

NASA's Juno successfully begins orbiting Jupiter

NASA celebrated a key triumph on Tuesday as its \$1.1 billion Juno spacecraft successfully slipped into orbit around Jupiter on a mission to probe the origin of the solar system.

NASA's Jet Propulsion Laboratory in Pasadena, California, erupted in cheers as the solar observatory successfully entered its aimed-for orbit around the biggest planet in our cosmic neighborhood at 11:53 pm.

"We are in it," hollered Scott Bolton, NASA's principal investigator from the Southwest Research Institute in San Antonio, Texas.

"You are the best team ever," he told his colleagues at mission control. "You just did the hardest thing NASA has ever done."

Juno launched five years ago from Cape Canaveral, Florida and has travelled 2.7 billion kilometres since then.

The spacecraft was traveling at a speed of more than 209,200 kilometres per hour when it fired its engines to slow down enough to be captured into Jupiter's orbit.

This "burn," or orbit insertion, began at 11:18 pm on July 4, the US national independence day holiday.

"We see the expected sharp shift upward in the Doppler residuals indicating that the engine has started," said an engineer at NASA's Jet Propulsion Laboratory, as applause filled the mission control room.

A tone from the spacecraft indicating the maneuver's success came right on time, 35 minutes later.

How Jupiter formed

Scientists hope to find out more about how much water Jupiter holds and the makeup of its core in order to figure out how the planet -- and others in the neighborhood, including Earth -- formed billions of years ago.

The solar system's most massive planet is fifth from the sun.

With an atmosphere of hydrogen and helium, it is known for its Great Red Spot, a storm bigger than Earth that has been raging for hundreds of years.

The first mission designed to see beneath Jupiter's clouds, Juno is named after the Roman goddess who was the wife of Jupiter, the god of the sky in ancient mythology.

The NASA mission aims to orbit Jupiter from pole to pole, sampling its charged particles and magnetic fields for the first time and revealing more about the auroras in ultraviolet light that can be seen around the planet's polar regions.

Juno should circle the planet 37 times before finally making a death plunge in 2018, to prevent the spacecraft from causing damage to any of Jupiter's icy moons, which NASA hopes to explore one day for signs of life.

Although Juno will not be the first spacecraft to orbit Jupiter, NASA says its path will bring it closer than its predecessor, Galileo, which launched in 1989.

That spacecraft found evidence of subsurface saltwater on Jupiter's moons Europa, Ganymede and Callisto before making a final plunge into Jupiter in 2003.

NASA says Juno should be able to get closer than Galileo -- this time within 3,100 miles (5,000 kilometers) above the cloud tops.

Dodge radiation

Earlier Monday, Heidi Becker, senior engineer on radiation effects at NASA's Jet Propulsion Laboratory, described the close approach as going "into the scariest part of the scariest place... part of Jupiter's radiation environment where nobody has ever been."

A key concern has been radiation levels -- as high as 100 million X-rays in the course of a year, she explained.

Those high-energy electrons, moving at the speed of light, "will go right through a spacecraft and strip the atoms apart inside your electronics and fry your brain if you don't do anything about it," she said.

"So we did a lot about it," she added, describing the half-inch-thick layer of titanium that protects the electronics in a vault to bring the radiation dose down.

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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Harnessing science and technology for a better future of people is the new spirit which drives the present Indo-UK cooperation – Dr. Harshvardhan

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India and UK Science & Technology Ministers review the progress made in the India-UK partnership in science, technology and innovation

Science and Technology Ministers of India and UK reviewed the progress made in the India-UK partnership in science, technology and innovation which has been significantly intensified under the Newton-Bhabha programme. Union Minister for Science & Technology and Earth Sciences Dr. Harsh Vardhan, had a meeting with UK Minister of State for Science, Research and Innovation Mr. Jo Johnson in New Delhi today.

Based on the shared principles of co-funding, co-development and co-creation multiple agencies both in India and UK are seamlessly contributing to the multifaceted cooperation which covers the three strands of people, project and translational research partnerships. Both the Ministers reiterated the spirit and essence of the Newton-Bhabha program which underlines that the scientific knowledge creation and its application is directed for the welfare of both the nations. In this context, Dr. Harsh Vardhan remarked that “harnessing science and technology for a better future of our people is the new spirit which drives the present Indo-UK cooperation.”

In November 2016, UK was the partner country in the Technology Summit which was inaugurated by Prime Minister Narendra Modi and Theresa May. Speaking in the event, our PM had remarked “today, the world is at an inflection point where technology advancement is transformational and it is vital that India and the United Kingdom, two countries linked by history, work together to define the knowledge economy of the 21st century”. Towards achieving this goal several major initiatives have been recently launched as a part of the multifaceted collaboration in STI between India and the UK. These include projects on Energy Efficient Building Materials as a part of green initiative with co-investment of £ 8.4 million. Indo-UK Clean Energy Virtual Centre has been established with leading academic centres in India and UK to work on advanced R&D in Solar Energy, Storage and Grid Networks.

The two Ministers welcomed the release of the scoping Indo-UK report on Antimicrobial Resistance which has been prepared to launch a virtual research centre to address the increasingly serious threat to public and animal health in both countries. To study the

impact of atmospheric pollution on Human Health a programme has been launched and first campaign for taking observation in Delhi is scheduled to begin soon.

Under Industrial R&D programme India and UK have made visible progress with support to 10 joint projects led by industries from both sides towards co-development of Clean Technologies and Affordable Healthcare devices.

In the meeting between the Science Ministers, it was also informed that the India-UK Frontiers of Science Symposium is planned for summer of 2018 in UK which will bring the future science leaders across disciplines for brainstorming the future direction of the bilateral cooperation.

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Successful Flight Test of Guided Bombs

Successful Flight Test of Guided Bombs

Indigenously developed light weight Glide Bomb, SAAW (Smart Anti Airfield Weapon) was successfully tested from Indian Air Force aircraft in the ranges at ITR, Chandipur, Odisha. The guided bomb released from the aircraft and guided through precision navigation system, reached the targets at greater than 70 km range, with high accuracies. A total of three tests with different release conditions and ranges were conducted and all were successful. The guided bomb is developed by Research Centre Imarat (RCI), DRDO along with other laboratories of DRDO and Indian Air Force.

Raksha Mantri Smt Nirmala Sitharaman congratulated the DRDO scientists and Indian Air Force for the successful tests. Secretary Department of Defence R&D and Chairman DRDO, Dr. S Christopher congratulated the team and said SAAW will be inducted soon into the Armed Forces. Director General Missiles and Strategic System DG (MSS) Dr G Satheesh Reddy said it's a major milestone in the indigenous capabilities to develop guided bombs.

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DRDO successfully tests guided bomb

The Defence Research and Development Organisation (DRDO) has successfully tested an indigenously developed light weight glide bomb, Smart Anti Airfield Weapon (SAAW), which can target large enemy infrastructure, like airfields.

“The guided bomb released from an Indian Air Force (IAF) aircraft and guided through precision navigation system, reached the targets at greater than 70 km range with high accuracies,” the Defence Ministry said in a statement on Friday.

The tests were conducted at Chandipur in Odisha.

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Navy to use U.S. aircraft launch system in ship

On track: INS Vikramaditya uses an entirely different launch system. Thulasi Kakkat

The Navy is likely to go with an advanced catapult-based aircraft launch mechanism (CATOBAR) from the U.S. for its second indigenous aircraft carrier (IAC-II), which is on the drawing board. For some time, India has been exploring the possibility of installing the U.S. electromagnetic aircraft launch system (EMALS).

“IAC-II will have a CATOBAR launch. However, the kind of propulsion is yet to be decided,” a senior officer said. The U.S. has offered India its latest EMALS technology, developed by General Atomics Aeronautical Systems Inc., which has just been installed on the *Gerald Ford* carrier.

While the older generation of CATOBAR was powered by a steam catapult, EMALS uses an electric motor-driven catapult instead, which allows the launch of much heavier aircraft and also reduces the stress on the aircraft.

However, the system is expensive, something that needs to be factored in.

“EMALS will allow us to operate heavy surveillance aircraft in addition to heavy fighters,” another officer observed.

50 aircraft

The Navy envisages the IAC-II to be around 65,000 tonnes and capable of carrying over 50 aircraft. While the Navy is keen on nuclear propulsion, which would give it unlimited range and endurance, its development in time seems doubtful.

The two countries had set up a joint working group on Aircraft Carrier Technology Cooperation (JWGACTC) under the Defence Technology and Trade Initiative, which held several rounds of discussions. The group concluded its 4th meeting in New Delhi last Friday.

India's first domestic carrier, *Vikrant*, weighing 40,000 tonnes, is in an advanced stage of construction in Kochi and is scheduled to be launched by 2018-end. It works on a Short Take-Off But Arrested Recovery (STOBAR) mechanism similar to that in the present carrier *INS Vikramaditya*, with an angular ski-jump.

