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## **GSAT-11 - BIG BIRD**

- India's next generation high throughput communication satellite, GSAT-11 satellite also called the "Big Bird " was successfully launched from Kourou launch base, French Guiana by Ariane-5.

### **About:**

- Weighing about 5854 kg, GSAT-11 is the heaviest satellite built by ISRO.
- This launch was the second attempt after ISRO's first bid failed in May earlier this year and was placed into space on its 102 nd flight, the Ariane 5 rocket.
- The GSAT-11 is equivalent to the combined power of almost all communications satellites sent into orbit by India.
- The satellite will be initially placed in the Geosynchronous Transfer Orbit and later, raised to the Geostationary Orbit by firing the on-board Liquid Apogee Motor.
- The 5854 kgsatellite is based on the new I-6K Bus and carry 40 transponders in the Ku-band and Ka-band frequencies (32 Ka × Ku-Band Forward Link Transponders and 8 Ku × Ka band Return Link Transponders), which are capable of providing up to 16 Gbit/s throughput.
- The Ka band, used in both communication satellites and military aircraft radars, is being introduced in India for the first time through GSAT-11.

### **Significances:**

- GSAT-11 will play a vital role in providing broadband services across the country. It will also provide a platform to demonstrate new generation applications.
- GSAT-11 will boost the **broadband connectivity** to rural and inaccessible gram panchayats in the country coming under the Bharat Net Project, which is part of the Digital India programme. Along with its three siblings, GSAT-19, GSAT-29 and GSAT-20, the satellite will be a game changer for providing internet access and data communications for India and will aid the digital India program. It will also helps in internet connectivity in flights in India.

## **SCHWARZITE -A NEW FORM OF CARBON**

- Schwarzite a 2D carbon structure has been discovered. Which has been predicted and modeled for decades, but only now have researchers been able to produce it.

### **About:**

- The new structure was created by scientists in South Korea and Japan by filling a particular type of silicon dioxide crystal (sand), known as a zeolite, with carbon.
- The new structures were built inside the pores of zeolites, crystalline forms of silicon dioxide – sand – more commonly used as water softeners in laundry detergents and to catalytically crack petroleum into gasoline.
- The important property of a schwarzite is its curvature. Graphene is a flat sheet so it has zero curvature. Fullerenes, also known as buckyballs (from the full name buckminsterfullerene), are convex structures with positive curvature. Schwarzites are the first carbon structures with negative curvature and are shaped a bit like saddles. Schwarzites have the smallest area for their configuration.
- The study showed that of the 200 zeolites created to date, only 15 can be used as a template to create schwarzite. But researchers think that there are over a million possible ways to make a zeolite, so there could be many more ways to make a schwarzite.

### **Significances:**

- Schwarzites are particularly suited to storing a large electric charge, making them efficient capacitors.
- They can also be constructed in ways that allow them to store other molecules, or even act as catalysts.
- Similarly, to graphene, finding an efficient, high-quality, and cost-effective way to produce the structure will be key to its commercialization.
- It will have unique electrical and storage properties like those now being discovered in Buckminster fullerenes (Bucky balls or fullerenes for short), nanotubes and graphene.

## **HIPPOCAMPUS JAPAPIGU**

- An international team of marine biologists has discovered a new species of the seahorse genus *Hippocampus* in the waters off southeast Japan.

### **About:**

- Named *Hippocampus japapigu*, the newly-discovered species measures between 0.55 and 0.62 inches (1.4-1.6 cm) in length.
- Scientists have named the creature *Hippocampus japapigu* – using the Latin for “Japan pig,” the name adopted for it by divers who have seen it in southeastern Japan
- The new species differs in several respects from its cousins, for example possessing an odd ridge on its upper back made of triangular struts of bone. The purpose of the ridge is unclear, though it could have evolved as a way to attract a mate, a process known as sexual selection.
- Besides being smaller than regular seahorses, pygmies also have only one gill slit on their upper back, instead of two below each side of the head, like larger seahorses.
- Their diet consists of plankton, such as copepods and other small crustaceans. As for their behavior, “they seem to be quite active, even playful
- The benefits of being so small include evading recognition by predators. But they have also escaped excessive attention by humans.
- Populations of larger seahorses are being depleted in many areas of the world by people who seek them for use in traditional Chinese medicine and the aquarium trade.
- *Hippocampus japapigu* occurs throughout subtropical southeast Japan and represents the fifth species of pygmy seahorse recorded in the country’s waters.

### **Seahorses:**

- Seahorses are a group (genus *Hippocampus*) of small fish belonging to the family Syngnathidae, which also includes pipefish and sea dragons.
- These creatures are named for the shape of their head, which looks like the head of a horse. They are found in shallow tropical and temperate waters throughout the world.

