

PSLV mission fails, ends dream run

A PSLV flight lasts 19 minutes. Normally the heat shield separates three minutes into launch but ISRO officials apparently waited through the entire flight period before conceding the failure.

“We could see the satellite circling along the orbit with the heat shield,” he said at the Satish Dhawan Space Centre at Sriharikota, from where ISRO launches Indian and foreign commercial satellites.

The unprecedented non-release of the 1425-kg satellite halts a dream run of successful launches of the PSLV. The light lift workhorse booster was the pride of ISRO and a commercial success; its only failure was the first developmental launch of September 1993.

On the one hand, the launch may somewhat dent the image that the PSLV commands in the global small-to-medium lifting launchers market. It has been easily the most-sought-after vehicle for small satellites of up to 600-700 kg. It has launched 209 satellites of 28 countries since it went commercial in 1999.

Antrix Corporation, ISRO's commercial arm, has firmed up many more client satellites, its chief had earlier said. On the other hand, the failure comes even as ISRO attempts to outsource satellite making to domestic industry. The rocket was carrying the satellite that ISRO assembled by involving a consortium of six Indian small and medium industries.

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What went wrong in PSLV-C39 launch? ISRO to probe

File photo of PSLV rocket taking off from Sriharikota in Andhra Pradesh. M. Vedhan

The Space establishment has started to diagnose what went wrong in [Thursday's failed launch of PSLV-C39](#). The launch resulted in the stillbirth of its much-needed navigation satellite IRNSS-1H.

A review meeting is slated for Saturday in Thiruvananthapuram, seat of the launch vehicle centre, according to people familiar with the developments.

An informed official said the analysis should be completed before the next launches of the PSLV and the GSLV came up, starting October or November.

Indian Space Research Organisation has given up on the satellite, which along with the launcher could have cost it an estimated 300-400 crore.

A debris tracking team linked to the Vikram Sarabhai Space Centre in Thiruvananthapuram has been monitoring the unreleased satellite which is moving in a low orbit even as it sits trapped inside the heat shield.

V.Adimurthy, Adviser at ISRO, former VSSC Associate Director and former Chairman of the Inter-Agency Space Debris Coordination Committee (IADC), said, "The spacecraft is in a low orbit and there will be natural decay. Going by its falling pattern, we expect it to fall back to Earth may be between four and eight weeks."

Most of its parts of the 1425-kg will burn up as it re-enters the atmosphere. The huge quantity of propellants on it is also a worry. ISRO is part of the IADC and will also get inputs of the North American debris watch body, NORAD.

ISRO veterans who have been associated with launch vehicle activity recounted that they knew they had a problem three minutes after the rocket carrying IRNSS-1H took off.

During the 19-minute flight, the heat shield or topmost nose cone of the PSLV-C-39 rocket should have separated after three minutes and fallen off but it did not happen. At that point, the second of the four-stage rocket was at a height of around 125 km.

Instead, the heat shield continued to travel with the spacecraft still inside it. Normally the satellite would have got safely exposed and zoomed ahead at that point. This adversely added undesirable weight to the spacecraft and dragged its velocity.

The satellite is encased in a heat shield - also called payload fairings - in the top fourth stage to protect it from atmospheric disruptions. After around 100 km above ground, it does not need the heat protection.

Teams have started ascertaining what went wrong, because the rest of the launch milestones went off as planned except for the heat shield issue – which never cropped up earlier, they said.

In an apparent attempt to crack down on revenge porn, Twitter has introduced a new policy that states that no one can post or share "intimate photos

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New source for brain's development found

The brain is made up of two broad cell types, nerve cells or neurons and glia, which are non-nerve cells that make up more than half the volume of the brain. File picture | Photo Credit: [Ch. Vijaya Bhaskar](#)

Researchers have discovered an unexpected source for the brain's development, an advance that offers new insights into the building of the nervous system.

They found that glia, a collection of non-neuronal cells that had long been regarded as passive support cells, in fact are vital to nerve cell development in the brain. "The results lead us to revise the often neuro-centric view of brain development to now appreciate the contributions for non-neuronal cells such as glia," said Vilaiwan Fernandes, a postdoctoral fellow at New York University. The findings were published in *Science*.

"Indeed, our study found that fundamental questions in brain development with regard to the timing, identity, and coordination of nerve cell birth can only be understood when the glial contribution is accounted for," said Fernandes, lead author of the study published in the journal *Science*.

The brain is made up of two broad cell types, nerve cells or neurons and glia, which are non-nerve cells that make up more than half the volume of the brain.

Neurobiologists have tended to focus on the former because these are the cells that form networks that process information.

However, given the preponderance of glia in the brain's cellular make-up, the researchers hypothesised that they could play a fundamental part in brain development.

To explore this, they examined the visual system of the fruit fly.

The species serves as a powerful model organism for this line of study because its visual system, like the one in humans, holds repeated mini-circuits that detect and process light over the entire visual field.

This dynamic is of particular interest to scientists because, as the brain develops, it must coordinate the increase of neurons in the retina with other neurons in distant regions of the brain.

Researchers found that the coordination of nerve-cell development is achieved through a population of glia, which relay cues from the retina to the brain to make cells in the brain become nerve cells.

A study of nearly 300 people living in different parts of India found that nine single-base variants (single-nucleotide polymorphisms or SNPs) account

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Speaking of science — Plastic waste: What man has wrought the bugs try to solve

Toxic: Ruminants like cow and buffalo unknowingly devour plastic material and end up dying a slow and painful death. | Photo Credit: [M. Karunakaran](#)

The tiny landlocked African country Rwanda has banned plastic bags since a few years. The ban has made this war-torn nation much cleaner. Kenya has just announced a ban on plastic bags, and a fine of 4 years in prison and/or \$40,000. The Kenyan seacoast has mountains of plastic waste, making life on land, and in the sea, difficult. Another African nation, Morocco, with a coastline of 1,800 km, has had such a ban for almost a decade. It is time that India, with its 7,500-km coastline, learns from these Africans and bans plastic bags and related stuff before we too choke our seacoasts—and land, too—into a man-made disaster.

The Task Force on plastic pollution, set up by the Planning Commission in 2014, estimated that 60 cities across the country generate over 15,000 tons of plastic waste every day—almost 6 million tons per year. This is what we see daily as we walk around the streets. And cattle and other animals, which freely move around the streets, unknowingly devour some of this plastic material, which is not digested but stays put in their stomachs. Ruminants like the cow and buffalo end up dying a slow and painful death. The holy cow meeting an unholy end!

This dump we see daily is just part of the problem. A much greater, and not so visible disaster looms underwater, a lot of this plastic waste from across the world eventually ends up in the oceans, which cover over 70% of the earth's surface and hold 97% of the earth's water. The amount of plastic rubbish reaching the oceans is 8 million tons per day—that is, one truckload every minute. This would mean that by 2050, there will be more plastic in the world's oceans than fish!

What can science do about it? An interesting theoretical analysis was recently made by Professor Richard Sole of the Pompeu Fabra University in Barcelona, Spain. He estimated that of the huge amounts of plastic thrown in the oceans, the amount floating around is hardly 1%. The rest is sunk way down and/or slowly being degraded or broken down. Which plant, animal or microbe in the ocean might be doing this? And if we identify them, we may have a biological solution to at least part of the problem. The site <http://www.dailymail.co.uk/sciencetech/article-4555014/Plastic-eating-microbes-evolved-ocean.html#ixzz4r7uHOSH2> is well worth visiting to learn more.

There is some interesting research being done towards identifying, isolating and studying the biological species that seem to degrade plastics into small molecules that are usable for safer purposes. The species identified so far are some fungi and bacteria. An elementary review on such 'biodegradation of plastics' by A. Muthukumar and S. Veerappanpillai of VIT Vellore lists as many as 32 species of microbes which degrade a variety of plastics which go to make water bottles, carry bags, industrial material and such (see their paper in *Intl. J. Pharm. Sci. Rev. Res.* 2015; 31 (2): 204-209; free access). And of immediate relevance to the Indian coastline is a report by Sangeetha Devi and others from Bharathidasan University, Tiruchi, also in 2015 (*Marine Pollution Bulletin*, 2015; 96: 32-40, no free access). They found that two strains of the fungus *aspergillus* spp, found in the waters of the Gulf of Mannar degrade the plastic HDPE (which is used to make milk and fruit juice bottles, grocery bags and such).

These fungi seem to release some enzymes which degrade HDPE, essentially breaking up the polymeric molecule into smaller pieces; these enzymes are being studied in some detail by the Tiruchi group. It is clear that further research work from marine organisms will reveal more microbes that are capable of degrading polymeric and plastic wastes. It would also be possible to find their cousins on earth which can degrade these wastes. And, once we study the basic biology

and genetics of these plastic-eating bugs, we can genetically modify them in order to make them more efficient and versatile in handling a variety of wastes.

And more data is becoming available on the types of wastes that are being handled by these microbes. In March 2016, a group from Kyoto University found an two enzymes from the microbe they named as *Ideonella sakainesis* (after the town Sakai in Japan), capable of breaking down the polymer PET (polyethylene terephthalate, used in making packaging trays, polyester clothing and others) into its basic monomeric molecules terephthalic acid and ethylene glycol (S. Yoshida et al., *Science* 2016; 351: 1196), which are used as building blocks for a variety of chemicals. The microbe is found in soil, sediment, waste water and similar material.

Most recently, a group of Pakistani, Sri Lankan and Chinese scientists together showed that the fungus *Aspergillus tubigensis* can degrade yet another major plastic material called polyurethane or PU (Sehroon Khan et al, *Environmental Pollution*, 2017; 225: 469-480). PU is used in the manufacture of car tyres, gaskets, bumpers, fibres, plastic foam, synthetic leathers and so on. The group found this bug in a general city waste disposal site in Islamabad, which suggests that it would very likely be found at several places in India too.

A cynical wag once said: what science made, let it unmake. It appears that whether it be in water or land (maybe even in the sky), if we work with focus, we would be able to find such plastic waste degrading organisms, and thus try to 'unmake' the problem. We can even genetically modify them to suit the purpose. This type of research will bring a great deal of benefit to not only terrestrial life forms but those living under water as well. Ironically enough, work of this kind could even fetch a Nobel Prize for safely breaking down plastics, just as Nobels were given for making plastics in the first place.

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A milestone in treating cancer

The United States's Food and Drug Administration (FDA) on Wednesday approved the first-ever treatment that genetically alters a patient's own cells to fight cancer, a milestone that is expected to transform treatment in the coming years.

The new therapy turns a patient's cells into a "living drug" and trains them to recognise and attack the disease. It is part of the rapidly growing field of immunotherapy that bolsters the immune system through drugs and other therapies and has, in some cases, led to long remissions and possibly even cures.

The therapy, marketed as Kymriah and made by Novartis, was approved for children and young adults for an aggressive type of leukemia — B-cell acute lymphoblastic leukemia — that has resisted standard treatment or relapsed. The FDA called the disease "devastating and deadly" and said the new treatment fills an "unmet need". Novartis and other companies have been racing to develop gene therapies for other types of cancers, and experts expect more approvals in the near future. Dr. Scott Gottlieb, the FDA commissioner, said that more than 550 types of experimental gene therapy were being studied.

Drawbacks and cost

There are drawbacks to the approach. Because Kymriah can have life-threatening side effects, including dangerous drops in blood pressure, the FDA is requiring that hospitals and doctors be specially trained and certified to administer it, and that they stock a certain drug needed to quell severe reactions.

Kymriah, which will be given to patients just once and must be made individually for each patient, will cost \$475,000 (approximately 2.8 crore). Novartis said that if a patient does not respond within the first month after treatment, there will be no charge. The company also said it would provide financial help to families who were uninsured or underinsured. Discussing the high price during a telephone news conference, a Novartis official noted that bone-marrow transplants, which can cure some cases of leukemia, cost even more, from \$540,000 to \$800,000.

About 600 children and young adults a year in the U.S. would be candidates for the new treatment.

The approval was based largely on a trial in 63 severely ill children and young adults who had a high remission rate of 83% within three months. The treatment was originally developed by researchers at the University of Pennsylvania and licensed to Novartis. It was identified in previous reports as CAR-T cell therapy, CTL019 or tisagenlecleucel.

The first child to receive the therapy was Emily Whitehead, who was six and near death from leukemia in 2012 when she was treated, at the Children's Hospital of Philadelphia. Now 12, she has been free of leukemia for more than five years.

Customising Kymriah

To customise Kymriah for individual patients, white blood cells called T cells will be removed from a patient's bloodstream at an approved medical centre, frozen, shipped to Novartis in Morris Plains, New Jersey, for genetic engineering and multiplying, frozen again and shipped back to the medical centre to be dripped into the patient. That processing is expected to take 22 days. Novartis said the treatment would be available at an initial network of 20 approved medical centres

to be certified within a month, a number that would be expanded to 32 by the end of the year. Five centres will be ready to start extracting T cells from patients within three to five days, the company said.

Certification is being required because the revved-up T cells can touch off an intense reaction, sometimes called a cytokine storm, that can cause high fever, low blood pressure, lung congestion, neurological problems and other life-threatening complications. Medical staff members need training to manage these reactions, and hospitals are being told that before giving Kymriah to patients, they must be sure that they have the drug needed to treat the problems, tocilizumab, also called Actemra. NYT

Lifestyle-related risk factors are being cited, compounded by an inadequate number of treatment centres in the region

Without policies to stop the worrying spread of antimicrobial resistance, the mortality rate could be disturbing

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TRAPPIST-1 planets likely to have water

The TRAPPIST-1 star, an ultra-cool dwarf, has seven Earth-size planets orbiting it.

The Earth-sized planets orbiting the ultracool TRAPPIST-1 dwarf star 40 light-years away may have substantial amounts of water and could be habitable, scientists say.

An international team of astronomers used the NASA/ESA Hubble Space Telescope to estimate whether there might be water on the seven planets orbiting in the nearby TRAPPIST-1 planetary system. The results suggest that the outer planets of the system might still harbour substantial amounts of water.

This includes the three planets within the habitable zone of the star, lending further weight to the possibility that they may indeed be habitable. In February this year, astronomers had announced the discovery of seven Earth-sized planets orbiting the ultracool dwarf star TRAPPIST-1, 40 light-years away.