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DRDO Conducts Successful Flight Trial of 'NIRBHAY' Sub-Sonic Cruise Missile**DRDO Conducts Successful Flight Trial of 'NIRBHAY' Sub-Sonic Cruise Missile**

Defence Research and Development Organisation (DRDO) achieved yet another feat today with the successful test flight of 'NIRBHAY' - India's first indigenously designed and developed Long Range Sub-Sonic Cruise Missile which can be deployed from multiple platforms. It was successfully test fired from the Integrated Test Range (ITR), Chandipur, Odisha. The missile has the capability to loiter and cruise at 0.7 Mach, at altitudes as low as 100 m. The flight test achieved all the mission objectives completely from lift-off till the final splash, boosting the confidence of all scientists associated with the trial.

The missile took-off in the programmed manner and all critical operations viz. launch phase, booster deployment, engine start, wing deployment and other operational parameters demonstrated through autonomous way point navigation. The guidance, control and navigation system of the missile is configured around the indigenously designed Ring Laser Gyroscope (RLG) and MEMS based Inertial Navigation System (INS) along with GPS system. The missile majestically cruised for a total time duration of 50 minutes, achieving the range of 647 km. The missile was tracked with the help of ground based radars and other parameters were monitored by indigenous telemetry stations developed by DRDO.

Raksha Mantri Smt Nirmala Sitharaman, hailed the success of DRDO Scientists and complimented them for this inspired achievement. She was optimistic that this successful trial would take India to the select League of Nations for possessing this complex technology and sub-sonic cruise missile capability.

Chairman DRDO and Secretary Department of Defence (R&D), Dr. S Christopher, DG (Aero) Dr. CP Ramanarayanan, Director ADE, RCI, ITR and CEMILAC, along with other senior DRDO scientists and user representatives from Army witnessed the momentous launch and congratulated the team 'NIRBHAY' for making DRDO proud for the long awaited achievement.

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Chinese scientists identify genetic pathway in ageing

According to the UN, the number of people aged 60 or older hit 1 billion worldwide this year and will rise to 3.1 billion by 2100. | Photo Credit: [AP](#)

Chinese scientists have found the first genetic pathway underlying natural variation in ageing, which could provide insights for developing interventions to slowdown the process of growing old in humans, state media reported on Friday.

The scientists, studying a worm, found that the combination of a certain neuropeptide coding gene and its receptor gene controls the stress reaction of a “longevity gene”, which regulates the rate of ageing, *China Daily* reported.

The more active the coding gene and stronger the receptor gene, the more rapid ageing occurs, according to the team from the Chinese Academy of Sciences’ Institute of Neuroscience.

An article about their study, which took more than five years, was published on Thursday in the journal *Nature*.

Uncovering the genetic secrets of the ageing rate is significant, as the average age of the global population is rising fast.

Ageing is also a major risk factor for diseases, such as cancers and diabetes, the researchers said.

According to the UN, the number of people aged 60 or older hit 1 billion worldwide this year and will rise to 3.1 billion by 2100. China itself has over 250 million above 60 years as it is undergoing demographic change.

“When people live longer, they begin to care more about healthy ageing, which means keeping healthy and youthful and having a better quality of life in their twilight years, like some lucky ones do,” said Cai Shiqing, the team’s lead researcher.

One peer review of the article said the results will be of interest to the readers of *Nature* because of the general lack of information about how natural genetic variation regulates ageing, and the role of neuromodulatory signalling in the process.

Lab experiments were conducted on *Caenorhabditis elegans*, a transparent worm about 1 millimetre in length that lives in temperate soil environments. It is the basis of the animal model widely used for age-related research because of its clear genetic profile and short life span — an average of three weeks.

The tiny free—living worms from different parts of the world show varied rates of decline in virility, eating and locomotion during ageing.

Researchers said they have not yet found the worms’ neuropeptide in the human body.

“But we know that animal evolution is conservative, and if we carry on with further studies we’re confident that we will probably find that the mechanism underlying the ageing rate of mammals is the same as for the worms,” said Mu-Ming Poo, director of the institute and an academician of the science academy.

“Healthy human life can be extended if there is a way to target these genes in the future,” he said.

Life is not always a serious affair, there is lightness, humour and nonsense, too, which we enjoy

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Can gene drive wipe out all mosquitoes?

Anopheles stephensi mosquito | Photo Credit: [HANDOUT](#)

In scientific research, periodically, blockbuster applications with the potential to prevent and cure diseases of mankind as never before take the community by storm. Gene therapy, stem cell therapy and synthetic biology are some such examples. Although, backed by strong scientific evidence, applications get entangled with too many technical, ethical and environmental issues to even realise modest success.

Gene drive technology to wipe out insects and pests is the latest addition in this category. It can potentially eliminate mosquitoes that cause malaria, dengue, Zika, chikungunya, yellow fever, West Nile, sleeping sickness, Lyme and others. It also has potential to eliminate pests infecting crops in agriculture. Elimination of the mosquito vector, starting with the malaria vector, has more than topical interest in India with Tata Trusts donating \$70 million (Rs 458 crore) over the next 5 years in setting up The Tata Institute of Genetics and Society at the University of California San Diego in the US (UCSD) and mentoring its branch at the Institute for Stem Cell Biology and Regenerative Medicine (InStem) in Bengaluru. Half the grant is said to be for use in India for research and training of scientists at UCSD.

The idea itself is not new. Barbara McClintock got the Nobel Prize for discovering the jumping genes in maize. Transposons or jumping genes are DNA elements that move from one location to another in the genome. The P element discovered in *Drosophila*, apparently not present before the 1950s, has now spread to all fruit flies. Propagation of a genetic modification to block sexual reproduction in mosquitoes can eliminate this pest. In gene drives, the inheritance bias for an altered gene can be pushed to 100% unlike the 50% inheritance seen in Mendelian division. In 10 generations, the gene drive can increase the frequency by a relative 1,024-fold. The idea was born at the Imperial college, London, based on the homing endonucleases of yeasts and algae. The endonuclease gene gets inserted into the target DNA sequence that will prevent further cleavage, but the enzyme will cut the homologous chromosome that does not contain the endonuclease gene. The endonuclease gene containing chromosome will now act as a template giving rise to a replica, thus facilitating 100% inheritance of this gene. This concept has received a fillip with the availability of precise gene editing mechanism using CRISPR-Cas9 system. Imperial college and other groups including those at the University of California (UCSD); Wyss Institute, Harvard University; Broad Institute, MIT are all in the fray, extending the studies to *Anopheles gambiae* (African malaria vector) and *Anopheles stephensi* (major vector in India).

Rapid expansion of the mutated gene introduced into the germ line has been shown in caged mosquito populations. Will it work in the wild? The idea is to release such altered populations in sufficient numbers even periodically so that they can mate with the wild types and render the entire population vulnerable.

The biggest challenge is to prevent emergence of resistance over a period of time to the nuclease. Interference with fertility genes to prevent reproduction may actually impose a large selection pressure for resistance development in the mosquito. This has turned out to be true in a recent experimental study, where after an initial increase in gene drive, nuclease-resistant mutants started to emerge. Alternate strategies to target the receptor for the parasite in the mosquito (yet to be discovered) or a gene drive carrying an antimalarial peptide/single chain antibody to kill the parasite are contemplated. At UCSD, researchers have successfully followed the latter strategy in *A. stephensi*. Use of multiple drives to prevent resistance development has been suggested as another option.

As expected there has been a huge backlash from ecologists and environmentalists. The concerns have ranged from consequences due to inadvertent escape in experimental studies, breakdown of species barriers, emergence of new disease-transmitting vectors and the unknown ecological and environmental consequences of eliminating an insect species. Altered male mosquitoes released in Florida to contain Zika virus were not self-propagating. The challenge is to halt the gene drive when required, so that application can be restricted to limited geography.

The arguments are all reminiscent of the concerns expressed with GM crops, which are actually not self-propagating. In India, where even Bt brinjal is considered as an environmental risk, gene drive, even if technically feasible after years of research, may be made to hibernate for ever.

Of course, as Bangladesh has benefited by picking up our Bt brinjal clone, Africa may benefit employing the gene drive to contain malaria, thanks to Gates Foundation!

(Department of Biochemistry, Indian Institute of Science

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The Ig Nobel Prizes show that scientists too have a sense of satire, sarcasm, humour and yet appreciation.

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Demystifying Science: What is the Pacific shadow-zone?