- Unlike most other fish, seahorses are monogamous and mate for life. They live in close association with octocorals, colonial hydrozoans, bryozoans, seagrass and algae.
- They are morphologically distinct from the more numerous and larger species (0.9-14 inches, or 2.4-35 cm) of seahorses in possessing a single rather than paired gill openings and trunk brooding of their young

### **BIONIC MUSHROOM**

- A team of researchers from the Stevens Institute of Technology in New Jersey have created a “bionic mushroom” that can produce electricity without using fossil fuels.

#### **About:**

- The researchers took an ordinary white button mushroom from a grocery store and made it bionic, supercharging it with clusters of cyanobacteria that create electricity and swirls of graphene nanoribbons that can collect the current.
- The mushroom is covered in cyanobacteria, tiny organisms found across the globe that turn sunlight into electrical current.
- Shining a light on the structure activated the bacteria’s ability to photosynthesise, and as the cells harvested this glow, they generated a small amount of electricity known as a “photocurrent”.
- The fungi supported this process by providing the bacteria with viable surface on which to grow as well as nutrients to stay alive.
- Cyanobacteria are known among bio-engineers for their ability to generate small jolts of electricity, but until now it has been difficult to keep them alive in artificial conditions.
- By creating a “hybrid system” that encourages the mushrooms and bacteria to collaborate, the scientists think they have solved this problem.
- The research first time showed that a hybrid system can incorporate an artificial collaboration, or engineered symbiosis, between two different microbiological kingdoms. With this work, it can be imagined an enormous opportunity for next-generation bio-hybrid application

## **BABIES FOR SAME SEX PARENTS**

- Scientists have been able to breed mice with same-sex parents using a breakthrough technique involving stem cells and gene editing.

### **About:**

- Researchers at the Chinese Academy of Sciences have produced healthy mice with two mothers, who were then able to go on to reproduce themselves.
- Mice with two fathers were also born during the study, but only survived for a matter of hours.
- Using female same-sex parents, the scientists were able to produce a total of 29 live mice from 210 embryos.
- The study focused why same-sex mammals are not typically able to reproduce, suggesting stem cells and targeted gene editing can make the process easier.
- By deleting imprinted genes from immature eggs, researchers have in the past been able to produce mice with two mothers, although most still displayed genetic defects.
- To produce healthy bi-maternal mice scientists used haploid embryonic stem cells (ESCs), containing half the normal number of chromosomes and DNA from each parent. The genomic imprinting that's found in gametes was 'erased'.
- Alongside the 29 healthy mice produced by same-sex female parents, a dozen mice were also born to two male parents during the course of the study.
- However, the process of creating mice from same-sex male parents, which involves modifying a larger amount of genes and inserting fertilised embryos into surrogate mothers, is more complicated.
- All offspring from two males born during the study died after less than 48 hours, although scientists believe they can improve the process in future tests.
- This research shows us what's possible. The defects in bi-maternal mice can be eliminated and that bi-paternal reproduction barriers in mammals can also be crossed through imprinting modification.

## **SPINNAKER**

- Researchers in the UK turned on the most powerful supercomputer designed to mimic the human brain for the first time marking a big step toward replicating the power of the brain with silicon

### **About:**

- After 12 years of construction and £15m in funding, a giant computer designed to mimic the human brain is finally ready to be switched on.
- Built by the University of Manchester, the SpiNNaker machine is made up of one million processors capable of 200 trillion actions per second – meaning it can model more biological neurons in real time than any other machine ever built.
- Unlike traditional computers, it does not communicate by sending large amounts of information from point A to point B via a standard network. Instead, it mimics the parallel communication architecture of the brain by sending small amounts of information to different destinations simultaneously.
- The ultimate objective for the project has always been a million cores in a single computer for real time brain modelling applications.
- Short for Spiking Neural Network Architecture, the SpiNNaker is the first step towards creating a model of a billion biological neurons in real time, although even in its current state it will provide unprecedented insight into how the human brain works.
- It will do this by running large-scale, real-time simulations of various regions of the brain, such as the Basal Ganglia – an area affected in Parkinson's disease.
- At the heart of the machine is a special computer chip that consists of 18 tightly-packed processor cores. Over 55,000 of these chips were linked together to endow the supercomputer with a million processor cores altogether that are coordinated using a new type of computer design known as a Spiking Neural Network Architecture

### **Significances:**

- SpiNNaker completely re-thinks the way conventional computers work



- Using computers to mimic the brain, also known as neuromorphic computing is a rapidly growing area of computer science research that focuses on developing system architectures and specialized computer chips that replicate the way the human brain processes information.
- Not only will this allow neuroscientists to create unprecedented models of the brain, but it will also allow roboticists to create robots that can navigate complex environments using computer vision.
- The Manchester supercomputer consists of one million processor cores that are capable of performing 200 trillion operations per second and has been under construction at the University of Manchester since 2006.
- It can also be adapted to power an artificial intelligence robot called the SpOmnibot, which is capable of navigating and interpreting objects in the real world.
- Neuroscientists can now use SpiNNaker to help unlock some of the secrets of how the human brain works by running unprecedentedly large-scale simulations,
- It also works as real-time neural simulator that allows roboticists to design large scale neural networks into mobile robots so they can walk, talk and move with flexibility and low power.