Following up on the discovery, scientists used the Space Telescope Imaging Spectrograph (STIS) on the Hubble telescope to study the amount of ultraviolet radiation received by the individual planets of the system.

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India could embrace CO2 capture technology

India will explore the possibility of introducing technologies for capturing carbon dioxide emitted while burning coal and other fossil fuels, the country's Coal Secretary Susheel Kumar has said. Mr. Kumar is leading an Indian delegation at an international conference on Carbon Capture Utilisation and Storage (CCUS) in Alabama.

"Attending the conference has been very informative for my colleagues and me, we now have some food for thought to carefully contemplate the feasibility of CCUS with relevance to India," he said.

Commercial uses

A lot of advanced research in the area, of late, has been focussing on capturing carbon dioxide emissions from sources like coal-fired power plants, to either reuse or store it so it will not enter the atmosphere. CO2 has commercial and industrial uses, particularly for Enhanced Oil Recovery (EOR) in depleting oil fields. Carbon dioxide has the ability to change the properties of oil and make it easier to extract.

The International Energy Agency's Green House Gas Research and Development initiative organises the annual Post Combustion Carbon Conference, which is currently in session in Birmingham, in the State of Alabama.

Dr. Prabhat Ranjan, Executive Director of Technology Information Forecast and Assessment Council (TIFAC) of Department of Science and Technology; S.K. Acharya, Chairman and Managing Director of Neyveli Lignite Corporation; and other officials are part of the Indian delegation at the conference.

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Scientists make methanol using oxygen

Methanol using oxygen may help in cleaner, greener industrial processes.

Scientists have found a way to produce methanol — an important chemical often used as fuel in vehicles — using oxygen in the air, an advance that may lead to cleaner, greener industrial processes worldwide.

Methanol is currently produced by breaking down natural gas at high temperatures into hydrogen gas and carbon monoxide before reassembling them — expensive and energy-intensive processes known as ‘steam reforming’ and ‘methanol synthesis.’

However, researchers from Cardiff University in the U.K. have discovered they can produce methanol from methane through simple catalysis that allows methanol production at low temperatures using oxygen and hydrogen peroxide.

The findings, published in the journal *Science*, have major implications for cleaner, greener industrial processes worldwide.

“The quest to find a more efficient way of producing methanol is a hundred years old. Our process uses oxygen — effectively a ‘free’ product in the air around us — and combines it with hydrogen peroxide at mild temperatures which require less energy,” said Graham Hutchings, from the Cardiff Catalysis Institute.

“Commercialisation will take time, but our science has major implications for the preservation of natural gas reserves as fossil fuel stocks dwindle across the world,” he said.

“At present global natural gas production is about 2.4 billion tonnes per annum and 4% of this is flared into the atmosphere — roughly 100 million tonnes,” he said.

“Our approach of using natural gas could use this “waste” gas saving, saving carbon dioxide emissions,” he added.

Jaggi Vasudev’s Rally for Rivers claims they will, but this is not based on the most nuanced science

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Successful Flight Test of 3rd Generation Anti Tank Guided Missile – NAG**Successful Flight Test of 3rd Generation Anti Tank Guided Missile – NAG**

India's indigenously developed 3rd generation Anti Tank Guided Missile (ATGM), Nag has been successfully flight tested twice by DRDO on 8-9-2017 against two different targets in the ranges of Rajasthan.

The ATGM Nag missile has successfully hit both the targets under different ranges and conditions with very high accuracy as desired by the Armed Forces.

With these two successful flight trials, and the flight test conducted earlier in June in the peak of summer, the complete functionality of Nag ATGM along with launcher system NAMICA has been established and marked the successful completion of development trials of Nag Missile.

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NASA's Cassini probe captures wave structure in Saturn rings

NASA's Cassini spacecraft has beamed back a stunning close-up image revealing the wave structure of Saturn's rings.

The image was taken on June 4 with the Cassini spacecraft narrow-angle camera.

It was acquired on the sunlit side of the rings from a distance of 76,000 kilometres away from the area pictured.

The spacecraft currently is closing in on the end of its epic 20-year-long journey in space, as it prepares to take the final plunge into the atmosphere of Saturn.

A gravitational kick in April from Saturn's moon Titan placed the two-and-a-half tonne space probe on its path for impending destruction on September 15.

Resulting from the same process that creates spiral galaxies, spiral density waves in Saturn's rings are much more tightly wound.

In this case, every second wave crest is actually the same spiral arm which has encircled the entire planet multiple times.

The wave known as the Janus 2:1 spiral density wave is the only major density wave visible in Saturn's B ring, NASA said.

Most of the B ring is characterised by structures that dominate the areas where density waves might otherwise occur, but this innermost portion of the B ring is different.

The radius from Saturn at which the wave originates is 96,233 kilometres from the planet. At this location, ring particles orbit Saturn twice for every time the moon Janus orbits once, creating an orbital resonance.

The wave is remarkable because Janus, the moon that generates it, is in a strange orbital configuration.

Janus and Epimetheus share practically the same orbit and trade places every four years. Every time one of those orbit swaps takes place, the ring at this location responds, spawning a new crest in the wave.

The distance between any pair of crests corresponds to four years' worth of the wave propagating downstream from the resonance, which means the wave seen here encodes many decades' worth of the orbital history of Janus and Epimetheus.

A study of nearly 300 people living in different parts of India found that nine single-base variants (single-nucleotide polymorphisms or SNPs) account

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India, U.S. in talks for C-17 deal

The consolidated cost of the aircraft is around \$366.2 million.

India is in talks with the U.S. for buying another Boeing C-17 Globemaster transport aircraft to be added to its fleet of 10.

Since induction in 2013, the aircraft has become the mainstay of India's humanitarian assistance and disaster relief efforts.

On June 26, the State Department notified Congress of a possible sale, approving it under the Foreign Military Sales programme. "The validity of the Letter of Acceptance for the sale expires in mid-October and India has to conclude the deal before that or ask the U.S. for an extension," an official said.

The aircraft, along with associated equipment, technical support and warranty, is estimated to cost \$366.2 million.

"The aircraft will be handed over within a month of the contract having been signed after some routine checks and maintenance. The handover will be done in the U.S. itself, and it will be flown to India by Indian pilots," Pratyush Kumar, president, Boeing India, told *The Hindu*.

The Defence Acquisition Council (DAC) gave its approval for the purchase in December last.

Big push

"The proposed sale will improve India's capability to meet the current and future strategic airlift requirements ... India lies in a region prone to natural disasters and will use the additional capability [aircraft] for humanitarian assistance and disaster relief," the Defence Security Cooperation Agency (DSCA), which manages the Foreign Military Sales programme, said in a statement in June.

In 2011, India purchased 10 C-17s under the Foreign Military Sales programme worth \$4.1 billion, which had a follow-on clause for six more aircraft. However, the delay in decision-making in the Defence Ministry meant the IAF missed out on the opportunity. The last C-17 aircraft left Boeing's Long Beach plant in California in 2015.

While the C-17 assembly line was shut down, Boeing made 10 additional aircraft without any order and offered them to all existing customers, including India. New Delhi's silence meant nine pieces were picked by the existing users and one is left with Boeing.

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Largest solar flare in 12 years observed

A file photo of a solar flare. Photo courtesy: NASA | Photo Credit: [AP](#)

The largest solar flare in more than 12 years — and the eighth largest since modern records began in 1996 — has been captured in high detail by scientists.

The huge burst of radiation, which was not harmful to humans due to the Earth's protective atmosphere and distance from the Sun, occurred unexpectedly on September 6, 2017, researchers, including those from the University of Sheffield and Queen's University Belfast in the United Kingdom, said.

The flare was one of three X-category flares — the largest type of flare — observed over 48-hour period, they said.

Large solar bursts have energies comparable to one billion hydrogen bombs and can drive plasma away from the solar surface at speeds of up to 2,000 kilometres per second (km/s) in phenomena known as coronal mass ejections.

These powerful events, known as space weather, can lead to disruption of satellites and Global Positioning System (GPS) signals, as well as spectacular aurora through their interaction with the Earth's atmosphere.

The largest X-class flare was measured to have an energy level of X9.3 (where X9 is nine times more powerful than X1).

The team observed these historic events in extremely high detail using the Swedish Solar Telescope in La Palma.

One of the most difficult aspects of flare observation using ground-based telescopes is the short time-scales over which flares evolve.

X-class flares can form and reach their peak intensities in little over five minutes, meaning observers, who only see a small part of the Sun at any one moment, must act fast to ensure they catch the crucial opening moments of the flares evolution.

"It is very unusual to observe the opening minutes of a flare's life," said Chris Nelson from the Solar Physics and Space Plasma Research Centre (SP2RC).

"We can only observe about 1/250th of the solar surface at any one time using the Swedish Solar Telescope, so to be in the right place at the right time requires a lot of luck. To observe the rise phases of three X-classes over two days is just unheard of," said Mr. Nelson.

"The Sun is currently in what we call solar minimum," said Aaron Reid, a research fellow at Queen's University Belfast.

"The number of Active Regions, where flares occur, is low, so to have X-class flares so close together is very usual. These observations can tell us how and why these flares formed so we can better predict them in the future," said Mr. Reid.

Using the data collected during this observation, researchers will be able to probe the conditions in the solar atmosphere as these powerful events are formed, allowing more accurate predictions

about when and where X-class flares might occur in the future.

This information can be channelled into the multi-billion pound space weather industry to better protect satellites from the dangers of the Sun.

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A push for cooperation in S&T and medical research

In the light of Japan's Prime Minister Shinzo Abe's visit to India, the two countries have signed a host of agreements on Wednesday to further cooperation in science and technology, including research into stem-cells for making bone-marrow transplants more accessible.

The Department of Biotechnology (DBT) already has an India-Japan cooperative programme that has Christian Medical College & Hospital, Vellore, and Kyoto University, Japan, as participants.

Though the DBT and Japan's National Institute of Advanced Industrial Science and Technology (AIST) have been collaborating in these areas, they renewed the agreement for five more years on Wednesday.

"The aim of the programme is to develop infrastructure and expertise for India to be a competitive force in regenerative medicine and induced pluripotent stem cell biology. The focus of the collaboration is on developing treatments for sickle-cell anaemia, Beta thalassaemia and brain disorders, and creating a haplobank relevant to Indian populations," said a press release. A haplobank refers to a specially maintained collection of embryonic cells that can, in theory, be directed to become any kind of cell and thus progenitor of replacement organs.

Japanese scientist Shinya Yamanaka was a co-recipient of the Nobel Prize for medicine for discovering ways to reprogram mature stem cells.

"Through this programme, Indian scientists will be part of a global network that shares research into and knowledge of these aspects of stem cell technology," said K. VijayRaghavan, Secretary, DBT.

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Cassini burns up in skies over Saturn, ends 20-year mission

NASA's Cassini spacecraft disintegrated in the skies above Saturn early on September 15 in a final, fateful blaze of cosmic glory, following a remarkable journey of 20 years.

Confirmation of Cassini's expected demise came about 7.55 a.m. EDT (5.25 p.m. IST). That's when radio signals from the spacecraft its last scientific gifts to Earth came to an abrupt halt. The radio waves went flat, and the spacecraft fell silent.

Cassini actually burned up like a meteor 83 minutes earlier as it dove through Saturn's atmosphere, becoming one with the giant gas planet it set out in 1997 to explore. But it took that long for the news to arrive at Earth a billion miles away.

The only spacecraft to ever orbit Saturn, Cassini showed us the planet, its rings and moons up close in all their glory. Perhaps most tantalising, ocean worlds were unveiled by Cassini and its hitchhiking companion, the [Huygens lander](#), on the moons Enceladus and Titan, which could possibly harbour life.

Cassini snapped its "last memento photos" of the Saturn system on September 14. Dutiful to the end, the spacecraft sampled Saturn's atmosphere on September 15 morning as it made its final plunge.

Programme manager Earl Maize made the final announcement: "This has been an incredible mission, an incredible spacecraft and you're all an incredible team," Mr. Maize said. "I'll call this the end of mission."

Flight controllers wearing matching purple shirts stood and embraced and shook hands.

More than 1,500 people, many of them past and present team members, had gathered at California's Jet Propulsion Laboratory for what was described as both a vigil and celebration. Even more congregated at nearby California Institute of Technology, which runs the lab for NASA.

Project scientist Linda Spilker noted Cassini has been running "a marathon of scientific discovery" for 13 years at Saturn. "So we're here today to cheer as Cassini finishes that race," she said.

The spacecraft tumbled out of control while plummeting at more than 122,000 kmph. Project officials invited ground telescopes to look for Cassini's last-gasp flash, but weren't hopeful it would be spotted from a billion miles away.

This Grand Finale, as NASA calls it, came about as Cassini's fuel tank started getting low after 13 years exploring the planet. Scientists wanted to prevent Cassini from crashing into Enceladus or Titan and contaminating those pristine worlds. And so in April 2017, Cassini was directed into the previously unexplored gap between Saturn's cloud tops and the rings. Twenty two times, Cassini entered the gap and came out again. The last time was last week.

The leader of Cassini's imaging team, Carolyn Porco, a visiting scholar at the University of California, Berkeley, was so involved with the mission for so long that now, "I consider it the start of life, part two."

Cassini departed Earth in 1997 and arrived at the solar system's second largest planet in 2004. The European Huygens landed on big moon Titan in 2005. Nothing from Earth has landed farther.

In all, Cassini collected more than 453,000 images and traveled 4.9 billion miles. It was an international endeavour, with 27 nations taking part. The final price tag was \$3.9 billion.

The [#GrandFinale](#) toolkit -- everything you need to know about why, how and when our mission is coming to a close: <https://t.co/TSA7uQe4KS> pic.twitter.com/pn18YcsFt8

5.32 p.m.: NASA says Cassini spacecraft has burned up in the skies over Saturn as planned, ending a 20-year mission. Earth received Cassini's final signal at 7:55 a.m. ET (5.25 p.m. IST). Cassini is now part of the planet it studied. Thanks for the science.

5.30 p.m.: Our Cassini spacecraft is now one with the planet it studied for so long. The rest is science. Goodbye Cassini, tweets [@NASAJPL](#).

