electricity generation, up to 40 per cent of the cost is attributed to the price of coal, oil or gas, as well as to the cost of their delivery. This figure is even higher for especially remote locations.
- The small size, lightweight, and fixed cost of the plant eliminate many such challenges. The small nuclear reactor can operate non-stop without the need for refuelling for three to five years, thereby considerably reducing the cost of electricity generation.
- The reactor has the potential to work particularly well in regions with extended coastlines, power supply shortages and limited access to electrical grids.
- Moreover, no spent nuclear fuel or radioactive waste will be left behind as it will be taken to the special storage facilities.

Criticisms

- Greenpeace has referred to the vessel as **Chernobyl on ice** and a **nuclear Titanic** bound for catastrophe.
- The 1986 Chernobyl disaster was a catastrophic nuclear accident that occurred in April 1986, at the Chernobyl Nuclear Power Plant in Ukraine.
- One of the major concerns with the power plant is that it has a flat-bottomed hull so that it can get close to the shoreline and it has no self-propulsion, making it more vulnerable to storms.
- The efforts of Greenpeace compelled Russia to change its plan to stock the power plant in St Petersburg and send it to Pevek.

ROSATOM

- ROSATOM is the only company in the world to offer integrated clean energy solutions across the nuclear supply chain and beyond, including the design, build and operation of nuclear power stations, uranium mining, conversion and enrichment, the supply of nuclear fuel, decommissioning, spent fuel storage and transportation and safe nuclear waste disposal.
- Globally, the company has the second biggest uranium reserves, has 40 per cent of the world's enrichment market, and is the world's biggest builder of the latest generation nuclear power stations and $133 billion 10-years export order book.
- **Headquartered in Moscow**, it also works in the segments of wind generation, nuclear medicine, and energy storage.

Hongyun Project

Syllabus: Science and Technology- developments and their applications and effects in everyday life

In News

- China has successfully launched the first satellite of its Hongyun project, which seeks to create a network of communication satellites on the low Earth orbit in order to provide stable internet connection to the country's remote regions.
- The satellite was launched from a Long March 11 carrier rocket from the Jiuquan Satellite Launch Centre in north-western China.
- The mission of the satellite is to **verify low-orbit broadband communication technologies** to be used on the Hongyun satellite constellation.

- Weighing 247 kilograms, the satellite works in a **sun-synchronous orbit** about 1,100 kilometres above earth. It is powered by solar arrays and has a design life of one year, but is expected to operate longer.
- Announced by China Aerospace Science and Industry Corp. (CASIC) in September 2016, the Hongyun project has the **goal of building a space-based communications network of 156 communications satellites into low Earth orbit, at an altitude of 160 to 2,000 km**. Each satellite of the network will be able to **transmit 500 megabytes of data per second**. It will become operational in 2022.
- The concept of running a low-cost, high-performance satellite network to provide space-based communications and internet services has become popular globally among industry players.
- Currently, many tech companies, including Google, SpaceX, OneWeb and Telesat, have already launched plans to use satellites to provide free internet access.
- When the Hongyun project is complete, it **will cover the whole world and offer round-the-clock communication services to users in polar regions**, who now have difficulties accessing telecommunication and internet services, even from on board an aircraft or a ship or in a remote area.
- The Hongyun system **will feature lower production and operational costs and fewer occurrences of data transmission delays** compared with existing communication satellite networks.
- It will achieve global coverage with communications, navigation, remote sensing and other functions, supplying application demands, including sensor data acquisition, industrial Internet of Things, and remote control of unmanned vehicles.

Navic Powered Gadgets For Tamil Nadu Fishermen

Syllabus: Science and Technology- developments and their applications and effects in everyday life

In News

- Eighty fishing boat groups were recently provided with 200 ISRO developed satellite enabled communication devices by the Tamil Nadu government that will provide them real-time alerts on cyclone and weather updates.
- During cyclone Ockhi last year, several fishermen went missing and the government had faced criticism that timely updates about the storm were not communicated to them to enable them to return home.
- The devices that are the size of a soap box and are Bluetooth enabled are basically receivers, which emit a beep signal when alerts are received. The alerts can be accessed by downloading the NavIC App in android phones and would come in very handy for those who go for deep sea fishing.