The shadow zone is an area of almost stagnant water sitting between rising currents caused by the rough topography and geothermal heat sources below 2.5 kilometres and shallower wind-driven currents closer to the surface in the North Pacific. This is the oldest water in the ocean in the North Pacific and has remained trapped in a shadow zone around 2 kilometres below the sea surface for over 1,000 years. Until recently, models of deep ocean circulation did not accurately account for the constraint of the ocean floor on bottom waters. Once the international team of researchers precisely factored it they found the bottom water cannot rise above 2.5km below the surface, leaving the region directly above isolated. "Carbon-14 dating had already told us the most ancient water lay in the deep North Pacific. But until now we had struggled to understand why the very oldest waters huddle around the depth of 2 km," said lead author from the University of New South Wales, Dr. Casimir de Lavergne. "What we have found is that at around 2km below the surface of the Indian and Pacific Oceans there is a 'shadow zone' with barely any vertical movement that suspends ocean water in an area for centuries." The article, "Abyssal ocean overturning shaped by seafloor distribution", has been published in the journal, *Nature*.

The Ig Nobel Prizes show that scientists too have a sense of satire, sarcasm, humour and yet appreciation.

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Seeing the light

A new gene therapy has helped restore vision in people who had lost their sight to an inherited retinal disease, scientists have said.

Patients in the study had a condition called Leber congenital amaurosis (LCA), which begins in infancy and progresses slowly, eventually causing complete blindness.

This new, first-of-its-kind gene therapy is currently under review by the U.S. Food and Drug Administration (FDA) for potential approval this year.

There are currently no treatments available for inherited retinal diseases.

Researchers from University of Iowa, U.S., showed that 27 of 29 treated patients or 93% experienced meaningful improvements in their vision, enough to navigate a maze in low to moderate light.

They also showed improvement in light sensitivity and peripheral vision, which are two visual deficits these patients experience.

More applications

Approval could open the door for other gene therapies that could eventually treat the more than at least 225 genetic mutations known to cause blindness. It could be applied to retinitis pigmentosa, another inherited retinal disease caused by a defective gene.

In the future, gene therapy could possibly provide key proteins needed to restore vision in more common diseases such as age-related macular degeneration.

What it entails

LCA is rare, affecting about one in 80,000 individuals. It can be caused by one or more of 19 different genes.

The tested gene therapy, voretigene neparvovec (Luxturna) from Spark Therapeutics, is currently under FDA review. An injection therapy, it uses a genetically-modified version of a harmless virus that's been modified to carry a healthy version of the gene to patients' retinas.

Doctors inject billions of modified viruses into both of a patient's eyes. Treatment does not restore normal vision. It does, however, allow patients to see shapes and light, allowing them to get around without a cane or a guide dog. It is unclear how long the treatment will last, but so far, most patients have maintained their vision for two years.

More than 200 patients with LCA have participated in gene therapy trials since 2007.

However, no gene therapy has got this close to FDA approval for retinal disease or any other eye disease.

In October, an advisory committee to the FDA unanimously endorsed the treatment.

The agency is expected to make its decision by January next year.

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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The AI battlefield

In the Mahabharata, Krishna wielded what would today be called a lethal autonomous weapon: the *Sudarshana Chakra* would track its target to the ends of the earth, eliminate it and return to its owner.

Such machines could soon be made for real. On November 13, a United Nations (UN) group of experts in Geneva kicks off the first formal inter-governmental discussion on what machine autonomy means for the laws of armed conflict and the future of international security. I have the honour to chair this group, on behalf of 125 states party to the Convention on Certain Conventional Weapons.

Krishna, being a god, had the wisdom not to deploy his awesome weapon — at least, not directly. He used it to block out the sun, which tricked opposing warriors into dropping their protective shield. Ancient India had rules of war, just as we do: they required fighting to cease at sunset.

Throughout history, the capacity to wield new technologies — from gunpowder to nuclear weapons to long-range missiles — has changed how wars are fought, and the strategic balance between attack and defence maintained.

Shaped by technology

The norms around what is considered acceptable in warfare have also evolved in response to new technologies. Since the 19th century, those norms have been codified in international humanitarian law, which is more or less universally accepted as regulating armed conflict among civilised nations.

Recent advances in artificial intelligence (AI) are throwing up a new challenge to these norms: if the weapon fuses with the wielder, who do they apply to and how? Should such a possibility even be allowed?

Reality might not have yet caught up with popular culture depictions of “killer robots” and “conscious synths” demanding their rightful place in society; indeed, such depictions can be a distraction from the complex challenges that do exist. But many technology leaders are worried about autonomous systems taking life-and-death decisions without “meaningful human supervision or control”. The American tech billionaire Elon Musk and over 100 others recently signed a letter warning that the weaponisation of AI-based technologies risks opening a Pandora’s box.

These are not the only concerns about AI. Technologists and ethicists are also grappling with such questions as legal liability when autonomous vehicles share the streets with pedestrians, predictive analytics subverting due process, and the algorithmic entrenchment of human biases.

Walking a tightrope

But AI applications are already a growing reality in areas such as health, finance and retail. Civilian applications of AI technologies will undoubtedly continue apace. And as has been the experience with other dual-use technologies, AI developed for civilian purposes could be repurposed.

How, then, to deliver on the promise of AI while protecting the hard-won tenets of international humanitarian law and respecting the legitimate security and commercial interests of states and industry? This is the question we will be grappling with this week in Geneva.

Mr. Musk's letter called on the UN to "find a way to protect us from all these dangers". Some will query if the UN can succeed. The multilateral system is often derided for its slow pace, its obsession with procedure and its opacity to the wider public. In many areas of technological complexity, alternative governance models have emerged, such as the 'multi-stakeholder' approach to Internet governance.

A new approach

However, in an era of diffusion of power and mistrust among the major powers, multilateral inter-governmental forums remain the only way to extend norms across the globe. For bad or for worse, governments still decide matters of war and peace. And the UN still offers a neutral venue to bring different points of view together.

The discussions in Geneva are an opportunity to test a new approach, one we might call 'distributed technology governance'. This means the multilateral system's search for durable international norms needs to integrate national regulatory approaches and industry self-regulation.

Each level in this chain of subsidiarity — international humanitarian law, national regulations, and industry self-regulation — needs to move in full cognition of the other two. We need to find ways for them to enjoy their respective sovereignty, while working in unison to deliver what the international community expects.

When Alan Turing, the British scientist who can rightfully be called the father of AI, first speculated on the promise of thinking machines, he pointed out their potential for making us think about ourselves — our faults, frailties and foibles. Aspiring to the wisdom of Krishna may be expecting too much, but we should welcome the fact that AI challenges us to learn in new ways about ourselves as individual sentient beings — and as nations and societies increasingly brought together in an interconnected globe.

Amandeep Singh Gill, India's Ambassador and Permanent Representative to the Conference on Disarmament, is Chair of the Group of Governmental Experts of the Convention on Certain Conventional Weapons (CCW) on emerging technologies related to lethal autonomous weapon systems

The definition of harassment needs to be constantly updated, and the process for justice made more robust

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National Conference on BharatNet - Launch of Phase II, Signing of MoU with States and Utilisation of Network

National Conference on BharatNet - Launch of Phase II, Signing of MoU with States and Utilisation of Network

- *With Optical Fibre connectivity now available at 1 lakh Gram Panchayats under Phase-1 of BharatNet, DoT has initiated discussions on delivering Broadband enabled Citizen Services in these locations*
- *The National Conference on Signing of MoU with States and Utilisation of Network will be held in New Delhi on 13th November 2017 with States and Service Providers*
- *Telecos like Airtel, Reliance Jio, Vodafone and Idea have expressed interest in providing last mile connectivity on BharatNet Infrastructure.*
- *Memorandum of Understanding to be signed with States for Implementation of BharatNet Phase II*

DoT is organizing a National Conference with the State Governments and Service Providers on Monday (13.11.2017) to brainstorm and showcase various utilization models leveraging BharatNet infrastructure. The Conference will be attended by IT Ministers and IT Secretaries from States.

Broadband infrastructure on Optical Fibre network has been made available at over 1 lakh Gram Panchayats across the country as part of BharatNet Phase I. State Governments shall be sharing their plans for leveraging the BharatNet infrastructure. DoT, on its part, has taken initiative to demonstrate various models that could possibly be adopted for these services. The Telecom Service Providers, who in collaboration with DoT, have taken initiative to set up centers in rural areas to demonstrate service delivery on BharatNet infrastructure, shall also be present to share their experiences.

The DoT had significantly increased the pace of implementation during the last six months to complete Phase I. Under BharatNet Phase I, Optical Fibre Cable (OFC) connectivity has reached in over 1, 00, 000 Gram Panchayats (GPs) across different States in the country. By Dec 2017, all 1, 00, 000 GPs will be operational on the BharatNet infrastructure. As of today, almost 90,000 installations have been completed and Services are expected to commence in 80,000 GPs shortly.