5.27 p.m. IST: NASA announces end of mission. Our spacecraft has entered Saturn's atmosphere, and we have received its final transmission, tweets [@CassiniSaturn](#)

5.01 p.m. IST: @NASAJPL tweets: Cassini Mission Control update: Loss of signal expected ~4.54 a.m. PT (5.24 p.m. IST).

4.53 p.m. IST: @CassiniSaturn tweets: Cassini's final transmission is currently traveling at the speed of light past Jupiter.

4.01 p.m. IST: Cassini's final dive is happening at Saturn, with the **last signal expected on Earth at 5.25 p.m. IST**. This means the spacecraft is entering the planet's atmosphere. (*NASA's Cassini Grand Finale update*)

2.25 p.m. IST: Cassini engineers have received the signal that Cassini has started a five-minute roll to point the instrument that will sample Saturn's atmosphere into the optimal direction, facing the direction of the oncoming gases. Along with this roll, the spacecraft is reconfiguring its systems for real-time data transmission at a rate of 27 kilobits per second (3.4 kilobytes per second). Final, real-time relay of data starts immediately after. That relay marks the beginning of Cassini's final plunge. (*NASA's Cassini Grand Finale update*)

Why did we end [@CassiniSaturn](#) mission with this [#GrandFinale](#) dive into [#Saturn](#)? To protect moons from contamination: <https://t.co/mzKW5uDsTi> pic.twitter.com/vJJvhkSnPR

Cassini flew by Titan one last time on September 12 before transmitting images and scientific data from the flight.

Mission engineers will use the information gathered from the encounter they dubbed "the goodbye kiss" to make sure the vessel is following the right path to plunge into the gas giant's atmosphere.

"The Cassini mission has been packed full of scientific firsts, and our unique planetary revelations will continue to the very end of the mission as Cassini becomes Saturn's first planetary probe, sampling Saturn's atmosphere up until the last second," said Linda Spilker, Cassini project scientist at NASA's Jet Propulsion Laboratory in Pasadena, California. "We'll be sending data in near real time as we rush headlong into the atmosphere — it's truly a first-of-its-kind event at Saturn."

Cassini is expected to lose communications with Earth one or two minutes into its final dive, but 10 of its 12 scientific instruments will be working right up until the last moment to analyze the atmosphere's composition. That data could help understand how the planet formed and evolved.

On the eve of its final descent, other instruments will make detailed observations of Saturn's aurora borealis, temperatures and polar storms.

Cassini's final maneuvers began at 7.14 a.m. GMT (12.44 pm IST) on September 15, although the signal will only reach NASA 86 minutes later.

At 10.31 a.m. GMT (4.01 pm IST), the spacecraft is due to enter Saturn's atmosphere with its antennas pointed toward Earth and its motors running full blast in order to hold its trajectory. Just a minute later, at some 1,500 km above Saturn's clouds, the probe's communications will stop before Cassini begins to disintegrate moments later, NASA predicts.

"The Grand Finale represents the culmination of a seven-year plan to use the spacecraft's remaining resources in the most scientifically productive way possible," said Earl Maize, Cassini project manager at the Jet Propulsion Laboratory. "By safely disposing of the spacecraft in Saturn's atmosphere, we avoid any possibility Cassini could impact one of Saturn's moons somewhere down the road, keeping them pristine for future exploration."

The mission is a cooperative project of NASA, the European Space Agency (ESA) and Italy's space agency. NASA's European and Italian partners built the Huygens probe Cassini carried until dropping it on Titan.

The Cassini-Huygens mission's total cost is about \$3.26 billion, including \$1.4 billion for pre-launch development, \$704 million for mission operations, \$54 million for tracking and \$422 million for the launch vehicle.

The United States contributed \$2.6 billion to the project, the European Space Agency \$500 million and the Italian Space Agency \$160 million.

Italian astronomer Giovanni Cassini discovered four of Saturn moons in the 17th century, although scientists have since identified more than 60. During the same era, Dutch mathematician Christiaan Huygens found that Saturn had rings. He also was the first person to observe Titan.

Cassini rocketed from Cape Canaveral, Florida, on October 15, 1997, carrying with it the European Huygens lander. The spacecraft arrived at Saturn in 2004. Six months later, Huygens detached from Cassini and successfully parachuted onto the giant moon Titan. Cassini remained in orbit around Saturn, the only spacecraft to ever circle the planet. In April 2016, NASA put Cassini on an ever-descending series of final orbits, leading to the September 15 swan dive. Better that, they figured, than Cassini accidentally colliding with a moon that might harbour life and contaminating it.

After more than a decade exploring [#Saturn](#), its moons and rings, we've embarked on our [#GrandFinale](#): <https://t.co/0ZbfbX6DNs> pic.twitter.com/qW4Ad5gUBr

The spacecraft

Travelling too far from the sun to reap its energy, Cassini used plutonium for electrical power to feed its science instruments. Its separate, main fuel tank, however, was getting low when NASA put the spacecraft on the no-turning-back Grand Finale. The mission already had achieved great success, and despite the chance of pounding Cassini with ring debris, flight controllers directed the spacecraft into the narrow gap between the rings and Saturn's cloud tops. Cassini successfully sailed through the gap 22 times, providing ever better closeups of Saturn.

The rings

Cassini discovered swarms of moonlets in Saturn's rings, including one called Peggy that made the short list for final picture-taking. Scientists wanted one last look to see if Peggy had broken free of its ring. Data from the spacecraft indicate Saturn's rings which consist of icy bits ranging in size from dust to mountains may be on the less massive side. That would make them relatively young compared with Saturn; perhaps a moon or comet came too close to Saturn and broke apart, forming the rings 100 million years ago. Or perhaps multiple such collisions occurred. On the flip side, more massive rings would suggest they originated around the same time as Saturn, more than 4 billion years ago.

The moons

Saturn has 62 known moons, including six discovered by Cassini. The biggest, by far, is the first one discovered way back in the 1655 — Titan, which slightly outdoes Mercury. Its lakes hold liquid methane, which could hold some new, exotic form of life. Little moon Enceladus is believed to have a global underground ocean that could be sloshing with life more as we know it. Incredibly, geysers of water vapor and ice shoot out of cracks in Enceladus' south pole. Project scientist Linda Spilker said if she could change one thing about Cassini, it would have been to add life-detecting sensors to sample these plumes. But no one knew about the geysers until Cassini arrived on the scene.

Next up

Scientists would love to return to Enceladus or Titan to search for any potential life. Nothing is firmly on the books right now. But there are proposals to go back, submitted under NASA's New Frontiers programme. So stay tuned.

A study of nearly 300 people living in different parts of India found that nine single-base variants (single-nucleotide polymorphisms or SNPs) account

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Indigenous Development of Trawl System by DRDO

Indigenous Development of Trawl System by DRDO

R&DE (Engrs), a premier system engineering laboratory under Armament & Combat Engineering (ACE) cluster of Defence Research and Development Organisation (DRDO) has recently undertaken the design and development of Trawl System for the minefield area in the battle zone to meet the operational requirements of Indian Army.

The indigenous developed Trawl System is employed for breaching of land mines and creating a vehicle safe lane, through a minefield for the advancing columns of mechanized forces in combat zone. The equipment consists of Trawl roller, track width mine plough and electro-magnetic device (EMD), which caters to the need of all types of mines usually encountered by the battle tank in such a scenario. The Trawl System developed by DRDO is capable of breaching a variety of land mines including passive and active influence mines.

The Trawl system recently crossed a major milestone with the successful completion of blast trials in collaboration with HEMRL Pune, which demonstrated the survivability of the equipment, when subjected to successive series of blast directly underneath it. The fieldable prototype of the Trawl System is in final stage of realization and would be shortly ready for conduct of User Evaluation Trials by the Army.

The indigenous development of Trawls by DRDO is an important step towards achieving self-reliance in area of critical military equipment under 'Make in India' initiative and would result in saving of precious foreign exchange for the country.

MJPS/NAo/NM/RP

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Successful Development Trials of Astra Missile

Successful Development Trials of Astra Missile

The final Development Flight Trials of Astra - Beyond Visual Range Air to Air Missile (BVRAAM) were successfully conducted over the Bay of Bengal, Off the Coast of Chandipur, Odisha during 11-14 Sep 2017. A total of seven trials were conducted against Pilotless Target Aircrafts (PTA) successfully.

The missions included engagement of target at very long range, engagement of high manoeuvring target at medium range and multiple launches of missiles in salvo to engage multiple targets. All the sub-systems including the indigenous RF Seeker performed accurately, meeting all the mission parameters and objectives. Two missiles were also launched in the combat configuration with warhead and the targets were neutralized.

This effort for building a state-of-the-art BVRAAM by Defence Research and Development Organisation (DRDO), together with Indian Air Force (IAF) has completed the development phase of the weapon system successfully. Hindustan Aeronautics Limited (HAL) has played a role in modifying the aircraft for weapon integration. More than 50 public and private industries have contributed in building the Astra weapon system. Dr S. Venugopal, Programme Director led the launch operations and flight trials along with the teams from multiple organisations.

The Defence Minister Smt Nirmala Sitharaman congratulated DRDO, IAF Air Force, Defence Public Sector Undertaking (DPSU) and industries for the successful trials of ASRTA Missile. Chairman DRDO and Secretary Department of Defence (R&D) Dr S. Christopher congratulated the 'Team Astra' (DRDO, IAF, DPSU & Industries) for developing and flight testing such a formidable class of weapon system. Director General, Missiles and Strategic Systems Dr G. Satheesh Reddy, said the technologies developed under the programme will be the building blocks for development of more variants of Air-to-Air and Surface-to-Air Missiles.

MJPS/Rajib

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First global map of water on Moon created

Scientists have created the first map of water trapped in the uppermost layer of the Moon's soil — which may prove useful to future lunar explorers — using data from an instrument aboard India's Chandrayaan-1 spacecraft.

The study, published in the journal *Science Advances*, builds on the initial discovery in 2009 of water and a related molecule — hydroxyl, which consists of one atom each of hydrogen and oxygen — in the lunar soil.

Scientists from Brown University in the US used a new calibration of data taken from NASA's Moon Mineralogy Mapper, which flew aboard Chandrayaan-1 spacecraft, to quantify how much water is present on a global scale.

"The signature of water is present nearly everywhere on the lunar surface, not limited to the polar regions as previously reported," said Shuai Li, former PhD student at Brown University.

"The amount of water increases toward the poles and does not show significant difference among distinct compositional terrains," said Li, who is now a postdoctoral researcher at the University of Hawaii.

The water concentration reaches a maximum average of around 500 to 750 parts per million in the higher latitudes.

That is less than what is found in the sands of Earth's driest deserts, researchers said.

"This is a roadmap to where water exists on the surface of the Moon," said Ralph Milliken, an associate professor at Brown.

"Now that we have these quantitative maps showing where the water is and in what amounts, we can start thinking about whether or not it could be worthwhile to extract, either as drinking water for astronauts or to produce fuel," said Milliken.

The researchers said that the way the water is distributed across the Moon gives clues about its source.

The distribution is largely uniform rather than splotchy, with concentrations gradually decreasing toward the equator.

That pattern is consistent with implantation via solar wind — the constant bombardment of protons from the Sun, which can form hydroxyl and molecular water once emplaced.

Although the bulk of the water mapped in this study could be attributed to solar wind, there were exceptions.

For example, the researchers found higher-than-average concentrations of water in lunar volcanic deposits near the Moon's equator, where background water in the soil is scarce.

Rather than coming from solar wind, the water in those localised deposits likely comes from deep within the Moon's mantle and erupted to the surface in lunar magma.

The study also found that the concentration of water changes over the course of the lunar day at

latitudes lower than 60 degrees, going from wetter in the early morning and evening to nearly bone dry around lunar noon. The fluctuation can be as much as 200 parts per million.

“This raises the possibility that water may re-accumulate after extraction, but we need to better understand the physics of why and how this happens to understand the timescale over which water may be renewed,” said Milliken.

A study of nearly 300 people living in different parts of India found that nine single-base variants (single-nucleotide polymorphisms or SNPs) account

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Black dot in 1,800-year-old Indian manuscript is first 'zero', say researchers

This handout photograph received from the Bodleian Libraries, University of Oxford on September 15, 2017, shows a close-up image of folio 16v, in which the use of a dot as a placeholder in the bottom line, which dot evolved into the use of zero as a number in its own right, is seen as part of the 70 leaves of birch bark which make up the Bakhshali manuscript. | Photo Credit: [HANDOUT](#)

A black dot on a third-century Indian manuscript has been identified by Oxford University as the first recorded use of the mathematical symbol for zero, 500 years earlier than previously thought.

"Scientists from the University of Oxford's Bodleian Libraries, have used carbon dating to trace the figure's origins to the famous ancient Indian scroll," the university said in a statement.

The birch bark scroll is known as the Bakhshali manuscript after the village, which is now in Pakistan, where it was found buried in 1881.

It has been held at the Bodleian Libraries since 1902.

"The creation of zero as a number in its own right, which evolved from the placeholder dot symbol found in the Bakhshali manuscript, was one of the greatest breakthroughs in the history of mathematics," said Marcus du Sautoy, a mathematics professor at Oxford.

"We now know that it was as early as the third century that mathematicians in India planted the seed of the idea that would later become so fundamental to the modern world," he said.

The Bakhshali scroll was already recognised as the oldest Indian mathematical text but its exact age was widely contested, and researchers used carbon dating to trace it back to the third or fourth century.

The text was in fact found to contain hundreds of zeroes, representing orders of magnitude in the ancient Indian numbers system.

The earliest recorded example of the use of zero was previously believed to be a ninth-century inscription on a wall in a temple at Gwalior in India.

Several ancient cultures, including the Mayans and the Babylonians, used the zero placeholder but the dot used in ancient Indian mathematics is the one that ultimately evolved into the symbol used today.

Librarian Richard Ovenden said the discovery was of "vital importance to the history of mathematics and the study of early South Asian culture".

"These surprising research results testify to the subcontinent's rich and longstanding scientific tradition," he said.