IRNSS

- IRNSS also called NavIC is an **independent regional navigation satellite system** being developed by India. It provides **position, navigation and timing services over India and its neighbourhood**.
- The system at present consists of a **constellation of seven satellites**, with two additional satellites on ground as stand-by.
- It is designed to provide accurate position information service to users in India as well as the region extending **up to 1500 km from its boundary**, which is its primary service area. It is expected to provide a position accuracy of better than 20 m in the primary service area.

- It provides two types of services, namely, **Standard Positioning Service (SPS)** which is provided to all the users and **Restricted Service (RS)**, which is an encrypted service provided only to the authorised users.

National Children's Science Congress (NCSC)

Syllabus: Science and Technology- developments and their applications and effects in everyday life

In News

- The 26th **National Children's Science Congress (NCSC)** was recently held in **Odisha** with over 700 children from India and 10 ASEAN and five Gulf countries participating in it.
- NCSC is a nationwide Science Communication programme **started in the year 1993**. It is a programme of **National Council for Science and Technology Communication** (NCSTC), Department of Science and Technology, New Delhi.
- It is a forum for children of the **age-group of 10-17 years**, both from formal school system as well as from out of school, to exhibit their creativity and innovativeness and more particularly their ability to solve a societal problem experienced locally using by method of science.
- Around 56% of the participants in the NCSC this year are girls while attempts are being made to bridge the rural-urban gap with 40% of the children hailing from rural areas.
- The theme for this year's NCSC was **Science, Technology and Innovation for a Clean, Green and Healthy Nation**, which has been aptly chosen as environment and health have emerged as two major concerns of our times.

About National Council for Science and Technology Communication

- NCSTC is mandated to communicate Science and Technology to masses, stimulate scientific and technological temper and coordinate and orchestrate such efforts throughout the country.
- It is devoted towards societal upliftment through the dissemination of scientific knowledge in an informed manner and builds programmes with the help of different media which percolate down to every nook and corner of the society.
- It focuses on outreach activities, training in Science and Technology communication, development, production & dissemination of S & T software, incentive programmes, and field based Sci-Com projects, research in S&T communication, international co-operation, motivating students and teachers, environment awareness and programmes with a special component exclusively for women.

Digital Sky Platform launched

Syllabus: Awareness in the fields of IT

In News

- The Civil Aviation Ministry has **started the registration process for drone operators** in the country, to be done through a portal called **Digital Sky**.
- The government, in August, had put in place regulations for operations of remotely piloted aircraft, to come into effect from December 1.
- Under these norms, drone users will be **required to do one-time registration of their drones**. They will **also need to register the pilots of drones as well as their owners**.
- For drones of micro size and above categories, operators are required to register on the Digital Sky portal whereas Nano drones can start flying legally from the day of the announcement.

- To get the permission to fly, RPAS (remotely piloted aerial system) or drone operators or remote pilots will have to file a flight plan.
- Flying in the green zones will require only intimation of the time and location of the flights via the portal or the app. Permissions will be required for flying in yellow zones and flights will not be allowed in the red zones.
- The location of these zones will be announced soon and permission will be made available digitally on the portal.
- To prevent unauthorised flights and ensure public safety, **any drone without a digital permit will not be able to take off**.
- The drone industry is an industry of the future. With the development of this platform, India will be taking lead in this sector and will be working with countries around the world to develop common, scalable standards. It has a large potential for Make in India and also to export drones and services from India.