DoT will also sign Memorandum of Understanding with States for the implementation of BharatNet Phase II during the Conference.

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U.S. approves first pill with digital tracking device

This photo provided by Otsuka America Pharmaceutical, Inc. shows a rendering of the packaging for Abilify MyCite. | Photo Credit: [AP](#)

The Food and Drug Administration has approved the first drug in the United States with a digital ingestion tracking system, in an unprecedented move to ensure that patients with mental illness take the medicine prescribed for them.

The drug Abilify MyCite, developed by Otsuka Pharmaceutical Co. Ltd, was first approved by the FDA in 2002 to treat schizophrenia. The ingestible sensor, made by Proteus Digital health, was approved for marketing in 2012.

The FDA said in a statement on Monday that the digitally enhanced medication “works by sending a message from the pill’s sensor to a wearable patch.” “Being able to track ingestion of medications prescribed for illness may be useful for some patients,” said Dr. Mitchell Mathis, director of the division of Psychiatry Products in the FDA’s Center for Drug Evaluation and Research.

“The FDA supports the development and use of new technology in prescription drugs and is committed to working with companies to understand how this technology might benefit patients and prescribers.”

Green-lighting the new medication, however, came with some caveats.

Among them, the FDA said it was important to note that Abilify MyCite’s labeling asserts “the ability of the product to improve patient compliance with their treatment regimen has not been shown.”

“Abilify MyCite should not be used to track drug ingestion in ‘real-time’ or during an emergency because detection may be delayed or may not occur,” the statement said.

In a portion of the statement to address privacy concerns, the FDA said the wearable patch that comes with the medication “transmits the information to a mobile application so that patients can track the ingestion of the medication on their smart phone.

Patients can also permit their caregivers and physician to access the information through a web-based portal.”

In a statement issued last May at the time the FDA accepted submission of product for review, Otsuka Pharmaceutical of Toyko and Proteus Digital, of California, said that “with the patient’s consent, this information could be shared with their healthcare professional team and selected family and friends, with the goal of allowing physicians to be more informed in making treatment decisions that are specific to the patient’s needs.”

The companies said the Proteus Ingestible sensor “activates when it reaches stomach fluids and communicates with the patch.”

The FDA said the product is designed for the treatment of schizophrenia, acute treatment of manic and mixed episodes associated with a bipolar disorder and for use as an add-on treatment for depression in adults.”

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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What are bots?

A bot is a computer programme designed to work automatically. It is mainly used to gather information on the Internet or perform repetitive jobs.

Like for every technology, there are two sides to bots as well. One of the typical beneficial uses of a bot is to gather information. Bots in such guises are called web crawlers, as cyber security solution major Norton has explained in its blog, adding that another good use is automatic interaction using instant messaging, instant relay chat or other web interfaces.

Dynamic interaction with websites is yet another way bots are used for positive purposes.

Norton defines a malicious bot as self-propagating malware that infects its host and connects back to a central server(s). Malicious bots can gather passwords, log keystrokes, obtain financial information, relay spam, and exploit back doors opened by viruses and worms, among other things. Bots have also come under scrutiny in relation to automated accounts on Twitter and Facebook. Efforts are being made to restrict these bots from spreading misinformation on the respective platforms.

Artificial intelligence-based bots are increasingly being used by organisations and entities to provide customer care, and sales and marketing services.

Microsoft CEO Satya Nadella has said, "Bots are the new apps." Interestingly, according to technology research and advisory firm Gartner, by 2021 more than 50% of enterprises will be spending more per annum on bots and chatbot creations than traditional mobile app developments.

Some popular examples of bots are Apple's Siri, the Google Assistant, Amazon's Alexa and Microsoft's Cortana. But the list is getting longer. Closer home, some banks have also introduced AI-based chatbots that are capable of interacting with users and answering information-related queries.

According to Norton, symptoms such as a slow Internet or crashing of computer for no apparent reason, pop-up windows and advertisements appearing even when a web browser is not being used, friends and family receiving mails you did not send, or a fan going into "overdrive" when the device is idle may mean that your system is infected.

It is important to have a good anti-malware software. All softwares should be updated and system updates should not be ignored.

The definition of harassment needs to be constantly updated, and the process for justice made more robust

END

Transforming internet usage with 5G

The telecom industry in India has evolved over the past few years, seeing numerous changes from 2G to 4G. Today, mobile handsets not only function as the means of communication with our loved ones but also as a source of entertainment. Now, fifth-generation, or 5G, technology is on its way to not only changing the way we communicate, but also paving the way for new consumer-technology interactions. The government has already set things rolling by creating a panel to ready a blueprint for the rollout of 5G mobile networks in India by 2020, a move that not only promises to make wireless connections seamlessly fast but will also provide for the spread of internet-connected smart devices. Here is how 5G will revolutionize the Indian telecom industry:

Speedy and reliable network: There is no denying the new 5G network will be fast and reliable. Through 5G connectivity one will achieve average speeds between 30Mbps (megabits per second) and 35 Mbps as compared to average 4G speeds between 4 Mbps and 16 Mbps. In terms of downloads, 5G networks would facilitate speeds up to 10 Gbps (gigabits per second). This implies that a full high-definition movie can be downloaded in a matter of minutes as opposed to a 4G network that can take more than an hour for the same.

Innovative services for IoT: The new capabilities of 5G will span several dimensions that will include tremendous flexibility, lower energy needs, greater bandwidth, better security and reliability as well as lower device costs. These, in turn, will yield innovative internet of things (IoT) services for automobile and other industries. It is expected that transportation services such as shared-bicycle services, which had earlier swept China, can succeed in India by utilizing the strengths of 5G.

The monetary aspect: Another benefit of 5G's roll out will be the revenue aspect which is incredibly important given the current flattish trend in the country. Experts predict there will be 2 billion connected devices by 2020, which will facilitate new revenue sources. Globally, 5G is expected to generate up to \$3.5 trillion in revenue and support up to 22 million jobs by the year 2035. Moreover, 5G will also enable organizations to move into new markets and explore new revenue streams.

Abundance of data: 5G technology can distribute internet access to 'nodes' within a building and can be deployed with union of wired or wireless network connections. The router and switch technology used in 5G networks can provide high connectivity. Moreover, all services such as telephony, gaming and other multimedia applications will be accessed by a single IP (Internet Protocol) address.

A smarter India: The dream of smart and connected cities, automobiles, appliances, etc., can never be fulfilled without the presence of appropriate network speed and security—something that can be enabled by 5G, thus bringing the dream closer to reality.

So, what will happen to 4G and older network technology in India?

Even with the coming of 5G, the older generations of mobile technology are expected to survive for a few more years due to the prevalence of a large number of feature phones. The transition to 5G will accelerate the changes brought about by the arrival of 4G—something we have already experienced. It is the pre-5G technology that will make the industry future-ready for meeting the burgeoning data demand in the country. So, for telecom players to be relevant in 5G, they would need to have a very good quality 4G network. Moreover, the introduction of 5G would likely be affected by how the competition among mobile carriers develops.

The coming of 5G will only complement the already growing data usage among Indian consumers. Data analysis by True Balance, which provides tracking services for mobile and data usage in India, reveals that the usage amount has shown a 200% increase over the last six months and the upward trajectory is expected to continue. Data consumption patterns among Indians show an increase in usage of video streaming apps—and with better bandwidth and connectivity, 5G would likely boost this consumption trend. These truly are exciting times for consumers.

Yisik Kim is chief strategy officer of Balance Hero India Pvt. Ltd.

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Earth-sized planet that may host alien life discovered

This artist's impression shows the temperate planet Ross 128 b, with its red dwarf parent star in the background. This planet, which lies only 11 light-years from Earth, was found by a team using ESO's unique planet-hunting HARPS instrument. Photo: European Southern Observatory/M. Kornmesser | Photo Credit: [Special Arrangement](#)

Astronomers have discovered an Earth-sized planet with 'mild' climate and peaceful parent star just 11 light years away, which may be the closest known comfortable abode for possible life.

A team working with High Accuracy Radial velocity Planet Searcher (HARPS) at the La Silla Observatory in Chile found that the low-mass exoplanet orbits the red dwarf star Ross 128 every 9.9 days.

This Earth-sized world is expected to be temperate, with a surface temperature that may also be close to that of the Earth. Ross 128 is the "quietest" nearby star to host such a temperate exoplanet.

"This discovery is based on more than a decade of HARPS intensive monitoring together with state-of-the-art data reduction and analysis techniques," said Nicola Astudillo-Defru from University of Geneva in Switzerland.

Red dwarfs are some of the coolest, faintest and most common stars in the universe. This makes them very good targets in the search for exoplanets.