A study of nearly 300 people living in different parts of India found that nine single-base variants (single-nucleotide polymorphisms or SNPs) account

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'Planet 9' formed closer to home than believed, says study

In this January, 2016 picture, California Institute of Technology astronomer Michael Brown points to a yellow dot simulating 'Planet 9' on a computer video at the CalTech USGS Media centre in Pasadena, California. | Photo Credit: [AP](#)

'Planet 9' — an unseen planet on the edge of our solar system — probably formed closer to home around the Sun than previously thought, astronomers say.

Researchers led by the University of Sheffield in the U.K. found that 'Planet 9' is unlikely to have been captured from another planetary system, as has previously been suggested.

The outskirts of the solar system have always been something of an enigma, with astronomers in the late 19th and early 20th centuries searching for a giant planet that was not there, and the subsequent discovery of Pluto in 1930.

Pluto was downgraded in status to a 'dwarf planet' because astronomers discovered many other small objects so-called Edgeworth-Kuiper Belt objects at similar distances from the Sun.

Last year, astronomers working in the U.S. postulated the presence of 'Planet 9' to explain the strange orbital properties of some Edgeworth-Kuiper Belt objects.

However, while it is not possible to directly observe Planet 9, it has not stopped theorists from trying to work out how it got there.

Planet 9 is at least ten times bigger than Earth, making it unlikely that it formed at such a large distance from the Sun.

Instead, it has been suggested it either moved there from the inner regions of the Solar System, or it could have been captured when the Sun was still in its birth star cluster.

Richard Parker from the University of Sheffield along with colleagues from ETH Zurich in Switzerland showed that the capture scenario is extremely unlikely.

Researchers simulated the Sun's stellar nursery where interactions are common and found that even in conditions optimised to capture free-floating planets, only five-to-ten out of 10,000 planets are captured onto an orbit like Planet 9's.

"We know that planetary systems form at the same time as stars, and when stars are very young they are usually found in groups where interactions between stellar siblings are common," said Parker

"Therefore, the environment where stars form directly affects planetary systems like our own, and is usually so densely populated that stars can capture other stars or planets," he added.

"In this work, we have shown that — although capture is common — ensnaring planets onto the postulated orbit of Planet 9 is very improbable.

"We are not ruling out the idea of Planet 9, but instead we are saying that it must have formed around the Sun, rather than captured from another planetary system," he said.

The study was published in the journal *Royal Astronomical Society*.

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Mysterious night side of Venus revealed for first time

This NASA handout image shows a global view of the surface of Venus. | Photo Credit: [AFP](#)

Scientists have characterised wind and cloud patterns of the night side of planet Venus for the first time, and found that it behaves very differently from the part facing the Sun.

The night side exhibits unexpected and previously-unseen cloud types, morphologies, and dynamics — some of which appear to be connected to features on the planet's surface.

“This is the first time we've been able to characterise how the atmosphere circulates on the night side of Venus on a global scale,” said Javier Peralta of the Japan Aerospace Exploration Agency (JAXA).

“While the atmospheric circulation on the planet's dayside has been extensively explored, there was still much to discover about the night side. We found that the cloud patterns there are different to those on the dayside, and influenced by Venus' topography,” said Peralta, lead author of the study published in the journal *Nature Astronomy*.

Venus' atmosphere is dominated by strong winds that whirl around the planet far faster than Venus itself rotates.

This phenomenon, known as 'super-rotation', sees Venusian winds rotating up to 60 times faster than the planet below, pushing and dragging along clouds within the atmosphere as they go.

These clouds travel fastest at the upper cloud level, some 65 to 72 kilometres above the surface.

“We've spent decades studying these super-rotating winds by tracking how the upper clouds move on Venus' dayside—these are clearly visible in images acquired in ultraviolet light,” said Peralta.

“However, our models of Venus remain unable to reproduce this super-rotation, which clearly indicates that we might be missing some pieces of this puzzle,” he said.

“We focused on the night side because it had been poorly explored; we can see the upper clouds on the planet's night side via their thermal emission, but it's been difficult to observe them properly because the contrast in our infrared images was too low to pick up enough detail,” he added.

The team used the Visible and Infrared Thermal Imaging Spectrometer (VIRTIS) on European Space Agency (ESA)'s Venus Express spacecraft to observe the clouds in the infrared.

“VIRTIS enabled us to see these clouds properly for the first time, allowing us to explore what previous teams could not—and we discovered unexpected and surprising results,” adds Peralta.

Rather than capturing single images, VIRTIS gathered a 'cube' of hundreds of images of Venus acquired simultaneously at different wavelengths.

This allowed the team to combine numerous images to improve the visibility of the clouds, and see them at unprecedented quality.

The VIRTIS images thus reveal phenomena on Venus' night side that have never before been seen on the dayside.

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How Tez works

Google forayed into the burgeoning mobile payments sector in India on Monday with its mobile wallet app, Google Tez. Here's what you need to know about Tez.

How does it work?

Google Tez is a mobile wallet based on the Unified Payments Interface (UPI) platform built by the National Payments Corporation of India (NPCI). UPI-enabled wallets permit users to transfer money without the recipient's bank account details. The UPI ID of the recipient is used as a proxy for the account number and IFSC code, thereby simplifying the money transfer.

How is it different from digital wallets?

Tez does not require money to be stored in the app to make digital payments. It works as an extension of one's bank account, So, unused money remains in the bank, earning interest. Each transaction is initiated by the sender entering his UPI pin with the additional security of existing phone locks.

How can you transfer money using Tez?

After installing the app on an Android or an iOS device, users have to sync their wallets with their Google account, and the mobile number linked to it. Access to the wallet from the app drawer is protected by a Google PIN and by security settings on the device, such as passcodes, fingerprints and pattern locks.

Integration of one's bank account with the wallet is done via SMS, and will not be completed if the phone number associated with the account does not match, or if the user holds an NRI account which is not supported for this feature. Users without a UPI id will have to create one and enter a secure UPI pin.

Once the user's bank account is linked, money can be transferred using the recipient's UPI id. Users also have the option of making transfers to bank accounts by entering the account number of the recipient and the related IFSC code.

Other means of making payments is by using the camera to scan a QR code, or entering the phone number of the recipient. The app automatically identifies contacts who have successfully registered with the Tez database. A fourth alternative is the 'Cash Mode' that allows quick transfers with nearby Tez users without sharing phone numbers. Cash Mode can be used to pay as well as receive money from devices within its range.

(For full story, visit <http://bit.ly/2xsHgBQ>)

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Indian Naval units of Western Naval Command on Long Range Deployment**Indian Naval units of Western Naval Command on Long Range Deployment**

Two Indian Naval Ships, a submarine and two Long Range Maritime Reconnaissance Aircraft of the Western Naval Command are presently on deployment to the Western Arabian Sea and southern Indian Ocean.

Indian Naval Ship Mumbai and submarine Shishumar entered Duqm, Oman today as part of this deployment to the Western Arabian Sea, after conducting a series of exercises enroute. An Indian naval submarine is visiting a foreign port after a long gap. The Naval units are on a month long deployment with the aim of enhancing surveillance and cooperation with the Arabian Sea rim nations. Another ship, INS Kochi which is also a part of this deployment, is proceeding to the Southern Indian Ocean with a similar aim.

The Western Naval Command, which exercises operational control of the naval units in this theatre, has been actively involved in enhancing three-dimensional surveillance efforts by Indian Naval units for strengthening regional Maritime security cooperation with littoral states.

NV/ST/MB/29/17

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Attaining New Heights in Biotechnology

Attaining New Heights in Biotechnology

DBT announces three High-investment, High Outcome Thrusts for the North East Region

Bio-technology in the NER – DBT's Efforts are bringing a paradigm shift

The Department of Biotechnology (DBT) under the Ministry of Science & Technology, has taken many steps to bring about a paradigm shift in biotechnology in the country's North-East Region (NER). Eyeing an inclusive growth, DBT has announced a series of new programs and missions to turn this into a reality. DBT has established a dedicated 'North Eastern Region Biotechnology Programme Management Cell (NER-BPMC)', with an annual investment of Rs. 180 crores, to evolve, implement and foster biotechnology research in the north east states.

On the occasion of Pandit Deendayal Upadhyaya Birth Centenary, the Minister of S&T, Earth Sciences and Environment, Forests & Climate Change, Dr. Harshvardhan announced three major new initiatives for the North East. These new initiatives are in congruence to the Pandit Deendayal Upadhyaya's philosophy of "Integral Humanism" which is a synthesis of the material and the spiritual, the individual and the collective, which the world is now calling as "One Health" embodying the health of human, animal and environment as one.

The Minister said that DBT has committed to dedicate each year, at least 10% of the budget for the North-East. This year at least Rs.200 crores is expected to be spent for North-East Programmes. The Minister informed that as a result of the programmes, North East has become a major hub of biotechnology at the foundational level. The biotech programmes are of the highest quality, the institutions have state-of-the-art facilities and there has now been an impact on innovation and entrepreneurship because of excellent human resources programmes.

I. Phyto-Pharma Plant Mission: This is a Rs 50 crore Mission aimed at conservation and cultivation of endangered and threatened endemic medicinal plants, and discovery of new botanical drugs for unmet medical needs using the rich traditional ethno-botanical knowledge and biodiversity of these states and at the same time also improve availability of authentic and quality botanical raw material on sustainable basis for a boom in the phyto-pharmaceutical industry. Through this Mission, it is expected to enable farmers from NE states and phyto-pharmaceutical industry to become global leaders in production and export of some quality botanical drugs for unmet medical needs. For this Mission, DBT will be the nodal coordinating and implementing department and work closely with Ministry of DONER and other identified institutions.

DBT has announced launch of the Phyto-pharmaceutical Mission in NER with three major objectives:

- (i) Captive cultivation of selected medicinal plants of NER, which have great demand to ensure supply of authentic and quality botanical raw material to the user industries in the country.
- (ii) Development of technology packages for production of GMP grade medicinal plant extracts for export markets.

(iii) Production of safe and efficacious phytopharmaceuticals from medicinal plants of NER for unmet medical needs using modern scientific tools and following global standards.

II. Brahmaputra Biodiversity and Biology Boat (B4) on the Brahmaputra River, a major ecology hotspot, in NER, in collaboration with DONER, B4 will establish a large barge on the river with a well-equipped laboratory for analysis of all components of the entire ecosystem of the river and surroundings. The B4 will link to all the local research institutions along the river, as well as national and international laboratories.

B4 will have capability to analyse soil, water, environment, plant and animal life, human health and agriculture and an equal component that involves local citizens in the experimental process of science in data generation and management. B4 will also have a teaching laboratory for school/college children. It is also proposed to have mobile satellite boat labs which will run along the tributaries of Brahmaputra to feed in data to the main B4.

III. Frugal microscopy through the Foldscope: a frugal microscope assembled from simple components, including a sheet of paper and a lens, is acting as a tool connecting students and science from the region, with the rest of the country.

A total 525 applications from schools, colleges have been received: 112 from schools, 357 from colleges and 56 from citizen scientists. All applicants will receive a micro grant between Rs 4 lakhs to 8 Lakhs as well as a supply of Foldscopes while being linked with NER.

Dr. Harshvardhan informed that in addition to the three new announcements, DBT has many major ongoing projects in the North-East in the following areas:

Skilling Human Resources:

Twinning R&D Programme: DBT has initiated 480 R&D twinning programs that link institutes in NER with those across the country. With an investment of Rs. 90 crores in the last three years, this effort has resulted in 252 research publications and 600 Junior and Senior Research fellowships awarded to the students to pursue biotechnology research.

To create an environment of training and research in medial biotechnology, DBT has **supported Medical Diagnostic facilities at 11 medical colleges** in NER with an investment of Rs. 40.00 crores. This facility is providing quality diagnostic services as well as carrying out research on various health problems prevalent in the region using modern biotechnology tools and technologies. So far more than 4.70 lakhs tests in different disease have been conducted by these diagnostic facility.

DBT's '**Overseas Associateship for North East Region**' has seen 208 scientists from NER being trained overseas with Rs. 5.25 crore invested every year to support this programme. Through the DBT-NER Visiting Research Professorship (VRP) Scheme, 30 Scientists/Faculty are selected for bringing advancement in the field of biotechnology and life sciences in various institutions by sharing their vast experience and expertise with NER researchers and students.

At school levels, DBT has launched the '**Biotechnology Labs in Senior Secondary schools (BLISS) programme**', a first of its kind in India, for schools where biotechnology labs have been set

up at 88 Senior Secondary Schools from NER with an investment of Rs. 2.20 crores.

For universities, DBT has **set up 30 Bioinformatics Centre** at an investment of Rs. 9 crores for conducting research on genomics, proteomics and data analysis.

Under the '**Biotech Industrial Training Programme**', deserving students have been provided stipends during their training at biotech/life science industries. DBT is also supporting 15 institutes in NER recognised as 'Star colleges' to provide them with enhanced lab infrastructure and mentoring by leading scientists and Fellows of various national academies.

To provide these students with access to world-class journals and publications, the DBT **e-Library consortium (DeLCON)** has been launched in partnership with 18 institutions of NER, which provides access to more than 900 high impact e-journals. With an investment of Rs. 54. crores in last 3 years, this facility has been extended to more than 150 colleges benefiting about 1500 life science students.

Infrastructure and Resource building

Infrastructural support for biotechnology has been provided under many programs. DBT has established 126 '**Biotech Hubs**' at various institutions, universities and colleges to promote education, training and research in biological sciences including biotechnology. With over Rs. 22 crores invested in last three years, about 1000 training programmes were conducted by these hubs, with more than 1000 students, researchers and school teachers as beneficiaries.

DBT has also created biotech infrastructural facilities at **North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences (NEIGRIHMS)**, Shillong, at an investment of Rs. 4.50 crores.

The DBT has established many centres of excellence across NER to focus on different applications of biotechnology. The **DBT-AAU Centre of Excellence on Agriculture Biotechnology** at Assam Agricultural University (AAU), Jorhat, promotes agriculture biotechnology research and is helping farmers by developing elite varieties for local crops and improving their yield. The centre, established with an investment of Rs. 36.70 crores.

The **Centre of Excellence on Fisheries & Aquaculture Biotechnology (FAB)** in Tripura has adopted 2 villages to provide local fishermen with good quality fish seeds to produce high quality fish products, benefiting 200 farmers.