### **'EPIC' PLANET**

- The team from the Physical Research Laboratory, Ahmedabad, has spotted for the first time a distant planet six times bigger than Earth and revolving around a Sun-like star about 600 light years away. Both the planet and the star have been named EPIC.

#### **About:**

- EPIC was found circling very close to the Sun-like star, going around it once in about 19.5 days and unlikely to be inhabitable because of its high surface temperature of around 600°C.
- The planet to be smaller in size than Saturn and bigger than Neptune. Its mass is about 27 times Earth's and six times that of Earth at radius. The scientists estimate that over 60% of its mass could be made up of heavy elements like ice, silicates and iron.
- The discovery was made using a PRL-designed spectrograph, PARAS, to measure and confirm the mass of the new planet.



- EPIC 211945201b (or K2-236b) is the name given to the planet by the discovery. The host star is named EPIC 211945201 or K2-236.
- The scientists observed the target over a time 420 days or about 1.5 years. They measured the mass of the planet using the indigenously designed PRL Advance Radial-velocity Abu-sky Search or PARAS spectrograph integrated with the 1.2-metre telescope located at PRL's Gurushikhar Observatory in Mount Abu, Rajasthan.

### Significances:

- With this discovery India has joined a handful of countries which have discovered planets around stars,
- Such a discovery is of importance for understanding the formation mechanism of such super-Neptune or sub-Saturn kind of planets that are too close to the host star. The detection also adds to a sparse catalogue of 22 other confirmed exoplanet systems that have a mass and radius in this range.

### MINERVA-II1

- Japan became the world's country to successfully land two robotic rovers on an asteroid. **This is the first time that the world will observe the surface of an asteroid via moving robots.**

### About:

- The MINERVA-II1 consists of two rovers, Rover-1A and Rover-1B. The two rovers are in good condition and are transmitting images and data.
- The hopping robots were stored at the base of the "mothership" Hayabusa2 in a drum-shaped container.
- Ryugu is a blackish coloured, diamond-shaped asteroid. It rotates on its axis once every 7.5 hours. Its surface is rougher than expected, with man boulders and barely any smooth patches. This was the main concern in terms of landing the rovers.
- MINERVA-II1 is the world's first rover (mobile exploration robot) to land on the surface of an asteroid. This is also the first time for autonomous movement and picture capture on an asteroid surface.

- Gravity on the surface of Ryugu is very weak, so a rover propelled by normal wheels or crawlers would float upwards as soon as it started to move. Therefore, this hopping mechanism was adopted for moving across the surface of such small celestial bodies. The rover is expected to remain in the air for up to 15 minutes after a single hop before landing, and to move up to 15 m horizontally.

### **Mission:**

- Asteroids are believed to be planetary debris left over from the time our solar system was formed 4.6 billion years ago. Ryugu is especially old and studying this asteroid could give us a lot of answers about Earth's evolution and origin.
- The rovers which weight around a kilo are equipped with wide-angle and stereo cameras.
- They can also measure the surface temperature of the asteroid using spine-like projections from the edges of the hoppers.
- Motor-powered internal rotors allow the rovers to propel across the asteroid surface.
- Next month, the spacecraft Hayabusa2 will deploy an explosive charge above the asteroid. It will shoot a two-kilo (four-pound) copper object to blast a small crater into the surface of Ryugu.
- From the crater created, the probe plans to collect "fresh" materials which haven't yet been exposed to millions of years of wind and radiation.
- Hayabusa2 will then descend to the crater to collect samples which will be sent to Earth for laboratory studies.

### **Hayabusa2:**

- Hayabusa2 an asteroid sample-return mission operated by the Japanese space agency, JAXA. It follows on from Hayabusa and addresses weak points identified in that mission. Hayabusa2 was launched December 2014 and rendezvoused with near-Earth asteroid Ryugu .
- It is in the process of surveying the asteroid for a year and a half, departing in December 2019, and returning to Earth in December 2020.
- Hayabusa2 carries multiple science payloads for remote sensing, sampling, and four small rovers that will investigate the asteroid surface to inform the environmental and geological context of the samples collected.