It is easier to detect small cool siblings of Earth around these stars, than around stars more similar to the Sun, said Xavier Bonfils from University of Grenoble in France, who is the lead author of the research published in the journal *Astronomy & Astrophysics*.

Although it is currently 11 light-years from Earth, Ross 128 is moving towards the Earth and is expected to become our nearest stellar neighbour in just 79,000 years — a blink of the eye in cosmic terms.

Ross 128 b will by then take the crown from Proxima b and become the closest exoplanet to Earth, researchers said.

Many red dwarf stars, including Proxima Centauri, are subject to flares that occasionally bathe their orbiting planets in deadly ultraviolet and X-ray radiation.

However, it seems that Ross 128 is a much quieter star, and so its planets may be the closest known comfortable abode for possible life, researchers said.

The team also found that Ross 128 b orbits 20 times closer than the Earth orbits the Sun. Despite this proximity, Ross 128 b receives only 1.38 times more irradiation than the Earth.

As a result, Ross 128 b's equilibrium temperature is estimated to lie between minus 60 and 20 degrees Celsius, thanks to the cool and faint nature of its small red dwarf host star, which has just over half the surface temperature of the Sun.

While the scientists consider Ross 128b to be a temperate planet, uncertainty remains as to whether the planet lies inside, outside, or on the cusp of the habitable zone, where liquid water may exist on a planet's surface.

Astronomers are now detecting more and more temperate exoplanets, and the next stage will be to study their atmospheres, composition and chemistry in more detail. The detection of biomarkers such as oxygen in the very closest exoplanet atmospheres will be a huge next step, researchers said.

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'PSLV built by domestic industry by 2020'

Joint effort: ISRO already has a partnership with private industry to produce satellites. AFP

The Indian Space Research Organisation (ISRO) is preparing to hand over the entire gamut of launch vehicle manufacture to domestic industry by 2020.

"Until now, public and private industries have only supplied devices, components and sub-systems for ISRO's launch vehicles, including the PSLV and the GSLV. Our effort is to give a push to industry for production of end-to-end systems. By 2020, we hope to have the first completely industry-built PSLV," Vikram Sarabhai Space Centre (VSSC) Director K. Sivan said here on Friday.

Inaugurating the National Aerospace Manufacturing Seminar (NAMS 2017) organised by the Society of Aerospace Manufacturing Engineers, he said efforts were on to set up a consortium of companies for the purpose. "Ultimately, we hope to see industry make the transition from vendors supplying parts, to partners providing integrated systems".

The theme of the seminar was 'Aerospace Manufacturing in India-Vision 2030.'

ISRO already has a partnership with private industry to produce satellites. The IRNSS-1H communication satellite aboard the ill-fated PSLV C-39 was the first to be produced by a consortium of six companies.

Dr. Sivan said ISRO had a partnership with about 500 domestic industries for the supply of various components and devices. "About 80% of the cost of launch vehicles and 40% of satellites are handled by these industries".

He stressed on the need for industry to reduce the manufacturing and material cost without compromising on quality to bring down the launch cost. ISRO, he said, had tightened tolerance to error following the failure of the PSLV- C39 mission.

Liquid Propulsion Systems Centre (LPSC) Director S. Somanath said the industry partnership for satellite production had paved the way for the transition to industry-made launch vehicles. He said automation and the increased use of composites and additives were turning the conventional manufacturing process on its head. "Reusable launch vehicles promise to bring down launch cost but pose a problem for industry due to lower demand. The solution is to create a market for more missions."

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'Lost' satellite unveils cosmic recipe for nearby universe

This composite image provided by NASA on August 20, 2008 shows the active galaxy NGC 1275 (Perseus A).

Data captured by a 'lost' satellite mission has provided scientists with vital information about gases in a galaxy cluster 240 million light years from Earth.

The Japanese Hitomi X-ray satellite, developed jointly by NASA and the Japan Aerospace Exploration Agency (JAXA), has given astronomers an important insight into the Perseus galaxy cluster — a collection of thousands of galaxies orbiting within a thin hot gas.

The Hitomi mission, involving University of Southampton in the United Kingdom, came to an abrupt end because of problems with its altitude control system. However, the data it captured during its 38 days in space has allowed scientists to analyse the composition of the Perseus gases and gain a deeper understanding of the stellar explosions that created them.

The gas in the Perseus cluster averages 50 million degrees Celsius and is the source of the cluster's X-ray emission.

Using Hitomi's high-resolution Soft X-ray Spectrometer (SXS) instrument, researchers observed the cluster between February 25 and March 6, last year, acquiring a total exposure of nearly 3.4 days.

The SXS observed an unprecedented spectrum, revealing a landscape of X-ray peaks emitted from various chemical elements with a resolution 30 times better than previously seen.

In a paper published in the journal *Nature*, researchers show that the proportions of elements found in the cluster are nearly identical to what astronomers see in our Sun.

One group of elements is closely tied to a particular class of stellar explosion, called Type Ia supernovas. These explosions entail the total destruction of a white dwarf, a compact remnant produced by stars like the Sun.

These blasts are thought to be responsible for producing most of the universe's chromium, manganese, iron and nickel — metals collectively known as 'iron-peak' elements.

The study suggests that the same combination of Type Ia supernovas producing iron-peak elements in our solar system also produced these metals in the cluster's gas.

This means both the solar system and the Perseus cluster experienced broadly similar chemical evolution, suggesting that the processes forming stars — and the systems that became Type Ia supernovas — were comparable in both locations.

"Despite the failure of the mission soon after launch, the precious few observations that we did obtain have proven to be transformational for our understanding of superheated cosmic plasmas," said Poshak Gandhi, astronomer at the University of Southampton.

"Such plasmas outweigh known galaxies in clusters 10 to one, so are an essential component to our complete understanding of the universe," said Mr. Gandhi, who was among a 200-strong team of scientists involved in the international collaboration.

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Scientists discover new parasitic plant in Nagaland

Gleadovia konyakianorum is a root parasite that grows up to 10 cm in height and bears white, tubular flowers.

Scientists have discovered a new species of parasitic flowering plant that has no chlorophyll, and survives by feeding on another species of plant that does (chlorophyll helps a plant make its own food using sunlight).

The species, named *Gleadovia konyakianorum*, in honour of the Konyak tribe of Nagas, was identified during a botanical exploration earlier this year near Tobu town of Mon district in eastern Nagaland.

“It is a holoparasite [complete parasite] that derives its entire nutritional requirement from the host plant, which is a *Strobilanthes* species. The plant was found in the semi-evergreen forest at an altitude of 1,500-1,600 metres,” said Dilip Kumar Roy, a scientist with the Botanical Survey of India (BSI).

Along with Mr. Roy, two others – N Odoyo, also from the BSI, and a Russian scientist, Leonid V. Averyanov – have published the details of the newly discovered species in the journal *Phytotaxa*.

Though it has no chlorophyll, the plant has a vascular system and extracts its nutrition from the host plant with the help of a haustorium, the scientists said. A haustorium is a specialised structure with which plant parasites attach themselves to the tissue of host plants and derive nutrition.

Gleadovia konyakianorum is a root parasite that grows up to 10 cm in height, and bears white, tubular flowers. Interestingly, this is only the fourth species from the genus *Gleadovia* to be found in the world. The other three are *Gleadovia banerjiana* (discovered in Manipur), *Gleadovia mupinense* (found in China) and *Gleadovia ruborum* (discovered in Uttarakhand and also reported from China).

The white flowering parasite was found in a group of 15-20 plants, and since the species hasn't been reported anywhere else, scientists have described its status as 'data deficient' as per the International Union for Conservation of Nature Red List of Threatened Species Criteria.

“Parasitic plants are often referred to as curious plants as they steal their entire nutritional requirement from the host. Not only are they rare but they are crucial evolutionary links in the plant kingdom that attest to Darwin's theory of survival of the fittest,” said Rajib Gogoi, a scientist from BSI's central national herbarium.

Plant parasites are differentiated as stem and root parasites. Common stem parasites found in India are *Loranthus* sp, on Mango trees, and *Cuscuta reflexa*, a climber. Among the root parasites are *Sapria himalayana*, a rare holoparasitic flowering plant found in Arunachal Pradesh and Meghalaya.

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ISRO opens doors to private sector

A file photo of a satellite being built at the ISRO Satellite Centre in Bengaluru ISRO

In an attempt to increase the number of satellite launches and build the capacity of the private sector, the Indian Space Research Organisation (ISRO) issued a tender on Monday to the private industry for Assembly, Integration and Testing (AIT) of 30-35 satellites.

“ISRO has issued a Request For Proposal (RFP) to the private industry to build 30-35 satellites over three years. Under this, 4-5 companies would be selected after evaluation and awarded parallel contracts. They would be responsible for the AIT of satellites at ISRO facilities,” said Dr. M. Annadurai, Director ISRO satellite centre. He was speaking at the first international seminar on Indian space programme jointly organised by ISRO and the Federation of Indian Chamber of Commerce and Industry.