DBT has also sanctioned an amount of Rs. 45.00 cores for the establishment of a regional level **Animal House facility at Regional Medical Research Centre (RMRC), Dibrugarh** in Assam, which will be accessible to entire biomedical research community of NER for carrying out critical animal experiments in disease biology, molecular medicine, vaccinology and pharmacology.

Another related initiative is the **Advance Animal Disease Diagnostic & Management Consortium (ADMaC)** for surveillance and control of trans-boundary, exotic and zoonotic pathogens from NER. This programme will house a first Animal-BSL 3 lab in NER.

To conserve the delicate ecology of the region, DBT has sanctioned Rs. 26 crores for a major **network programme on chemical ecology of NER** in collaboration with leading institutions in India like IISc, NCBS, and UAS Bangalore.

Recognising the rich biodiversity of the region, DBT is also pushing for the **development of 'NER-Scented Rice'** -- a biotechnology inspired variant of the aromatic rice, and NER-Banana. The

aromatic rice of NER, especially Joha and Black rice, are of premium value because of their aroma and high medicinal characteristics. But, these are also poor yielders and are susceptible to pest attacks. DBT is now seeking innovative approaches that use biotechnological intervention to ameliorate the agronomic characteristics of this aromatic rice and other scientific properties, besides yield enhancement. Under the various twinning programmes, projects like these are being implemented with an investment of Rs.16.67 crores.

Existing programs flagged off by DBT in the region have been enormously successful with almost all the allocated budget being utilised for the proliferation of biotechnology in the North-Eastern states of India. Dr. Harsh Vardhan, Hon'ble Minister for Science & Technology and Earth Sciences has been instrumental in implementing these initiatives in the region and has personally visited each and every state in NER to review on-the-spot progress of these programmes and to interact with students, academia, scientists and local communities. This has resulted in skilled human resources and enhanced research infrastructure and resource building

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GM mustard in for a long wait

Many activist groups are against GM Mustard.

Union Environment Minister Harsh Vardhan has indicated that a decision on releasing genetically modified (GM) mustard commercially was unlikely any time soon.

“There are compelling arguments from those who support it and those against it,” he said responding to a query from *The Hindu*. “The government however will only take a decision based on common good.”

Dr. Harsh Vardhan, who holds the Science portfolio, took over the Environment Ministry after the death of Anil Dave. That makes him the final government arbiter on allowing GM mustard to be made available commercially. GM mustard was developed by scientists at Delhi University and the project was part-funded by the Department of Biotechnology, a division of the Science Ministry.

‘No conflict’

Dr. Harsh Vardhan said there was “no conflict” in his position as a Science and Environment Minister.

In June, he said he would have a fresh consultation with environmental groups, scientists and farmers’ bodies before taking a call on the release of GM mustard. Multiple officials have since confirmed to *The Hindu* that this has not happened.

The Genetic Engineering Appraisal Committee (GEAC), India’s regulator for genetically modified seeds, had on May 12 this year cleared GM mustard for environmental release and use in fields. Though it was cleared by scientists, the Environment Minister’s approval is required.

The Centre told the Supreme Court last week that it was considering various aspects and was still to take a final call on the commercial release of GM mustard. “We are looking into all reports by experts including that of the Rajya Sabha sub-committee before a final decision is taken,” said Additional Solicitor-General P.S. Narasimha, representing the Centre.

A Parliamentary Standing Committee, headed by Renuka Chowdhary of the Congress, last month said that there was a paucity of studies on the impact of GM crops on human health. Should the Minister’s consent be obtained, GM mustard would be the first transgenic food crop to be allowed for commercial cultivation in India. It could pave the way for several other GM food crops in the country. Dhara Mustard Hybrid (DMH -11), the transgenic mustard in question, has been developed by a team of scientists at Delhi University under a government-funded project.

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The new technology, of trust

What is blockchain?

Blockchain is the backbone technology on which bitcoins run. Simply put, it is a digital public ledger that records every transaction. Once a transaction is entered in the blockchain, it cannot be erased or modified. Blockchain removes the need for using a trusted third party such as a bank to make a transaction by directly connecting the customers and suppliers. Each transaction is recorded to the ledger after verification by the network participants, mainly a chain of computers, called nodes. Blockchain today may be compared to what the Internet was in the early 1990s. While we have witnessed how the 'Internet of Information' has changed our society over the past two decades, we are now entering a phase where blockchain may do the same by ushering in a new paradigm comprising 'Internet of Trust' and 'Internet of Value', as per a Deloitte and Assocham study.

Where did it originate?

While the origin of the technology is not clear, it is widely believed that a person or group of people by the pseudonym Satoshi Nakamoto, who invented bitcoins, released the technology to support cryptocurrency.

What are the use cases?

Bitcoin is just one of the applications for the technology, whose use is being tested across industries. It is witnessing a lot of traction within India, in sectors such as banking and insurance. In most of these industries, players are coming together to form a consortium to realise the benefits of blockchain at an industry level.

For example, in India, there is a consortium 'BankChain' which has about 27 banks from India (including State Bank of India or SBI and ICICI) and the Middle East as its members. The consortium is exploring using usage of Blockchain technology to make business safer, faster and cheaper.

The Institute for Development and Research in Banking Technology (IDRBT), an arm of the Reserve Bank of India (RBI), is developing a model platform for blockchain technology.

What are the benefits?

The benefits of using blockchain will vary from case to case. However, according to a Deloitte and Assocham report on the issue, blockchain becomes a good fit when there is a lot of data that is shared across multiple parties with no trust mechanism among the participants.

Financial players are the first movers to capitalise on this technology. As per a study by the World Economic Forum, "With over 90 central banks engaged in Blockchain discussion globally, over 2,500 patents filed over the last three years and 80% of the banks predicted to initiate Blockchain and distributed ledger technology (DLT) projects by 2017, the Blockchain technology is on its course to become the new normal in the world of financial services." Non-financial players too have been paying attention to and looking for ways to leverage the opportunities that blockchain offers, the report adds, pointing out that the front runners among them are retail, travel, health care, telecommunications and public sector industries. "The major use cases applicable to these industries are focused on the decentralized data storage, data immutability, and distributed ownership features of Blockchain," it says.

Blockchain is expected to improve the efficiency of a transaction by eliminating the middlemen, while also reducing the cost of all transactions. It is also likely to increase transparency. and bring down fraud as every transaction would be recorded and distributed on a public ledger.

What is happening in India?

A high-level committee, which consists of officials from the Ministries of Finance, Home Affairs and IT as well as SEBI, the RBI, SBI, and NITI Aayog, is currently deliberating on whether or not cryptocurrencies should be banned in India. However, the discussions till now are learnt to be in support of encouraging the use of blockchain technology.

The new U.S. Fed Chairman is unlikely to opt for policies that might upset the President's plan

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Hubble spots unique binary asteroid with comet-like features

Hubble Space Telescope. was used to image the asteroid, designated 300163 (2006 VW139), in September 2016 just before the asteroid made its closest approach to the Sun. File Photo | Photo Credit: [PTI](#)

An unusual object, discovered in the solar system's asteroid belt, is actually two asteroids orbiting each other, scientists including one of Indian origin have found using the Hubble Space Telescope.

The object has comet-like features including a bright halo of material, called a coma, and a long tail of dust.

Hubble was used to image the asteroid, designated 300163 (2006 VW139), in September 2016 just before the asteroid made its closest approach to the Sun.

The images revealed that it was actually not one, but two asteroids of almost the same mass and size, orbiting each other at a distance of 96 kilometres.

Asteroid 300163 (2006 VW139) was discovered by Spacewatch in November 2006 and then the possible cometary activity was seen in November 2011 by Pan—STARRS.

Both Spacewatch and Pan-STARRS are asteroid survey projects of NASA's Near Earth Object Observations Program.

After the Pan-STARRS observations it was also given a comet designation of 288P.

This makes the object the first known binary asteroid that is also classified as a main-belt comet. The more recent Hubble observations revealed ongoing activity in the binary system.

"We detected strong indications for the sublimation of water ice due to the increased solar heating - similar to how the tail of a comet is created," said Jessica Agarwal of the Max Planck Institute for Solar System Research in Germany.

The combined features of the binary asteroid - wide separation, near-equal component size, high eccentricity orbit, and comet—like activity- also make it unique among the few known binary asteroids that have a wide separation.

Understanding its origin and evolution may provide new insights into the early days of the solar system. Main-belt comets may help to answer how water came to a bone-dry Earth billions of years ago.

The team estimates that 2006 VW139/288P has existed as a binary system only for about 5,000 years. The most probable formation scenario is a breakup due to fast rotation.

After that, the two fragments may have been moved further apart by the effects of ice sublimation, which would give a tiny push to an asteroid in one direction as water molecules are ejected in the other direction.

The fact that 2006 VW139/288P is so different from all other known binary asteroids raises some questions about how common such systems are in the asteroid belt.

“We need more theoretical and observational work, as well as more objects similar to this object, to find an answer to this question,” said Agarwal.

The research appears in the journal Nature.

A study of nearly 300 people living in different parts of India found that nine single-base variants (single-nucleotide polymorphisms or SNPs) account

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On GM crops, a failure to heed scientific evidence

Last week, the Centre told the Supreme Court that it was yet to make up its mind on the commercial release of genetically modified (GM) mustard (*Brassica juncea*) and was still studying the matter. This week, Union environment minister Harsh Vardhan reiterated the point, underlining that there were “compelling arguments” both for and against GM crops. Vardhan, who also serves as science minister, proffered that the government’s decision will be “based on common good”. If that is indeed to be the case, then this government’s continued dithering on GM crops simply does not add up.

Yes, this has been a controversial issue with the green lobby raising a litany of complaints but the fact of the matter is that a large and growing body of evidence indicates in no uncertain terms that GM crops are indeed safe and economically beneficial.

The Indian state, however, has seemingly always been in two minds about GM crops. During the UPA era, Prime Minister Manmohan Singh and agriculture minister Sharad Pawar favoured GM crops while two successive environment ministers, Jairam Ramesh and Jayanthi Natarajan, stood in opposition. Natarajan’s successor Veerappa Moily, however, was in the pro-GM camp and reversed a moratorium on field trials, which were then re-started in some BJP-ruled states after the NDA came to power at the Centre in 2014. Prime Minister Narendra Modi was considered to be in favour of GM crops, and his environment ministry reported in 2016 that there were no safety concerns regarding the use of GM mustard. In May this year, the Genetic Engineering Appraisal Committee (GEAC), the apex regulatory body for GM seeds, cleared the Dhara Mustard Hybrid-11 (DMH-11) for commercial field use.

But by then the Supreme Court had put a spanner in the works—it was hearing anti-GM campaigner Aruna Rodrigues’ demand for an “independent evaluation” of DMH-11. That case is scheduled for a final hearing in November; meanwhile, a parliamentary standing committee, headed by the Congress party’s Renuka Chowdhury, has advised the government to go slow because it believes that there isn’t enough evidence to decide either way.

This is decidedly odd, for research done by at least six different institutes under the Indian Council of Agricultural Research has found GM crops to be safe for animal health. The Central Avian Research Institute in Bareilly gave genetically modified cottonseed meal to broiler chickens over a period of nine years and found no difference with those that consumed non-GM feed. The Central Sheep and Wool Research Institute at Malpura, in collaboration with the Central Institute of Cotton Research, Nagpur, did similar tests on lambs, and again found no adverse impact. The Indian Veterinary Research Institute, in Bareilly, came up with similar results for goats, the National Dairy Research Institute at Karnal for cows, and the Central Institute of Fisheries Education, Mumbai for fish.

Additionally, the National Institute of Nutrition in Hyderabad conducted tests for toxicity and allergenicity and found no adverse effects. And if all this wasn’t enough, sample this: a 2014 meta-study by Wilhelm Klumper and Martin Qaim of the University of Göttingen, Germany, analysing 147 other studies of GM crops from around the world, found that GM technology helped increase crop yields by 22%, reduced the use of chemical pesticides by 37%, and increased farmer profits by 68%.

Today, GM crops are cultivated over 185 million hectares of land, by more than 18 million farmers across 26 countries, marking a 110-fold increase since GM crops were first commercialized, according to data from the International Service for the Acquisition of Agri-biotech Applications. At least 30 other countries import GM produce, which means about nearly 68% of the world’s

population is already consuming GM products.

In fact, India too has been importing GM products—specifically, GM soybean oil and GM canola oil (which is a sister crop of mustard)—for nearly two decades now. These imports cost about Rs80,000 crore annually and are needed to cover nearly half of India's edible oil demand. Now, if GM mustard, which has a much higher yield than traditional varieties, can be cultivated domestically, it can not only reduce the import bill significantly but also increase the income of about six million mustard farmers.

One only needs to look at the enormous success of BT cotton, the only GM crop that is allowed to be cultivated in the country, to gauge the potential here. In fact, while BT cotton was developed by a foreign company, thus fuelling concerns about vested interests and corporate control among environmental activists, GM mustard has been developed at the publicly funded Centre for Genetic Manipulation of Crop Plants at the University of Delhi after 20 years of research.

Simply put, GM crops make for good science and good economics, and India needs to embrace both. If it doesn't, it will fall behind.

Do you think India should begin cultivating GM mustard? Tell us at views@livemint.com

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ISRO working on substitute navigation satellite

The PSLV-C22 rocket carrying IRNSS-1A, first of India's seven navigation satellites, lifts off from the Satish Dhawan Space Centre in Sriharikota on July 1, 2013. | Photo Credit: [REUTERS](#)

Work has begun in Bengaluru to assemble a substitute navigation spacecraft, which became essential after the main backup was lost in a [failed launch](#) on August 31, 2017.

IRNSS-1I was earlier approved as a ground spare, to be sent to space in an emergency. The Indian Space Research Organisation has been training a team from an industry consortium to assemble this spacecraft and its lost fellow satellite, IRNSS-1H.

Will there be another backup, an IRNSS-1J, and if so, who would assemble it? M. Annadurai, director of ISRO Satellite Centre (ISAC), Bengaluru, said the current approval is for seven navigation spacecraft (all of which are in orbit) and two spares — IRNSS-1H and IRNSS-1I. Should a new backup be sought and approved, it may be part of another model of outsourcing of its satellites to the Indian industry. ISRO has just begun the process of identifying a set of external partners who would assemble its future satellites, he noted. Until now all Indian spacecraft have been assembled at ISAC by its engineers.