Exseed Sat-1

Syllabus: Awareness in the fields of Space

In News

- India's **first privately built satellite Exseed Sat-1** was recently launched into polar orbit by SpaceX's Falcon 9 rocket.
- With this launch, Mumbai-based **Exseed Space has become the first private commercial organisation in India to have a satellite in space**.
- It develops small satellite platforms with primary focus on assembly, integration, testing and operation of satellites with the ultimate goal to **democratise space exploration**.
- The company is working toward setting up India's first contract satellite manufacturing facility. Once operational, the facility will cater to the growing global demands of manufacturing Cubesats, Nano-sats & Micro-sats.
- ISRO has been encouraging private players to form a small consortium to undertake satellite and rocket manufacturing work so that it can focus on R&D.
- Costing Rs 2 crore, it was built in just 18 months by a team of eight scientists. It weighs only one kilo, and has dimensions that are no bigger than a tissue box. However, it will play a large role in India's communication systems.
- It is expected to have a life of two years, depending upon how long the battery lasts and when the satellite de-orbits naturally.
- It is an amateur (ham) radio, the kind of communication system that functions perfectly irrespective of the terrestrial systems.
- An amateur radio operator or Ham is someone who uses equipment at an amateur radio station to engage in a two-way personal communication with other amateur operators on radio frequencies assigned to the amateur radio service.
- It **looks to serve the amateur radio community, and will help in coordinating messages among them and help the country in time of emergencies and natural disasters**. At the same time, it will be used **for commercial purposes, agricultural solutions and communication**.

Crew Interactive Mobile Companion (CIMON)

Syllabus: Awareness in the fields of Space

In News

- A small robot **CIMON endowed with artificial intelligence (AI)** has been launched on a two-day trip to the International Space Station aboard SpaceX's Dragon cargo capsule.
- **No other AI-equipped machine** has ever flown to space before.
- Weighing about 5 kilograms, the 3D-printed robot designed jointly by the German space agency DLR, Airbus and IBM can converse with people and knows who it's talking to, due to the facial-recognition software.
- It doesn't process commands itself, but instead communicates with a ground-based cloud computer — **IBM's natural-language-processing computer Watson**.
- The astronaut assistant is mobile. Once aboard the ISS, it will be able to fly around, by sucking air in and expelling it through special tubes. With its ability to float around, CIMON could save astronauts a lot of time during experiments and help them perform more efficiently.
- The mission is a technology demonstration of what a future AI-based assistant on the International Space Station or on a future, longer term exploration mission would look like.
- It'll be a while before intelligent robots are ready to do any real heavy lifting in the final frontier — say, helping astronauts repair damaged spacecraft systems or treating sick crewmembers. But the mission could help pave the way for significant developments in the future.
- Having AI, the knowledge base and the ability to tap into it in a way that is useful for the tasks required to be done in space is critical for having humans further and further away from the planet.

GSAT-7A

Syllabus: Awareness in the fields of Space

In News

- ISRO has recently launched its military communication satellite GSAT-7A from Sriharikota, Andhra.
- Second in the family of military satellites (GSAT-7 was for the Indian Navy) weighing 2250 kg, GSAT-7A has a **mission life of eight years**. It has been built to provide communication capability to the Indian Air Force in the **Ku-band**, over the Indian region.
- The GSLV-F11 space vehicle will release it to an eventual geostationary orbit of 36,000 km from Earth. However, it will become fully functional after a month of testing payloads. GSLV F-11 with **indigenous cryogenic upper stage** has a total of three stages.
- The satellite is expected to add a new space-based dimension to the way IAF interlinks, operates and communicates with its aircraft as they fly and with command centres on ground.
- The IAF has several platforms (aircrafts) which have capabilities of communication through satellite. The communication to the platform through the satellite will be made possible with this launch.
- It is designed to expand the communication capabilities of the Indian Air Force by connecting many of the ground radar stations, airbases and aircrafts operated by the IAF, and is also expected to boost some of their network dependant warfare and drone capabilities.
- It will be a major booster and force multiplier for the IAF as such systems will help achieve full network centricity in a network centric warfare.