He said ISRO currently launches 3-4 launches per year but the demand is for 16-18 satellites. ISRO expects to get the responses to the RFP by December 5, complete selection of the companies by January 5 and sign contracts by February 5.

“The aim is to launch 3-4 satellites in 2018 and improve it further,” Dr. Annadurai said to a question from *The Hindu*.

Gaining experience

Another ISRO official said it had tried this model on a pilot scale with two satellites. “Alpha Design Technologies was allowed to build satellites at our facilities. We did the hand holding on the first one and tried their staff. The second satellite was completely built by them at our facility,” he said.

In the next step, the idea is to let the private industry build their own facilities after gaining enough expertise, the official added. The private sector already supplies majority of the sub-systems in satellite manufacturing.

Giving the reason for the push, he said in the next 3-4 years ISRO plans to launch 58 satellites. “Our in-house capacity is limited. So we are looking to offload 30-40% of the work to the private sector,”

To this end, ISRO has built a space technology park spread over 25 acres in Bengaluru where the entire range of facilities have been set up for use by the industry.

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Gravitational waves from black hole collision detected

The collision of two black holes is seen in this computer simulation File photo: Reuters

Scientists have yet again detected gravitational waves — ripples in the fabric of space and time — produced by the merger of two light black holes about a billion light-years away from the Earth.

The waves were produced by the merger of black holes seven and 12 times the mass of the Sun, and left behind a final black hole 18 times the mass of the Sun.

This means that energy equivalent to about one solar mass was emitted as gravitational waves during the collision.

This event, detected by detectors on June 8 this year, was actually the second binary black hole merger observed during Laser Interferometer Gravitational-Wave Observatory (LIGO)'s second observation run since being upgraded in a programme called Advanced LIGO.

However, its announcement was delayed due to the time required to understand two other discoveries: a three-detector observation of gravitational waves from another binary black hole merger on August 14, and the first-ever detection of a binary neutron star merger in light and gravitational waves on August 17.

GW170608 is the lightest black hole binary that LIGO and Virgo detectors have observed — and so is one of the first cases where black holes detected through gravitational waves have masses similar to black holes detected indirectly via electromagnetic radiation, such as X-rays.

This discovery will enable astronomers to compare the properties of black holes gleaned from gravitational wave observations with those of similar-mass black holes previously only detected with X-ray studies, and fills in a missing link between the two classes of black hole observations.

Despite their relatively diminutive size, GW170608's black holes will greatly contribute to the growing field of "multimessenger astronomy," where gravitational wave astronomers and electromagnetic astronomers work together to learn more about these exotic and mysterious objects.

The LIGO and Virgo detectors are currently offline for further upgrades to improve sensitivity.

Scientists expect to launch a new observing run next year, though there will be occasional test runs during which detections may occur.

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India calls for stronger treaties to protect space assets

Fine example: The SAARC satellite being launched from the Satish Dhawan Space Centre in Sriharikota. PTI

Stressing international cooperation in space as in all domains of global commons, Foreign Secretary S. Jaishankar on Tuesday called for strengthening global treaties to protect space-based assets and prevent militarisation of outer space.

“International cooperation is critical in the space domain as in other global commons. Our approach therefore goes beyond national considerations. In fact, it is not an exaggeration to state that international cooperation is today hard-wired into India’s space programme,” Dr. Jaishankar said addressing a conference on the space programme jointly organised by the Indian Space Research Organisation (ISRO) and the Federation of Indian Chamber of Commerce and Industry.

Over 200 treaties

In line with this, Dr. Jaishankar said India had more than 200 international cooperation agreements with more than 40 countries and international organisations, and called the maiden moon mission, Chandrayaan-I, a “successful example of international cooperation with international payloads”.

“The South Asia satellite is a matter of particular pride as it literally raises the heights to which we had taken our ‘neighbourhood first’ policy,” the Foreign Secretary said.

In May, ISRO launched the communications satellite GSAT-9, also called SAARC satellite, meant to provide connectivity and disaster support to countries in South Asia.

The satellite cost around Rs. 235 crore and had a life span of 12 years.

Saying India is party to all the legally binding instruments on outer space, Dr. Jaishankar said, “India has also noted with concern the growing diverse threats in this frontier and is sensitive to these challenges.”

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Govt. unveils law to regulate the sector

The draft of the country's first Space Law, unveiled on Tuesday, stipulates licences for all space-related players and activities. The draft also sets out penalties of Rs. 1 crore and above and jail terms for violations.

The proposed Space Activities Bill, 2017 that will go before Parliament, also seeks to keep the government out of any liability arising out of harm that these commercial activities may cause — to people, environment, other countries or outer space.

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Govt. unveils draft of law to regulate space sector

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So far, the national space agency Indian Space Research Organisation's major works have related to satellites, launchers and applications. These were governed by the Satellite Communication Policy, 2000; the Remote Sensing Data Policy, 2011; and international treaty obligations on outer space activities as mandated by the UN Committee on Peaceful Uses of Outer Space or UNCOPUOS.

New body proposed

The draft Bill defines objects, people and geography that will come under the future law. While all persons or entities engaged in space will now need a licence, the government will form a new authorised body for this purpose.

The Centre will keep a registry of all space objects.

The draft has been posted on the website of Indian Space Research Organisation (ISRO). Stakeholders have a month to send in their comments, according to a note signed by G. Ravi Shankar, Under Secretary in the Department of Space.

Explaining the need for a Space Law now, the notification says increasing applications of Space-based solutions have meant an increased participation of private sector industry and startups. "Commercial opportunities in space activities and services, nationally and internationally, demand a higher order of participation by private sector agencies. This situation demands a necessary legal environment for orderly performance and growth of space sector," it said.

A.S. Kiran Kumar, ISRO Chairman and Secretary, Department of Space, stated at an industry event in Delhi on Monday that the country needed to at least double the number of its 42 functional satellites in order to meet national demands. ISRO has started the process of selecting industry teams to quickly build spacecraft and launch vehicles for it in the next two to three years. It also launches many foreign spacecraft for a fee on the PSLV launcher.

Multiple players

According to a senior DoS official who requested not to be named, "Until now, ISRO being the only player never felt the need for a separate law. Now, many Indian and foreign companies are setting up shops here as well as 20-odd Indian startups. It is very important now that to have a regulatory mechanism and law to govern these activities."

The draft clearly defines space players, licences, violations, the official said, adding that detailed specific guidelines may come in later for each activity in consultation with stakeholders and industry bodies. The draft law is available at:

<https://www.isro.gov.in/update/21-nov-2017/seeking-comments-draft-space-activities-bill->

2017-stake-holders-public-regarding

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Oldest stars in our galaxy discovered

An artist's rendering provided by the Harvard-Smithsonian Centre for Astrophysics of shows the Milky Way's structure. | Photo Credit: [AP](#)

Astronomers have discovered some of the oldest stars in our Milky Way galaxy by determining their locations and velocities. Just like humans, stars have a life span: birth, youth, adulthood, senior and death.

Scientists at Georgia State University in the U.S. focussed on old or "senior citizen" stars, also known as cool subdwarfs, that are much older and cooler in temperature than the Sun.

In a study, astronomers conducted a census of our solar neighbourhood to identify how many young, adult and old stars are present. They targeted stars out to a distance of 200 light years, which is relatively nearby considering the galaxy is more than 1,00,000 light years across.

A light year is how far light can travel in one year.

This is farther than the traditional horizon for the region of space that is referred to as "the solar neighbourhood," which is about 80 light years in radius.

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In a first, air-launched BrahMos missile test-fired

On target: The BrahMos missile in flight. Special Arrangement

In a first, India on Wednesday successfully test-fired the air-launched version of the BrahMos supersonic cruise missile from an IAF Su-30MKI aircraft.

BrahMos, which is multi-platform, multi-mission missile, is now capable of being launched from land, sea and air and completes the tactical cruise missile triad.

“The air-launched BrahMos missile is a 2.5 ton supersonic air-to-surface cruise missile with ranges of more than 400 km. The IAF is the first Air Force in the world to have successfully fired an air-launched 2.8 Mach surface attack missile of this category,” the IAF said.

The missile was gravity-dropped from the Su-30MKI from its fuselage, and the two stage engine fired up and propelled towards the intended target, a ship, in the Bay of Bengal.

Heaviest weapon

BrahMos weighing 2.5 ton is the heaviest weapon to be deployed on the Su-30 fighter aircraft which was modified by the Hindustan Aeronautics Limited (HAL) to carry the weapon.