Is the Assembly of 1I being advanced? Back in December, the consortium of six industries was given six months to work on each spacecraft. The deadline for IRNSS-1I was around May 2018. Dr. Annadurai said that as of now, the timeline was the same. The launch of 1I, when it was ready, would also have to align with ISRO's other missions, he said.

ISRO awaits the report of the [failure analysis committee](#), which is looking into reasons why the launch failed, before it returns to launch its next missions. The seven IRNSS spacecraft, from 1A to 1G, are part of the 1,400-crore GPS-like fleet for India, called NavIC (Navigation in Indian Constellation). They were put in orbit between July 2013 and April 2016 and have a life of 10 years each.

Soon after all of them were in place, all three atomic clocks in IRNSS-1A failed, warranting its replacement. IRNSS-1H was sent up on a PSLV rocket but was not released from the upper heat shield of the rocket. It has been falling slowly to Earth in the same state, embedded in the heat shield. Which is where 1I enters — as a backup to both IRNSS-1A and IRNSS-1H.

The atomic clocks on the other satellites are being used sparingly to extend the clocks' life in space. ISRO chairman A.S. Kiran Kumar recently said there was no urgency as the remaining six are working as planned.

A study of nearly 300 people living in different parts of India found that nine single-base variants (single-nucleotide polymorphisms or SNPs) account

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Navy takes delivery of Scorpene submarine

Mazagon Dock Shipbuilders Ltd. (MDL) of Mumbai on Thursday handed over the first of the Scorpene submarines, *Kalvari*, to the Navy. This is the Navy's first new conventional submarine in two decades.

"The state-of-the-art technology utilised in the Scorpene has ensured superior stealth features such as advanced acoustic silencing techniques, low-radiated noise levels, hydro-dynamically optimised shape and the ability to launch a crippling attack on the enemy using precision guided weapons," MDL said.

MDL is constructing six Scorpene submarines with technology transfer from Naval Group, formerly DCNS of France.

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Bio-Innovations: Propelling the Bio-economy of the Nation**Bio-Innovations: Propelling the Bio-economy of the Nation****Dr. Harshvardhan Inaugurates Two-Day Innovators Conclave and Bio-Innovation Fair**

“The Government is focused on making India a global hub for innovation and BIRAC is playing a crucial role in shaping the biotech innovation ecosystem of India”, said Dr. Harshvardhan, Union Minister for Science & Technology, Earth Sciences and Environment, Forest and Climate Change, while inaugurating BIRAC’s Innovators Conclave & Bio-Innovation Fair at New Delhi today. The Minister further added, “DBT is playing a catalytic role in building a 100 billion-dollar Indian bio-economy and is now effectively leveraging the research and entrepreneurial capabilities of this sector to address the needs of our people by creating affordable products that have the potential to change lives and catapult India in to a brighter future.”

Speaking on the occasion, the Minister of State for Science & Technology and Earth Sciences Shri Y.S. Chowdary said, “Over the last 5 years, a foundation has been laid for making India a global leader in biotechnology research and development. We are ensuring that our innovators and indigenous products receive the encouragement and support to make their mark on the international biotech stage. We are very proud of the impact that BIRAC has generated in such a short span and this Innovation Conclave is testament to it.”

On the occasion, the Dignitaries also released two books, namely (i) BIRAC Innovations: Propelling the Bio-Economy and (ii) The BIRAC Star Entrepreneurs

Biotechnology Industry Research Assistance Council (BIRAC), a public sector undertaking of the Department of Biotechnology (DBT), Ministry of Science & Technology has organized a two-day Innovators Conclave & Bio-Innovation Fair at the India Habitat Centre, New Delhi. The theme for the conclave is BIRAC Bio-Innovations: Propelling the Bio-economy. The Conclave brings together nearly 300 innovators and startups, scientists from industry and academia, public and private sector, policy makers, and national and international organisations.

Biotechnology Industry Research Assistance Council (BIRAC) is a not-for-profit Public Sector Enterprise, set up by Department of Biotechnology (DBT), Ministry of Science and Technology Government of India, to empower the emerging biotech industry to undertake

strategic research and innovation. BIRAC is a new industry-academia interface and implements its mandate through a wide range of impact initiatives, be it providing access to risk capital through targeted funding, technology transfer, IP management and handholding schemes that help bring innovation excellence to Indian biotech firms and make them globally competitive. BIRAC has initiated several schemes, networks and platforms that help to bridge the existing gap between industry-academia research and facilitate novel, high quality and cost-effective affordable technologies. BIRAC has initiated partnerships with several national and global partners to collaborate and deliver the salient features of its mandate.

Prof. VijayRaghavan, Secretary, DBT and Chairman, BIRAC during the event said, “The country’s biotech startup landscape has shown immense growth over the last five years. BIRAC was created to bridge the space between policy, industry and academia in the biotech sector and bring all stakeholders together on one platform. Our impact on the biotech innovation landscape is clearly visible.”

Dr. Renu Swarup, Senior Advisor, DBT and Managing Director, BIRAC said, “BIRAC has transformed the biotech innovation ecosystem in the country. Our investments in the Indian innovation ecosystem are bearing fruit and our innovations are now showing real impact and producing tangible benefits for society. This Innovation Fair is the perfect occasion for us to showcase what our up and coming investigators are working on and how they hope to transform India. This fair also gives us the opportunity to showcase the potential for scale-up of these innovations to relevant stakeholders and decision-makers.”

The keynote address was given by Dr. Anil Kakodkar, former Chairman of Atomic Energy Commission of India.

The conclave was host to a bio-innovation fair and an innovation market place and featured a number of key panel discussions including “The Startup Conversation: Gaps, Opportunities and the way forward” featuring venture capitalists and angel investors and a discussion on “Pathways to create impact through Biotech Innovations to the power of Infinity” featuring decision-makers and experts. The conclave ended with the bio-innovation fair awards. The bio-innovation fair played host to more than 65 innovations supported under various initiatives of DBT and BIRAC.

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All you need to know about Graded Surveillance Measure

The BSE website mentions a list of more than 900 companies that are monitored under the Graded Surveillance Measure, designed by market regulator Securities and Exchange Board of India (SEBI). Here are more details about Graded Surveillance Measure.

What is the Graded Surveillance Measure?

SEBI introduced the measure to keep a tab on securities that witness an abnormal price rise that is not commensurate with financial health and fundamentals of the company such as earnings, book value, price to earnings ratio among others.

Why did SEBI bring in the measure?

The underlying principle behind the graded surveillance framework is to alert and protect investors trading in a security, which is seeing abnormal price movements. SEBI may put shares of companies under the measure for suspected price rigging or under the ambit of 'shell companies'. The measure would provide a heads up to market participants that they need to be extra cautious and diligent while dealing in such securities put under surveillance.

How the Graded Surveillance Measure works?

Once a firm is identified for surveillance it goes through six stages with corresponding surveillance actions and the restrictions on trading in those securities gets higher progressively. In the first stage the securities are put in the trade-to-trade segment (meaning no speculative trading is allowed and delivery of shares and payment of consideration amount are mandatory). A maximum of 5% movement in share price is allowed.

In the second stage, in addition to the trade-to-trade segment, the buyer of the security has to put 100% of trade value as additional surveillance deposit. The deposit would be retained by the exchanges for a period of five months and refunded in a phased manner.

In the third stage, trading is permitted only once a week ie every Monday, apart from the buyer putting 100% of the trade value as additional surveillance deposit.

In the fourth stage, trading would be allowed once a week and the surveillance deposit increases to 200% of the trade value.

In the fifth stage, trading would be permitted only once a month (first Monday of the month) with additional deposit of 200%.

In the sixth and final stage, there are maximum restrictions.

Trading is permitted only once a month at this stage, with no upward movement allowed in price. Also, the additional surveillance deposit would be 200%.

Will securities remain permanently in the Graded Surveillance list?

There would a quarterly review of securities. Based on criteria, the securities would be moved from a higher stage to a lower stage in a sequential manner.

What are the points small investors should keep in mind about the Graded Surveillance

Measure?

As and when a security is shifted to various levels of surveillance, it is publicly announced on a daily basis on BSE and NSE websites as well as through circulars to the stock brokers. Moreover, the exchanges can also appoint independent auditors to audit the books of accounts of these companies and do forensic audit, wherever needed.

This indirectly may also be an indication that the sudden rise in either the volumes traded or the price increase are not commensurate with the fundamentals of the said companies and hence small / retail investors are protected from getting stuck in such stocks inadvertently on some wrong advice.

The only challenge for the small investors is that these announcements are often made at very short notice and implemented from the next day itself thus giving those who have already entered the stock less than adequate time to exit it. Of course, there is also potentially another risk. For example, even if time is given, the stock might crash next day on the news, triggering the lower price circuit and leaving no exit opportunity.

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A step closer to treating oral cancer without surgery

Researchers in Mumbai have moved a step closer to treating surface tumours such as oral, breast and cervical cancer and other tumours such melanoma and colon cancer through photothermal ablation using gold-polymer nanoparticles and near infrared light. The researchers from Mumbai's Indian Institute of Technology (IIT) Bombay and Tata Memorial Centre have synthesised hybrid polymer-gold nanoparticles as photothermal agent to ablate solid tumours.

The near infrared light heats up the nanoparticles and the heated nanoparticles, in turn, can kill the cancer cells. Unlike other agents tried out by others, the hybrid nanoparticles used by the Mumbai team has no toxicity, is biodegradable and gets cleared from the body through urine.

The team led by Prof. Rohit Srivastava from the Department of Biosciences and Bioengineering at IIT Bombay and Dr. Abhijit De from the Molecular Functional Imaging Lab at ACTREC, Tata Memorial Centre used a thermoresponsive polymer (poly(N-vinyl caprolactam)) nanoshell which can be loaded with an anticancer drug. The polymer nanoshell is coated with gold nanoparticles.

Besides killing the cancer cells through thermal ablation, the polymer degrades at about 43 degree C and releases the drug to completely kill the tumour. Cancer cells get killed above 42 degree C.

"The gold nanoparticle coating is important. In its absence the temperature of the polymer does not rise to 43 degree C when we shine near infrared light," says Deepak S. Chauhan from the Department of Biosciences and Bioengineering at IIT Bombay and the first author of the paper published in the journal *RSC Advances*. "The polymer shrinks and disintegrates when ablated and releases the drug efficiently."

"We are pretty confident that the heat generated by the gold-polymer nanoparticles alone [when we shine laser] is sufficient to kill the cancer cells. Addition of a drug is possible but complicates the nanoparticle-production process," says Dr. De.

Studies carried out using breast cancer cell lines have been very encouraging. Preliminary studies on mice for breast cancer photoablation have also shown promising results. The cancer cells (cell lines and in animals) were killed using heat alone; no anticancer drug was used.

Phase I trial

"We are planning to carry out clinical trials (Phase I) on people with oral cancer," says Dr. De. "We have already carried out trials in animals and the efficiency is really encouraging. We were able to burn out the tumour in animals."

"We have already started all the process towards a Phase I trial. If no company or entity comes forward to produce the hybrid nanoparticles for the Phase I trial then we will set up a GMP facility ourselves at IIT Bombay," says Prof. Srivastava.

"If phototherapy alone is not 100% efficient then we can load the polymer nanoparticle with a drug to kill cancer cells," says Prof. Srivastava. "Oral cancer is largest subset of cancer in India. If we can make photoablation work it will be a simple therapy that can be used as outpatient procedure — inject the nanoparticles and just shine laser. There will be no need for surgery. I see tremendous potential using this technology." Besides oral cancer, breast and cervical cancers can also be treated the same way.

Quicker and safer

Unlike surgery, the thermal ablation procedure takes very less time. Once the nanoparticles are injected at the site of the tumour, one has to wait for 15-30 minutes for the nanoparticles to settle and spread in the cancer cells before shining the laser for 3-5 minutes. "In 30-40 minutes we can deliver effective treatment to individuals and thus as an outpatient service one can treat up to 15-20 patients a day easily," says Dr. De.

Deep-seated tumour can also be treated with photoablation using catheter that can carry light. Right now the cable that delivers the laser is thicker. "Once we miniature it then can reach deeper tumours," says Dr. De.

Contrast medium

The hybrid nanoparticles can be injected into the blood and need not be injected directly into the tumour. The nanoparticles are able to reach the tumour cells through enhanced permeability and retention effect.

Since the hybrid nanoparticles absorb light and can automatically reach the cancer cells when injected into blood, they can also be used as a contrast medium. Unlike the conventionally used iodine contrast medium for CT scan, the nanoparticles produce better contrast due to higher absorption coefficient (due to higher electron density) and at one-fifth the concentration.

Also, the gold nanoparticles get accumulated in tumour cells and so the contrast increases with time. Additionally, the gold nanoparticles have longer half-life and circulate in the body for a longer time and so imaging can be done for a longer time.

Lifestyle-related risk factors are being cited, compounded by an inadequate number of treatment centres in the region

Without policies to stop the worrying spread of antimicrobial resistance, the mortality rate could be disturbing

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Centre forms group to work on plans for 5G roll-out by 2020

Manoj Sinha

The government has formed a high-level panel to evaluate and approve road maps and action plan to achieve the target of rolling out 5G technology in India by 2020. The Centre has created a support fund of about Rs. 500 crore to facilitate research and development for 5G.

‘Another opportunity’

“We missed the opportunity to participate when the standards were being set for 3G and 4G, and don’t want to miss the 5G opportunity. Now, when the standards are being set for 5G across the world, India will also participate in the process,” Minister of State for Communications Manoj Sinha told reporters.

“As per the OECD Committee on Digital Economic Policy, it has been stated that 5G technologies roll-out will help in increasing GDP, creating employment and digitising the economy,” Mr. Sinha added.

The forum, which comprises secretaries of the ministries of Communications, Information Technology and Science and Technology, and representatives from the industry and academia, will aim to have Indian participation in the process of defining global standards for the next generation of wireless technology.