GSAT-11 Launched

Syllabus: Awareness in the fields of Space

In News

- ISRO's heaviest and most-advanced high throughput communication satellite GSAT-11 has been successfully launched from a European spaceport - **Arianespace in South America**.
- The 5854-kg satellite adds 40 more transponders, 32 in the Ku band and eight in the Ka band being introduced newly in an Indian satellite.
- The spacecraft has the **highest number of five communication antennas ever used in an ISRO satellite and largest solar panels and payload panels**.
- It is a fore-runner in a series of **advanced communications satellite with multi-spot beams** covering Indian mainland and islands.
- The satellite will **boost the broadband connectivity to rural and inaccessible Gram Panchayats** in the country coming under the Bharat Net Project, which is part of Digital India Programme.
- It will act as a forerunner to all future high throughput communication satellites and will also provide a platform to demonstrate new generation applications.
- By enabling rural high-speed connectivity the HTS satellite also promises to **bridge the urban-rural digital divide**.

Chang'e-4 Moon Mission

Syllabus: Awareness in the fields of Space

In News

- China has launched the Chang'e-4 moon mission (named after an ancient lunar goddess), successfully sending it into a lunar transfer orbit to make **the first ever attempt at a landing on the far side of the Moon**.
- The vast majority of the **far side of the Moon never faces the Earth due to tidal locking**, and humanity's first glimpse of that hemisphere did not come until the Soviet Luna 3 mission sent back images in 1959.
- The topography of the far side is far more rugged and variable than the near side, which is marked with vast, smooth basaltic seas or mare, which can be seen from Earth with the naked eye. The far side contains few such maria and the Chang'e-4 mission may bring insight into this mystery.
- The mission will target an area within the **South Pole-Aitken Basin (SPA)**, a huge, ancient and scientifically significant impact crater on the far side of the Moon. It has a diameter of around 2,500 kilometres and could contain exposed material from the Moon's mantle.
- A lunar far side landing is unprecedented, hence innovative solutions are needed to facilitate communications for sending commands to the spacecraft and aiding landing, and receiving telemetry and the all-important science data.

Objectives

- With the Moon shielding the spacecraft from Earth's interference, Chang'e-4 will be able to **carry out unprecedented radio observations at low frequencies not possible on Earth due to its atmosphere**.

- The imaging spectrometer will allow an **analysis of the composition of the lunar surface**, while the radar will be **capable of bringing insights into the layers, and therefore the history, and other geological features below the surface**.
- The ASAN instrument will tell scientists about **how the solar wind interacts with the Moon**, and the German LND payload will help in understanding processes on the lunar surface mixing processes while also being sensitive to possible lunar water.
- Meanwhile, **the cameras will return clear, high-resolution images from the lunar far side**, comparable to those from Chang'e-3 on the near side.
- Investigation of the composition of areas of the SPA could **reveal clues to the history of the moon and development of the wider solar system**.
- Furthermore, China is also developing the capabilities required for putting astronauts on the lunar surface, including massive launch vehicles and new generation crewed spacecraft.

Cell-by-Cell DNA Science is Breakthrough of 2018

Syllabus: Awareness in the fields of Bio-Tech

In News

- The US journal Science has coined as Breakthrough of the Year for 2018 **new technologies that reveal how DNA cues individual cells to grow through time**.
- Scientific papers have been published this year on how a flatworm, a fish, a frog, and other organisms begin to make organs and appendages.
- International researchers are hard at work, looking for ways to apply these techniques to human cells -- how they mature, regenerate, and what goes wrong when cancer, diabetes or even physical malformations occur.
- Among the projects underway is an international consortium called the **Human Cell Atlas**, which is identifying every human cell type, where each type is located in the body, and how the cells work together to form tissues and organs.
- According to experts these methods **will transform science over the coming decades, allowing an ever clearer picture of the processes behind ageing, healing, and disease**.
- A combination of technologies is revealing when genes in individual cells switch on, cueing the cells to play their specialized parts.
- **The result is the ability to track development of organisms and organs in stunning detail, cell by cell and through time**.
- Modern methods build on the 2002 Nobel Prize-winning work of John Sulston, who mapped the development of the roundworm Caenorhabditis elegans by painstakingly watching larvae mature cell by cell through microscopes.
- With today's technologies, the cells that comprise C.elegans have been mapped again using tag-analyze-assemble methods based on gene expression patterns within each cell.