“This success not only bolsters the combat effectiveness of IAF but also demonstrates the capabilities of indigenous onboard avionics with innovative algorithms developed by DRDO,” said Dr. G. Satheesh Reddy, Scientific Advisor to Defence Minister and Director General, Missiles and Strategic Systems.

The integration of the missile on the aircraft was a complex process involving mechanical, electrical and software modifications on the aircraft. In fact, the test launch had been delayed by the complexities in the integration. The software development of the aircraft was undertaken by the IAF engineers. “One of the major challenges overcome by the scientists of the Research Centre Imarat, DRDO in the missile development was optimisation of transfer alignment of the inertial sensors of the missile,” the IAF said.

Original range

The land and sea variants of BrahMos are already operational with the Army and the Navy. The original range was 290 km in line with the limitations of the Missile Technology Control Regime. After India joined the grouping in June 2016, the range was extended to 450 km and would be further extended to 600 km.

BrahMos is a joint venture with Russia and named after the Brahmaputra and Moskva rivers. The development trials of an anti-shipping variant began in 2003 and combat trials in 2005.

The significance of the development is that in an increasingly complex air defence environment, the missile gives long stand-off distance to the IAF to strike targets deep inside the enemy territory and get away quickly.

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Mars water theory gets dusted

A view of the planet Mars as taken by the NASA Hubble Space Telescope on May 12, 2016, when it was 50 million miles from Earth. | Photo Credit: [Reuters](#)

A new study suggests that dark streaks found on images of Mars represent flowing sand, not water.

The research throws cold water on a 2015 study that indicated that lines on some Martian slopes were signs of water currently on the planet. Instead, Arizona scientists report in *Nature Geoscience* that these lines appear more like dry, steep flows of sand, rather than water trickling downhill, at or near the surface.

If water is present, they said, it's likely a small amount and not conducive to life.

NASA, though, said the jury is still out.

The lead scientist for NASA's Mars exploration program, Michael Meyer, points out that the latest study does not rule out the presence of water. But he acknowledges, "It just may not be as exciting as the idea of rivers going down the sides of cliffs."

NASA's Mars Reconnaissance Orbiter provided the images of these so-called recurring slope lineae, or RSL. Thousands have been spotted on the planet.

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Novel molecule prevents malaria, shows research

Researchers from New Delhi have, for the first time, deciphered a multiprotein complex that is involved in the invasion of the red blood cells (RBCs) by Plasmodium falciparum malaria parasites. They have also identified a peptide molecule that can effectively prevent the interaction between malaria parasites and receptors found on RBCs thereby preventing the parasites from invading the RBCs and causing the disease.

During infection with Plasmodium species, the parasite invades RBCs and replicates inside them. It is during the blood stage of infection that malaria disease occurs.

P. falciparum parasites are known to quickly develop resistance against drugs through mutations. A team led by Dr. Anand Ranganathan from the Special Centre for Molecular Medicine at Jawaharlal Nehru University (JNU), New Delhi and Dr. Pawan Malhotra from the International Centre for Genetic Engineering and Biotechnology (ICGEB), New Delhi has used a different approach to overcome the problem of drug resistance.

Instead of targeting the parasite, the molecule targets a specific receptor — cyclophilin B — found on the surface of RBCs that are used by the parasites to bind and invade them. Since the peptide molecule binds to cyclophilin B receptors, the parasites are unable to bind to receptors and invade the cells.

In experiments carried out in test tubes, there was about 80% reduction in parasite invasion of RBCs.

“Unlike the malaria parasites, the red blood cell receptors will not undergo mutation. That is why we were able to target the receptors and prevent the invasion of RBCs by even the drug-resistant malaria parasites,” says Dr. Ranganathan.

An immunosuppressive drug (cyclosporine A) that binds to cyclophilin B receptors on RBCs is effective in killing malaria parasites. “But in mice model it has been shown that the drug has adverse effects as it also kills RBCs. Using the drug in two different experiments we confirmed that cyclophilin B receptors were involved in the invasion process,” says Dr. Prem Prakash from ICGEB and the first author of the paper published in Nature Communications.

“We found multiple sets of interactions between parasites and human RBCs,” says Dr. Mohammad Zeeshan from ICGEB and the other first author of the paper. There are two main receptors on RBCs and two parasite proteins which form a four-protein complex.

“By interrupting the binding of the parasite protein with RBCs at one of the receptors the whole protein complex falls apart. It is like a number lock with a four-digit combination. Interrupting any one of the steps will prevent the parasite invasion of RBCs,” says Dr. Ranganathan.

Having deciphered the mechanism of parasite entry, the team is now working to reduce the dosage to use the peptide as a drug. “We can either modify the cyclosporine A drug to make it less toxic and use it for preventing malaria or use the peptide as an inhibitor. It is easier to take the drug than the peptide to clinical testing by making necessary modifications,” says Dr. Malhotra.

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NASA unveils stunning 'farewell image' of Saturn

After more than 13 years at Saturn, and with its fate sealed, NASA's Cassini spacecraft bid farewell to the Saturnian system by firing the shutters of its wide-angle camera and capturing this last, full mosaic of Saturn and its rings two days before the spacecraft's dramatic plunge into the planet's atmosphere. | Photo Credit: [NASA/JPL-Caltech/Space Science Institute](#)

NASA has released a stunning view of the Saturn and its splendid rings and moons, captured by the Cassini spacecraft during the final leg of its 20-year-long epic journey in space.

The probe snapped a series of images that has been assembled into a new mosaic.

Cassini's wide-angle camera acquired 42 red, green and blue images, covering the planet and its main rings from one end to the other on September 13 this year.

Imaging scientists stitched these frames together to make a natural colour view.

"Cassini's scientific bounty has been truly spectacular - a vast array of new results leading to new insights and surprises, from the tiniest of ring particles to the opening of new landscapes on Titan and Enceladus, to the deep interior of Saturn itself," said Robert West, Cassini's deputy imaging team leader at NASA's Jet Propulsion Laboratory in the US.

The Cassini imaging team had been planning this special farewell view of Saturn for years.

"It was all too easy to get used to receiving new images from the Saturn system on a daily basis, seeing new sights, watching things change," said Elizabeth Turtle, an imaging team associate at the Johns Hopkins University Applied Physics Laboratory in the US.

"For 37 years, Voyager 1's last view of Saturn has been, for me, one of the most evocative images ever taken in the exploration of the solar system," said Carolyn Porco, former Voyager imaging team member and Cassini's imaging team leader at the Space Science Institute in the US.

"In a similar vein, this 'Farewell to Saturn' will forevermore serve as a reminder of the dramatic conclusion to that wondrous time humankind spent in intimate study of our Sun's most iconic planetary system," said Porco.

Launched in 1997, the Cassini spacecraft orbited Saturn from 2004 to 2017.

The mission made numerous dramatic discoveries, including the surprising geologic activity on Saturn's moon Enceladus and liquid methane seas on Saturn's largest moon, Titan.

Cassini ended its journey with a dramatic plunge into Saturn's atmosphere on September 15, this year, returning unique science data until it lost contact with Earth.

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Successful firing of Brahmos Air Launched Missile from Su-30 MKI Aircraft**Successful firing of Brahmos Air Launched Missile from Su-30 MKI Aircraft**

Today, IAF has successfully fired the BrahMos air version anti shipping missile from its frontline Su-30 MKI fighter aircraft off the Eastern Coast. The launch from the aircraft was smooth and the missile followed the desired trajectory before directly hitting the ship target. The missile was fired by the test crew comprising Wg Cdr Prashant Nair and Wg Cdr KP Kiran Kumar. The chase aircraft was flown by Sqn Ldr Angad Pratap and Gp Capt Badrish N Athreya.

The air launched BrahMos missile is a 2.5 ton supersonic air to surface cruise missile with ranges of more than 400 kms. The IAF is the first Air Force in the world to have successfully fired an air launched 2.8 Mach surface attack missile of this category. The integration on the aircraft was very complex involving mechanical, electrical and software modifications on aircraft. The IAF was totally involved in the activity from its inception. The software development of the aircraft was undertaken by the IAF engineers while the HAL carried out mechanical and electrical modifications on aircraft. One of the major challenges overcome by scientists of RCI, DRDO in the missile development was optimization of Transfer Alignment of the inertial sensors of the missile.

The rich experience of the IAF flight test crew ensured that the integration was smooth. The dedicated and synergetic efforts of the IAF, DRDO, BAPL and HAL have proven the capability of the nation to undertake such complex integrations on its own.

The firing could be successfully undertaken with dedicated support from Indian Navy by way of ensuring availability of the target and a large number of monitoring ships to ensure range safety clearance.

The BrahMos missile provides Indian Air Force a much desired capability to strike from large stand-off ranges on any target be in sea or land with pinpoint accuracy by day or night and in all weather conditions. The capability of the missile coupled with the superlative performance of the Su-30 aircraft gives the IAF a strategic reach and allows it to dominate the ocean and the battle fields.