## 3D PRINTED CORNEAS

- The first human corneas have been 3D printed by scientists at Newcastle University, UK.

### About:

- As the outermost layer of the human eye, the cornea has an important role in focusing vision.
- The proof-of-concept research, reports how stem cells (human corneal stromal cells) from a healthy donor cornea were mixed together with alginate and collagen to create a solution that could be printed, a 'bio-ink'.
- Using a simple low-cost 3D bio-printer, the bio-ink was successfully extruded in concentric circles to form the shape of a human cornea.
- It took less than 10 minutes to print. The stem cells were then shown to culture -- or grow. The unique gel -- a combination of alginate and collagen -- keeps the stem cells alive whilst producing a material which is stiff enough to hold its shape but soft enough to be squeezed out the nozzle of a 3D printer.
- Now it is ready to use bio-ink containing stem cells allowing users to start printing tissues without having to worry about growing the cells separately.
- The dimensions of the printed tissue were originally taken from an actual cornea. By scanning a patient's eye, they could use the data to rapidly print a cornea which matched the size and shape.

### Significances:

- There is a significant shortage of corneas available to transplant, with 10 million people worldwide requiring surgery to prevent corneal blindness as a result of diseases such as trachoma, an infectious eye disorder.
- In addition, almost 5 million people suffer total blindness due to corneal scarring caused by burns, lacerations, abrasion or disease.
- It means the technique could be used in the future to ensure an unlimited supply of corneas.

## **MICROFACTORY**

- The world's first microfactory for e-waste can convert computer circuit boards to metal alloys, and glass and plastic to micro materials used in ceramics and plastic filament.

### **About:**

- The e-waste microfactory and another under development for other consumer waste types offer a cost-effective solution to one of the greatest environmental challenges of our age.
- Using this green manufacturing technologies, these microfactories can transform waste where it is stockpiled and created, enabling local businesses and communities to not only tackle local waste problems but to develop a commercial opportunity from the valuable materials that are created.
- The modular microfactories can operate on a site as small as 50 square metres and can be located wherever waste may be stockpiled.
- A microfactory is one or a series of small machines and devices that uses patented technology to perform one or more functions in the reforming of waste products into new and usable resources.
- The e-waste microfactory that reforms discarded computers, mobile phones and printers has a number of small modules for this process and fits into a small site.
- The discarded devices are first placed into a module to break them down. The next module may involve a special robot for the identification of useful parts. Another module then involves using a small furnace which transforms these parts into valuable materials by using a controlled temperature process developed via extensive research.

### **Significances:**

- This microfactory can prevent electronic waste from going to landfills by turning it into valuable materials for reuse.
- Recycling waste can be transformed into a value-added resource and producing the best outcome for environment. This led to a new manufacturing paradigm that includes reforming waste.

- so the microfactory was created to turn waste burden into a profitable new industry.
- Microfactories are about producing a diverse range of products and outcomes, empowering local communities, and creating local jobs.
- The aim is to create a ripple effect not only in jobs but also in export markets or local opportunities for local communities. It shakes up the core of our thinking about recycling by synthesising materials that are superior to what the waste was.

## **CELLULOSE NANOFIBRES FROM BAGASSE CAN HELP IN CONTROLLED RELEASE OF PESTICIDES**

- Scientists at Pune-based National Chemical Laboratory (NCL) of Council of Scientific and Industrial Research (CSIR) have developed an environment-friendly controlled release formulation system for applying agrochemicals in agricultural fields.

### **About:**

- The system has been developed by blending sugarcane bagasse with gelatinized maize starch and urea formaldehyde to form nanocomposite granules.
- As a model system, the researchers have encapsulated Dimethyl phthalate (DMP), an insect repellent and ecto-parasiticide, within the granules.
- Various natural polymers like starch, gelatin, natural rubber, and synthetic polymers such as polyurea, polyurethane, poly vinyl alcohol, and epoxy resins are employed to prepare these systems.

### **Significances:**

- It is Environment-friendly. Over the years, overuse of pesticides is posing a major hazard to human health and environment. In recent times, a solution has been found in the form of controlled release formulation systems.
- Such systems help prolong the release of the pesticide over a desired time period and help to reach the target sites in a focused manner. This enhances crop yield and reduces environmental pollution.
- The growing problem of micro-plastic pollution has made it necessary to focus more on producing controlled release systems based on biodegradable microcapsules from sustainable feed stocks.

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- The system with cellulose nanofibers, releases DMP slowly in the beginning and releases 90% of DMP, as more water is absorbed due to its hydrophilic nature. Cellulose nanofibres also control the pore size of starch granules and hence DMP release.