The International Telecommunication Union (ITU), which will finalise the standards, has already proposed key performance requirements for the fifth-generation mobile technology. Under the 5G technology, the government aims to deliver about 10,000 megabit per second (10 gbps) in urban areas and 1,000 mbps (1 gbps) in rural areas, the Minister said.

The ‘5G 2020’ forum will also aim to strengthen domestic telecommunication equipment manufacturing that is necessary for the technology, with the aim that local manufacturers should be able to capture 50% of the Indian market and 10% of the global market over the next five to seven years.

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Why India has announced its 5G plans

Mumbai: Even with a fourth generation, or 4G, connection, making an uninterrupted cellphone call or surfing the internet on your mobile remains a challenge for many users. Especially if you are in a moving vehicle, a small town or village, or any area where there are fewer base stations and towers.

Regardless, India is readying to implement the fifth generation, or 5G, networks, by 2020 in a bid to speed up its “Digital India” and “Make in India” initiatives and keep pace with “global technology adoption” where the younger generation is used to connected devices like smartphones, smartwatches, other smart wearables, Artificial Intelligence (AI)-powered devices and are looking forward to driving connected cars.

On Tuesday, the government announced it has set up a 5G India 2020 Forum comprising secretaries, experts and academics. The government added it will create a corpus of Rs500 crore for an “early” 5G roll-out. India, according to the government release, is aiming at “a globally competitive product development and manufacturing ecosystem targeting 50% of the Indian market and 10% of global market over next five to seven years”.

The government hopes that this move to usher in 5G will help companies design and manufacture 5G technologies, products and solutions in India, thus developing some “essential IPR (intellectual property rights) in the 5G standard”, besides facilitating “accelerated deployment of next generation ubiquitous ultra-high broadband infrastructure with 100% coverage of 10 Gbps (gigabits per second) across urban India and 1 Gbps across rural India”.

What does this actually mean?

The telecom world has seen a new mobile generation roughly every 10 years since the first 1G system was introduced in 1981. The first 2G system started to roll out in 1992 while the first 3G system first appeared in 2001.

The 3G network is several times faster than the 2G one. Almost all telecom firms claim that they can provide speeds up to 21.1 Mbps on their 3G networks but real download speeds invariably fall when shared among users. Besides, most telecom firms have a “fair usage” policy wherein speed drops after reaching a specified download limit. 4G, at least technically, should have data speeds capable of reaching 100 megabytes per second while on the move, and 1GB per second when stationary.

However, 5G networks can increase download speeds to up to 10 gigabits per second. This implies that a full HD movie can be downloaded in a matter of seconds as opposed to a 4G network that can take more than an hour to do so.

5G is the next-generation mobile technology defined by 3GPP (3rd Generation Partnership Project)—the standards body that also overlooked the development of 4G LTE standards. A 5G user will be able to seamlessly use 5G, 4G (LTE), and wi-fi since 5G will interwork both with 4G and wi-fi, according to Qualcomm Technologies Inc.

Hence, for 5G to be successful, 4G has to attain maturity.

On the 5G devices front, experts expect customer premises equipment (CPE) to appear first, followed by tablets and terminals. 5G, say experts, will be able to handle more data, connect more devices, and significantly reduce latency—the time it takes for a packet of data to get from one

designated point to another. 5G also enables Multiple Input, Multiple Output (MIMO) and promises to improve network capacity, thus improving the quality of service (QoS).

Operators around the world, including India, are developing a 4G or long term evolution (LTE) footprint in a bid to provide better coverage to the consumer. 5G will not be an overlay network, it will work in tandem with 4G. So, for operators to be relevant in 5G, they would need to have a very good quality 4G network.

For instance, India's largest telecommunications service provider, Bharti Airtel Ltd is deploying India's first MIMO technology. Airtel is starting with the first round of deployment in Bengaluru and Kolkata and will expand to other parts of the country soon, the company said in a press release on Tuesday. MIMO technology expands existing network capacity by "five to seven times using the existing spectrum, thereby improving spectral efficiency", Airtel added.

Introducing 5G also has economic benefits.

These benefits, according to the Organization for Economic Cooperation and Development (OECD) Committee on Digital Economic Policy, include an increase in GDP, additional employment and faster digitization.

In his keynote speech on 14 September at the International Motor Show in Frankfurt, Germany, Qualcomm CEO Steve Mollenkopf cited the IHS 5G economic impact study, noting that the 5G mobile value chain alone could generate up to \$3.5 trillion in revenue in 2035, and support up to 22 million jobs. The study also forecasts that in the same period, the total contribution of 5G to "real global GDP growth is expected to be equivalent to a country the size of India".

5G, [according to Qualcomm](#), will also "natively support all spectrum types (licensed, shared, unlicensed) and bands (low, mid, high), a wide range of deployment models (from traditional macro-cells to hotspots), as well as new ways to interconnect (such as device-to-device and multi-hop mesh)".

5G is yet to be standardized, yet vendors are investing in 5G development efforts. Major companies that are involved in the development and deployment of these technologies include Alcatel-Lucent, Ericsson, Huawei Technologies, Nokia Solutions and Networks, AT&T Inc., Motorola Solutions Inc., NTT DOCOMO Inc., Samsung Electronics Co. Ltd., China Mobile and Verizon Communications.

In fact, on 28 June at Mobile World Congress (MWC) in Shanghai, China Mobile and Huawei jointly showcased the world's first 5G core network prototype on the service-based architecture (SBA). The prototype adheres to 3GPP's 5G SBA standard.

According to ReportsnReports.com, an online market research firm, 5G networks are expected to "generate nearly \$250 billion in annual service revenue by 2025".

Meanwhile, Asia-Pacific region countries, including South Korea, China and Japan, are teaming together to research on frequencies for 5G mobile telecommunications to secure early both 5G frequencies and their position as leaders in the technology, according to a 26 September [report](#) in BusinessKorea, an online Korean portal.

Chinese operators are on track to launch commercial 5G networks by 2020 and are expected to establish China as the world's largest 5G market by 2025, according to a [study](#) released on 28 June by GSMA Intelligence and the China Academy of Information and Communications Technology (CAICT).

Countries including South Korea, China, Japan, the US, the UK and Brazil are expected to roll out 5G networks by 2020. Even the Pakistan government in April [said](#) it will roll out 5G networks soon.

If India wants a truly connected future, it has its work cut out.

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Indian Navy commissions Water Jet Fast Attack Craft at Mumbai - 26 Sep 17**Indian Navy commissions Water Jet Fast Attack Craft at Mumbai - 26 Sep 17**

INS Tarasa, a Water Jet Fast Attack Craft was commissioned into the Indian Navy by Vice Admiral Girish Luthra, Flag Officer Commanding-in-Chief, Western Naval Command at the Naval Dockyard, Mumbai today. At an impressive commissioning ceremony, Vice Admiral Luthra expressed confidence that the new INS Tarasa will discharge her duties with élan and resolve, and bring laurels to the Western Naval Command and the Nation.

Complimenting the designers, builders, engineers, overseers, and the officers and the men whose efforts have fructified in the commissioning of the ship, he said that the ship is of proven design, has good endurance, low draught, high speed and manoeuvrability, thus making her most suited for her primary role of extended coastal and offshore surveillance and patrol. He reserved special praise for the ship's crew and the Warship Overseeing Team, Kolkata for ensuring that the ship has been commissioned with all Weapon and Sensor trials completed. The passage of the ship during her maiden voyage from Kolkata to Mumbai, in rough weather, bears testimony to the seaworthiness of the ship.

INS Tarasa is the fourth and last of the follow-on Water Jet FAC's built by the Garden Reach Shipbuilders and Engineers (GRSE), Kolkata. The first two ships of the class i.e. IN ships Tarmugli and Tihayu were commissioned in 2016 and are based at Visakhapatnam; while the third ship INS Tillanchang was commissioned earlier this year at Karwar on 09 March 2017. These ships are an upgrade of the Car Nicobar class Fast Attack Crafts with the Indian Navy, which were also indigenously designed and built by GRSE, Kolkata.

INS Tarasa is 50 m long and powered by three waterjets which give it speeds of over 35 knots (65 kmph). The ship is armed with a 30 mm main gun indigenously built, and a number of light, medium and heavy machine guns to undertake coastal defence operations. The ship is an ideal platform for missions like coastal and off-shore surveillance, EEZ Patrol, law enforcement as well as non-military missions such as Search and Rescue, Humanitarian Assistance and Disaster Relief. The commissioning Commanding Officer of the ship is Lieutenant Commander Praveen Kumar.

This is the second ship of the Indian Navy to be named INS Tarasa. The first INS Tarasa was in service of the Navy from 1999 to 2014. She was gifted to Seychelles Coast Guard as a symbol of India's partnership with friendly maritime nation in IOR. The new INS Tarasa will be based at Mumbai under the operational control of Western Naval Command.





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India Joins Race in 5G Ecosystem, Constitutes High Level Forum on 5G India 2020**India Joins Race in 5G Ecosystem, Constitutes High Level Forum on 5G India 2020**

India is at the cusp of a next generation of wireless technology 5G. 5G has been conceived as a foundation for expanding the potential of the Networked Society. A digital transformation brought about through the power of connectivity is taking place in almost every industry. The landscape is expanding to include massive scale of “smart things” to be interconnected. Therefore, the manner in which future networks will cope with massively varied demands and a business landscape will be significantly different from today.

The economic benefits from the 5G technology are also quite immense. As per the OECD (Organization for Economic Cooperation and Development) Committee on Digital Economic Policy, it has been stated that 5G technologies rollout will help in,

- a) Increasing GDP
- b) Creating Employment
- c) Digitizing the economy.

For India, 5G provides an opportunity for industry to reach out to global markets, and consumers to gain with the economies of scale. Worldwide countries have launched similar Forums and thus, India has joined the race in 5G technologies. We are open for collaboration with them.

Government has constituted High Level 5G India 2020 Forum with three Secretaries of key Ministries/Departments Telecom, Meity and DST, and also comprising of renowned experts like Dr. A. Paulraj, Professor Emeritus, Stanford University, USA, Mr Gururaj Deshpande - Chairman of Sycamore Networks, Sandstone, USA, Indian industry led by CEOs of ICT industry, Telecom Standard Development Organisation of India (TSDSI), Professors from IIT Madras, IIT Mumbai, IIT Delhi, IIT Hyderabad, IISc Bengaluru, IT industry and stakeholders from industry associations.

The Term of Reference of the High Level Forum for 5G India 2020 shall be: -

- a) Vision Mission and Goals for the 5G India 2020, and
- b) Evaluate, approve roadmaps & action plans for 5G India 2020.

The primary goals of the forum are to achieve:

- early deployment of 5G in India
- a globally competitive product development and manufacturing ecosystem targeting 50% of India market and 10% of global market over next 5 to 7 years.

The forum will complement the eco-system by focused actions in the following areas:

- Research Ecosystem – for IPR development, standards development and proof of concepts through research projects, PPP projects, testbeds and pilot roll-outs.
- Regulatory Framework – including spectrum assignments and a start-up friendly regulatory

environment to enable leap-frog and embracing of innovative technologies.

- Inclusive Business environment – with special focus on investment incentives favourable to start-ups and innovators and enablement of Venture capitalists.

Forum will constitute a number of Steering Committees in different domains.

A vibrant eco-system of research built around 5G that encompasses Industry, Government and Academia will further strengthen the MAKE (& DESIGN) in INDIA initiatives to enable:

- Design and manufacture of 5G technologies, products and solutions in India;
- 5G start-ups that enable this design and manufacturing capabilities;
- Generation of IPR backing the above designs;
- India based companies should have some essential IPR in the 5G standard;
- Manufacture of 5G chipsets, this may require massive investments;
- Appropriate testbeds and technology platforms to enable and help Indian technical ecosystem to have an edge in 5G;
- Accelerated deployment of next generation ubiquitous ultra-high broadband infrastructure with 100% coverage of 10 Gbps across urban India and 1 Gbps across Rural India.



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Russia, U.S. to cooperate on lunar station

Russia and the United States agreed on Wednesday to cooperate on a NASA-led project to build the first lunar space station, part of a long-term project to send humans to Mars.

The project envisages building a crew-tended spaceport in lunar orbit that would serve as a “gateway to deep space and the lunar surface”, NASA has said.

On Wednesday, the Russian space agency Roscosmos and NASA said they had signed a cooperation agreement at an astronomical congress in Adelaide.

NASA said the agreement reflected the two agencies’ common vision for space exploration.

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India International Science Festival 2017: 'Science for New India'**India International Science Festival 2017: 'Science for New India'****Curtain Raiser
IISF 2017**

India has made significant strides in scientific and technological development by also becoming the first nation to reach Mars in its maiden attempt. *India is facing various challenges and opportunities.* Some of these important challenges are in the key sectors of clean water & energy, food, environment, climate, and healthcare. It is important to translate the scientific knowledge into innovations through start-ups and industry so as to facilitate India to achieve inclusive and sustainable growth in the coming decades. This goal can be achieved, through developing scientific temper among the masses and by strengthening India's science and technology institutions & furthering their basic research.

Emphasizing the role of technologies and innovation, India has declared 2010-20 as the 'Decade of Innovation'. The Ministry of Science and Technology, Ministry of Earth Sciences, and Vijnana Bharati (VIBHA) have come together to organize The India International Science Festival (IISF) every year, since 2015 to encourage scientific temper among the masses and showcasing Indian contribution in the field of S&T over the years. The previous two editions of IISF held at New Delhi have been a great success.

The 3rd edition of IISF 2017 will be held in Chennai during 13-16 October, 2017 at various venues which include Anna University, Central Leather Research Institute (CLRI), Structural Engineering Research Centre (SERC), National Institute of Ocean Technology (NIOT) and IIT-Madras.

The prime objective of the festival is to instill scientific temper among the masses and showcasing India's contribution in the field of S&T over the years. It aims to build a strategy for rural India through the advancement of Science and Technology. Further, the science festival also intends to make innovation beneficial for the people and develop technology that is affordable to the masses.