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The Hindu Explains: What is the Space Activities Bill, 2017?

The Space Activities Bill is up on the ISRO website, with an invitation for comments from stakeholders. | Photo Credit: [PTI](#)

A Bill pending before the Parliament is to encourage both the public and private sectors to participate in the space programme.

It is a proposed Bill to promote and regulate the space activities of India. The new Bill encourages the participation of non-governmental/private sector agencies in space activities in India under the guidance and authorisation of the government through the Department of Space.

According to the draft, as few start-up companies in India have shown interest in space systems activities and as space activities need participation from private sector agencies, “there is an urgent need for a legal environment for orderly performance and growth of space sector.”

The draft was posted on the website of Indian Space Research Organisation (ISRO) on November 21, 2017.

The Bill seeks comments on the draft from stakeholders and the public. ISRO has given a month’s time to read the 20-page draft and send comments.

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Open SESAME: a new light from West Asia

Jordan's King Abdullah inaugurates the International Centre for Synchrotron-Light for Experimental Science and Applications in the Middle East, known by the acronym SESAME, an international research centre on May 16, 2017. | Photo Credit: [AFP](#)

A new radiation project called SESAME in Jordan has emitted a 'new light' of single wavelength for the first time on November 22, indicating the start of the lab's experimental programme and opening of a new area of research. According to a press release, the new light, which falls in the X-ray spectrum, can be used to carry out research "from solid state physics to environmental science and archaeology".

SESAME stands for Synchrotron-light for Experimental Science and Applications in the Middle East. The synchrotron is a vast circular apparatus containing a ring of a 133-metre circumference (longer than a football field). Along the ring, beams of electrons travel at near-light speed. They circulate for several hours, completing millions of revolutions each second. As they circulate and get deflected by magnets in the loop, they give off radiation called synchrotron light. This light can be collected and used to study the properties of materials.

The synchrotron light has better brightness and resolution than conventional X-ray or infrared sources. The light can be used to study new drugs for cancer therapy and study of cultural heritage like bio-archaeology (the study of our ancestors) and also for investigating ancient manuscripts.

"We are...starting with an experiment to investigate heavy metal contamination... in the soil," said SESAME scientist Messaoud Harfouche in a press release.

"There is always an excitement when you see the first light from a new set-up. This new light can also be used for imaging of molecules and for dissociation studies (to understand splitting of a molecule into smaller molecules, atoms, or ions)," says Sourabh Dube, Assistant Professor, Department of Physics, Indian Institute of Science Education and Research, Pune.

The project was officially opened in Amman, Jordan, in May 2017. It is a cooperative venture by scientists and governments of the region of CERN (European Organisation for Nuclear Research). It is West Asia's first major international research centre with members from Cyprus, Egypt, Iran, Israel, Jordan, Pakistan, the Palestinian Authority, and Turkey. It was developed with the help of UNESCO.

The SESAME is currently operating with a beam current of 80 milli amps while it is capable of up to 400 milli amps. The researchers are planning to gradually increase the current in the coming months and study its capabilities.

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Here comes India's sun watcher Aditya-L1

With this advantage, the instrument has the capacity to observe the loop-like magnetic structures that form in the corona, the outer layer of the sun. "This will be the first experiment to measure the coronal magnetic field from a space platform. This was not even done by SOHO," says Dipankar Banerjee, the principal investigator of the VLEC.

Between them, the three payloads — VLEC, the Solar Ultraviolet Imaging Telescope (SUIT) and the X-ray spectrometers — can image the sun in all wavelengths.

Like seasonal changes on the earth, the sun experiences approximately eleven-year-long cycles during which sunspots, caused by the sun's magnetic field, start forming, increase in the ascending phase and decrease in the descending phase towards the end of the cycle.

"Studying coronal mass ejections [a phenomenon that would correlate with high sunspot activity] is not the only objective. This study can also help us understand the coronal heating problem," says Prof. Banerjee. The 'coronal heating problem' refers to the fact that the photosphere, a deeper layer of the sun, is at a much lower temperature than the outer layer, the corona. Since it is believed that the heating process happens from within, what causes this heating of the outer layer, the corona, remains a mystery.

First proposed in 2008 as a 400 kg-class satellite with one scientific instrument, a coronagraph, the project has since changed and grown in size and scope. Aditya-L1 will carry seven payloads. Each of these will either image the sun or sample the space around it for traces of charged particles spewed out by the sun during coronal mass ejections.

The payloads alone will weigh close to 250 kg. The biggest of these is the VLEC, about 170 kg. The next is SUIT, weighing around 35 kg; others are much lighter. Orbiting about the L1 point, due to a play of gravitational forces acting on it, Aditya-L1 will require little energy to keep it in place.

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Surge in oxygen levels led to explosion of life: study

The event also brought on geological changes to the Earth | Photo Credit: [REUTERS/NASA IMAGES](#)

A boost in levels of oxygen may have caused a three-fold increase in biodiversity during between 445 and 485 million years ago, a study has found.

The explosion of diversity, recognised as the Great Ordovician Biodiversification Event, brought about the rise of various marine life, tremendous change across species families and types, as well as changes to the Earth, starting at the bottom of the ocean floors.

“This oxygenation is supported by two approaches that are mostly independent from each other, using different sets of geochemical records and predicting the same amount of oxygenation occurred at roughly the same time as diversification,” said Cole Edwards, assistant professor at Washington University in the U.S.

“We made another link between diversification and oxygen levels, but this time during the Ordovician where near-modern levels of oxygen were reached about 455 million years ago,” said Mr. Edwards.

“It should be stressed that this was probably not the only reason why diversification occurred then. It is likely that other changes — such as ocean cooling, increased nutrient supply to the oceans and predation pressures - worked together to allow animal life to diversify for millions of years,” he said.

Chemical signatures

Using geochemical proxies, high-resolution data and chemical signatures preserved in carbonate rocks formed from seawater, researchers were able to identify an oxygen increase during the Middle and Late Ordovician periods.

They found a nearly 80% increase in oxygen levels where oxygen constituted about 14% of the atmosphere during the Darriwilian Stage (Middle Ordovician 460-465 million years ago) and increased to as high as 24% of the atmosphere by the mid-Katian (Late Ordovician 450-455 million years ago).

‘Major pulses’

“This study suggests that atmospheric oxygen levels did not reach and maintain modern levels for millions of years after the Cambrian explosion, which is traditionally viewed as the time when the ocean-atmosphere was oxygenated,” Mr. Edwards said.

“In this research, we show that the oxygenation of the atmosphere and shallow ocean took millions of years, and only when shallow seas became progressively oxygenated were the major pulses of diversification able to take place,” Mr. Edwards said.

A book on geological history that explains climate change

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Cleaning up oil spills

Photo for representative purpose.

A chemical compound (Meisenheimer complex) synthesised through a simple, single-step process of mixing two chemicals at room temperature has been found to be highly effective in removing fluoride and metal ions such as lead, mercury, cadmium, copper, and iron from drinking water.

The compound repels water by nature. A two-member team led by Professor Debasish Haldar from the Department of Chemical Sciences at the Indian Institute of Science Education and Research (IISER), Kolkata tested its efficiency in removing oil spills. A polystyrene sponge that absorbs water became a water-repelling material when coated with the compound and was able to absorb a wide variety of oils and organic solvents from water.

“The compound has negative and positive charged parts and this helps it absorb metal ion pollutants and fluoride from water,” says Professor Haldar.

“One gram of the compound was able to remove a large amount of lead (817 mg) and mercury (830 mg) from water and nearly half its weight of copper (451 mg) and iron (511 mg),” says Tanmay Das from IISER, Kolkata and the first author of a paper published on this in the journal *ACS Omega*.

The researchers tested the efficiency of the compound to absorb different metals by passing water containing 50-100 parts per million (ppm) of metal solutions through two grams of the compound mixed in 60 grams of silica gel. The absorption capacity was extremely high at around 99%.

To test the compound's capacity to remove metal ions below the World Health Organisation's limit, the researchers used the compound to treat water containing five ppm of copper, mercury, cadmium and iron. After 10 minutes of treatment, the concentration levels of the metals dropped to below 2 parts per billion (ppb), which is far below the WHO limit for these metals.

In the case of fluoride, water with a high concentration of fluoride (10 ppm) was treated with the compound. After 10 minutes of treatment, the fluoride concentration dropped to 10 ppb. The silica gel filter containing the compound showed equal efficiency for three cycles and has to be recycled after the third cycle.

“We are trying to commercialise it. We are already working with a company based in Chennai, which is testing the material. A water filter using our compound may become commercially available in a year's time,” Professor Haldar says.

The definition of harassment needs to be constantly updated, and the process for justice made more robust

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