Major Activities during the Festival will be:

1. Special Thematic Session on 'Deep Ocean Research'
2. Science & Technology Minister's Conclave
3. Sensitizing Youth to Flagship Programs of Government (SYPOG)
4. Science Village: Parliament to Panchayat"
5. National Meet on 'Social Organisations and Institutions': 'Transforming India through Science & Technology'
6. Women Scientists & Entrepreneur's Conclave
7. National Science Teachers Workshops (Focusing North East States)

8. Industry Academia Interaction
9. Mega Science, Technology & Industry Expo
10. India International Science Festival
11. Grassroots Innovators Summit
12. National Start-up Summit
13. Round Table Meet on Mass Communication
14. World Record attempt will be made in "Largest Biology Lesson"
15. National Level Competitions – Ideas for Bharat Nirman
16. Outreach Programme in R&D Labs
17. Satellite Seminars
18. Cultural Events

The Govt of India is launching a National Mission on Deep Ocean Research which will bring in huge economic benefits by harnessing the ocean resources (water, energy and minerals). A **special thematic session on Deep Ocean Research** will be held.

The Scientific departments and Ministries of the Government of India have active international collaboration in science and technology both at the bilateral and regional level. India is engaged in R&D cooperation with more than 44 countries across the globe including advanced, emerging and developing nations. **The S&T Ministers Conclave at IISF-2017** will provide an opportunity to exchange the scientific and technological priorities of the participating countries that can help to develop a roadmap for S&T cooperation. This roadmap can be used by all the S&T Departments to engage proactively with each of these countries. The focus will be on capacity building through mechanisms such as fellowships, internships, twinning, training, data sharing, joint projects and technology transfer. The development and deployment of affordable and innovative technologies that provide solution to societal problems will also be a common agenda for the Conclave. Participation of Ministers from Afghanistan, Bangladesh, Nepal and Portugal are expected in the Conclave.

'Science for New India' aims to provides a platform to young students, scientists and technocrats from across India for the exchange of knowledge & ideas in the line of flagship programs like 'Swachh Bharat Abhiyan', 'Swasth Bharat Abhiyan', 'Make in India', 'Digital India', 'Smart Villages', 'Smart Cities', 'Namami Gange', 'Unnath Bharath Abhiyan', etc.

An important event of the IISF-2017 is the Science Village program which is linked with the **Pradhan Manthri Sansad Adarsh Gram Yojana** to reach out to the rural masses and propagate science to the extent of seeking scientific solutions to the diverse challenges facing our society, particularly rural India.. Each Member of Parliament will nominate 5 students from class 9th – 11th and 1 teacher from their adopted village. The Science Village will thus demonstrate a mass representation from the rural parts of India and a continuation of the democratic process: "Parliament to Panchayat". The prime goal of the science village is to give exposure to the students from rural India and make them aware of India's achievements in the frontier areas of science & technology.

As a unique programme of IISF 2017, a **Women Scientists & Entrepreneur's Conclave** titled "**Game Changers Driving Science for New India**" would be organized to promote and encourage science education and entrepreneurship among the women. The aim of the programme is to develop new entrepreneurship and also explore new vistas of opportunities in the field of science and technology among the women.

The Industry-Academia interaction meet aims at Industry – Academic Institutional tie ups in R&D and achieving improved efficiency in production and manufacturing. The interaction will bring out a brief proceeding on the recent paradigm changes in various sectors of Industry. Representatives from industry and academia will also have a good opportunity to discuss the changing trends on management principles, scientific advancement and technological assimilation in industry and economy.

National Innovation Foundation (NIF) will be organising the 'Innovation Exhibition' as a part of the **Grassroots Innovators Summit**, which aims at providing a common platform for various stakeholders—from innovators, students, researchers to policy makers. About 100 innovative technologies from all states of the country will be showcased at the exhibition. The special focus will be given to those which could be diffused socially and generate employment.

The Round Table Meet on Mass Communication will address the various methods and techniques to popularize science and its applications. In the International Science Film Festival, Films on science focusing on science fiction from India and abroad will be screened.

World record attempts have been a key part of IISF since 2015; in IISF 2015, students took a successful shot at the Guinness world record for the World's Largest Science Lesson at IIT Delhi. In IISF 2016, at NPL, Pusa, a group of 550 students attempted the world record for Largest Gathering of People Dressed as Nobel Prize-winning scientist Albert Einstein. In IISF 2017, a World Record attempt will be made in "**Largest Biology Lesson**". 1000 students from Class 9th & 10th will be gathering at the venue in Chennai for this attempt.

The IISF is not only a celebration of science and technology through exhibitions and relevant events, but also has been geared up to spread awareness on the flagship programs like 'Swachh Bharat Abhiyan', 'Swasth Bharat Abhiyan', 'Make in India' and 'Digital India'.

The Honourable Vice President of India and many Union Ministers will be participating in IISF-2017.

The IISF will go a long way in delivering the goal of imparting 'spirit of enquiry' to the public masses.

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Asteroid-bound NASA spacecraft swings by Earth

An artist's concept shows the OSIRIS-REX spacecraft passing by Earth. | Photo Credit: [NASA](#)

NASA's asteroid-chasing spacecraft swung by Earth on Friday on its way to a space rock.

Launched a year ago, Osiris-Rex passed within 17,237 kilometres of the home planet early Friday afternoon above Antarctica. It used Earth's gravity as a slingshot to put it on a path toward the asteroid Bennu.

Osiris-Rex should reach the small, roundish asteroid next year and, in 2020, collect some of its gravel for return to Earth. If all goes well, scientists should get the samples in 2023.

Friday's flyby was a quick hello- The spacecraft zoomed by at about 19,000 mph (31,000 kph). NASA took precautions to ensure Osiris-Rex about the size of an SUV did not slam into any satellites.

"Congratulations OSIRISREx team on a successful Earth Gravity Assist — trajectory is absolutely perfect — right up the middle!" the University of Arizona's Dante Laretta, chief scientist for Osiris-Rex, said via Twitter.

Ground telescopes tried to observe the spacecraft while it's in the neighbourhood. NASA posted a picture gallery online.

NASA said the spacecraft's science instruments would be turned on four hours after the closest approach and tested over the next two weeks, scanning the Earth and moon. Laretta said it would be good practice for operations at Bennu.

Bennu is just 500 meters or so across and circles the sun in an orbit slightly wider than ours. Osiris-Rex will go into orbit around the asteroid and seek the best spot for grabbing a few handfuls of the bite-size bits of rock. It will hover like a hummingbird as a mechanical arm briefly rests on the surface and sucks in samples stirred up by nitrogen gas thrusters.

Scientists say the ancient asteroid could hold clues to the origin of life. It's believed to have formed 4.5 billion years ago, a remnant of the solar system's building blocks.

This is the first U.S. attempt to bring back samples from an asteroid. Japan already has visited an asteroid and returned some specks.

A study of nearly 300 people living in different parts of India found that nine single-base variants (single-nucleotide polymorphisms or SNPs) account

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Fourth gravitational wave detected, with European help

The 3-km-long arm part of the Virgo detector for gravitational waves that is located within the site of EGO, European Gravitational Observatory, between Cascina and Pisa in Tuscany. File | Photo Credit: [AFP](#)

A fourth gravitational wave has been detected — this time with help from Italy-based equipment — after two black holes collided, sending ripples through the fabric of space and time, researchers said Wednesday.

[Gravitational waves](#) were predicted by Albert Einstein a century ago as part of his theory of general relativity, but the [first hard evidence of their existence](#) came only in 2015, when two U.S. detectors found the first such signal.

The latest space-time ripples were detected on August 14, 2017 at 10.30 a.m. GMT (4 p.m. IST) when two giant black holes with masses about 31 and 25 times the mass of the Sun merged about 1.8 billion light-years away.

Also read: [Measuring gravitational waves — in layman's terms](#)

“The newly produced spinning black hole has about 53 times the mass of our Sun,” said a statement from the international scientists at Virgo detector, located at the European Gravitational Observatory (EGO) in Cascina, near Pisa, Italy. “While this new event is of astrophysical relevance, its detection comes with an additional asset: this is the first significant gravitational wave signal recorded by the Virgo detector.”

The Virgo detector — an underground L-shaped instrument that tracks gravitational waves using the physics of laser light and space — recently underwent an upgrade, and while still less sensitive than its U.S. counterparts, it was able to confirm the same signal.

Known as interferometers, these high-tech underground stations do not rely on light in the sky like a telescope does, but instead sense vibrations in space and can pick up the “chirp” created by a gravitational wave.

“It is wonderful to see a first gravitational-wave signal in our brand new Advanced Virgo detector only two weeks after it officially started taking data,” said Virgo spokesman Jo van den Brand of Nikhef and Vrije Universiteit (VU) University Amsterdam. The space-time ripple was picked up by all three detectors at nearly the same time.

Previously, gravitational waves have been found using two U.S.-based detectors, which are the most sophisticated in the world — known as the Laser Interferometer Gravitational-Wave Observatory (LIGO) detectors in Livingston, Louisiana, and Hanford, Washington.

The first was found in September 2015 and [announced to the public in early 2016](#), a historic achievement that culminated from decades of scientific research. LIGO is funded by the National Science Foundation and operated by the California Institute of Technology (Caltech) and the Massachusetts Institute of Technology (MIT).

Also read: [Second breakthrough for LIGO gravitational wave detectors](#) | [LIGO makes third gravitational wave detection](#)

The Virgo collaboration includes more than 280 physicists and engineers belonging to 20 different

European research groups. "This is just the beginning of observations with the network enabled by Virgo and LIGO working together," said David Shoemaker, MIT's spokesman for the LIGO Scientific Collaboration. "With the next observing run planned for Fall 2018 we can expect such detections weekly or even more often."

Details about the latest discovery will be published in the journal *Physical Review Letters*.

A study of nearly 300 people living in different parts of India found that nine single-base variants (single-nucleotide polymorphisms or SNPs) account

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Celebrating Science for New India**Celebrating Science for New India****Dr. Harshvardhan Addresses a Curtain-Raiser Press Conference on IISF 2017**

Science is for the masses and it needs to communicate with people and identify and solve the problems, said the Minister of Science & Technology, Earth Science and Environment, Forest & Climate Change, Dr. Harshvardhan, today, while addressing the media in the Curtain-Raiser Press Conference to the India International Science Festival(IISF), 2017 to be held from 13-16 October, 2017 in Chennai.

The Minister apprised the media about the events organized during the upcoming IISF-2017. The Minister informed that CSIR has more than 250 new technologies in pipeline which they have readied to solve public problems. He said that IISF 2017 is striving to be the World's largest science festival with the motive of 'Science for the masses'. The series of India International Science Festivals (IISF) is an integral part of India's long term vision in developing and widening the spectrum of scientific temper in India and abroad.

The Minister also informed about the series of events to be held during IISF 2017 which include:

Science and Technology Ministers conclave

- S&T Partnership for Addressing Societal Challenges on a bilateral and multilateral level.
- The focus will be on capacity building through mechanisms such as fellowships, internships, training, data sharing, joint projects and technology transfer.
- Co-develop and deploy affordable and innovative technologies that provide solution to societal problems will also be a common agenda for the Conclave.
- Participants: S&T Ministers of Bangladesh, Afghanistan, Nepal & Portugal

Sensitizing Students and Youth to Flagship Programs of Government**SYPOG**

- Young scientists across the country (state and central universities, R&D labs) will be made aware of the important flagship programmes of the Government of India such

as Swachh Bharat Abhiyan, Swastha Bharat, Digital India, Make in India, Bio-diversity etc.

Science Village

- **Parliament to Panchayat:** Students and teachers to be nominated by Hon'ble Members of Parliament from their adopted villages under *Pradhan Manthri Sansad Aadarsh Gram Yojna*.
- Mass representation of Rural India: Cultural integration, social interaction and exchange of scientific knowledge through science activities; experiencing '*Unity in Diversity*';

Women Scientist & Entrepreneur's Conclave

As a unique programme of IISF 2017, a Women Scientist & Entrepreneur's Conclave titled "**Game Changers Driving Science for New India**" is being organized to promote science and entrepreneurship among the young women.

Industry (MSMEs) Academia Interaction

- Representatives from industry and scholars from academic background will have a good opportunity to discuss the changing trends on management principles, scientific advancement and technological assimilation in Industry and economy. The interaction meet also aims at Industry – Academic Institutional tie ups on research and development and improve efficiency in production and manufacturing._

Grassroots Innovators' Summit

- National Innovation Foundation (NIF) will showcase about 100 innovative technologies from all states of the country.
- Aims to strengthen the grassroots technological innovations and outstanding traditional knowledge.

Start-Up Summit

- "Start-up Contest - 2017" is framed under the Start-up Summit event to scout, award and support best start-ups happening in academic institutions across the country._

National Science Teachers' Workshop with special focus on North East:

- To orient the teachers on novel Teaching Methodologies in Science; upgrade and refine level of teaching; knowledge dissemination through innovative practices;

showcase the innovative teaching-learning practices in Science Education

Science Film Festival – Science Fiction Focus

Films on science focusing on science fiction from India and 9 foreign countries (South Korea, France, Germany, Sweden, UK, Australia, Norway, Italy and USA) will be screened.

Round Table Meet On Mass Communication

- Science communicators, science journalists, social media and electronic and print media communicators dealing with science and passionate science students will be invited to discuss the various aspects of mass communication .

Mega Science, Technology & Industry Expo

- It will showcase the remarkable Contribution of India in the World of Science & Technology. The expo would highlight the Govt. Missions.
- Various Theme Pavilions will highlight the achievements of Indian Space, Defence, Advanced Technologies, Rural Development, Energy, Agriculture, Healthcare, Industry/Trade, EDP/MSME, Environment/ Climate Change, Ocean, Bio Sciences/ Biotechnology, Women Empowerment, Education, Urban Development, Tourism/ Culture, and soon, serving in the main domain of Societal growth.

Guinness Book of World Records

- Conduct the “Largest Biology Lesson” involving a group of 1000 school students.
- The event will include a short power-point presentation about Cell Biology. It will be followed by a demonstration of the process of isolation of DNA from papaya fruits.

Ideas for Bharat Nirman

- Three socially relevant challenges faced by the society across the nation have been posed before the general public for deriving the most feasible solutions.

Special Session on Deep Ocean Research

- The Govt of India is launching a National Mission on Deep Ocean Research which will bring in huge economic benefits by harnessing the ocean resources (water,

energy and minerals).

- A special thematic session on Deep Ocean Research will also be held.

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