

## 'Methanol a clean, cheaper fuel'

Nitin Gadkari

Road Transport and Highways Minister Nitin Gadkari on Monday held a high-level stakeholders meeting to deliberate upon a strategy to use methanol as an alternative fuel in automobiles. The Minister has asked government think-tank Niti Aayog to study the automobile standards developed in China to use methanol as an alternative fuel.

"Methanol economy will help India use its vast reserves of coal while driving import substitution. Research in converting carbon dioxide to methanol is promising and can be a game-changer for methanol economy," Mr. Gadkari said after chairing the meeting. Petroleum and Natural Gas Minister Dharmendra Pradhan, New and Renewable Energy Minister Piyush Goyal along with former union minister and Nationalist Congress Party (NCP) chief Sharad Pawar were also present in the meeting.

"Mr. Gadkari stressed on the use of local or indigenous materials for production of fuel like making ethanol from agriculture produce or waste and from coal," a Road Transport and Highways Ministry spokesperson said. In its presentation, Niti Aayog said methanol is a promising fuel for waterways as it is clean, cheaper than fossil fuels and a good substitute for heavy fuels. It suggested that ethanol could be made out of coal and informed that a pilot project was already underway in Talcher in Odisha.

India imports methanol from Saudi Arabia and Iran at present, the think-tank said, adding that it is working on a roadmap for conversion from coal to methanol.

The government think-tank also said that methanol can be produced from municipal waste as well.

"All stakeholders agreed that methanol is a promising fuel used in many parts of the world. While in most countries it is being made from natural gas, for India it makes much more economic sense to use locally available coal," the spokesperson said.

The service is available in Bengaluru, Kolkata and Chennai, operating 500 bicycles

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## India, China home to 39% of young Internet users: UN report

**United Nations:** India and China are home to 39 per cent of the 830 million young people worldwide who use the Internet, according to a UN report.

The data released by the International Telecommunication Union (ITU), the United Nations specialised agency for Information and Communication Technologies (ICTs), shows that of the 830 million young people online worldwide, 320 million, or 39%, are in China and India.

The ITU's ICT Facts and Figures 2017 also shows a significant increase in broadband access and subscriptions with China leading the way. The ICT data shows that youths (15-24 years old) are at the forefront of Internet adoption.

In Least Developed Countries (LDCs), up to 35% of individuals using the Internet are aged 15-24, compared with 13% in developed countries and 23% globally. "ITU's ICT Facts and Figures 2017 shows that great strides are being made in expanding Internet access through the increased availability of broadband networks.

Digital connectivity plays a critical role in bettering lives, as it opens the door to unprecedented knowledge, employment and financial opportunities for billions of people worldwide," said ITU Secretary-General Houlin Zhao.

The report adds that mobile broadband subscriptions have grown more than 20% annually in the last five years and are expected to reach 4.3 billion globally by the end of 2017. Between 2012 and 2017, LDCs saw the highest growth-rate of mobile broadband subscriptions.

Despite this, the number of mobile subscriptions per 100 inhabitants in LDCs is the lowest globally at 23%. The number of fixed-broadband subscriptions has increased by 9% annually in the last five years with up to 330 million subscriptions added.

There has been an increase in high-speed fixed broadband subscriptions parallel to the growth in the number of fibre connections.

Most of the increase in high-speed fixed broadband subscriptions in developing countries can be attributed to China, which accounts for 80% of all fixed-broadband subscriptions at 10 Mbit/s or above in the developing world, the report said.

Mobile broadband prices, as a percentage of gross national income per capita, dropped by half between 2013 and 2016.

Mobile broadband is more affordable than fixed broadband in most developing countries. While the Internet user gender gap has narrowed in most regions since 2013, the proportion of men using the Internet remains slightly higher than the proportion of women using the Internet in two-thirds of countries worldwide.

In 2017, the global Internet penetration rate for men stands at 50.9% compared to 44.9% for women.

International Internet bandwidth grew by 32% between 2015 and 2016, with Africa registering an increase of 72% during this period, the highest of all regions.

Global telecommunication revenues declined by 4% from \$2.0 trillion in 2014 to \$1.9 trillion in

2015. Developing countries, which are home to 83% of the global population, generate 39% of the world's telecommunication revenues, it said. **PTI**

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## israel: Israel launches first environmental research satellite

[Jerusalem](#), Aug 2 ( [IANS](#)) [Israel](#) has successfully launched its first spatial environmental research vehicle designed for orbital monitoring of Earth's vegetation, the [Israel Space Agency](#) (ISA) said on Wednesday.

The [Venus](#) satellite (Vegetation and [Environment](#) Monitoring New Micro-Satellite) is an earth-observation micro-satellite designed jointly by Israel's agency and [France's National Centre for Space Studies](#) ( [CNES](#)), Efe [news](#) reported.

Venus has a dual mission: one scientific and the other technological. The scientific mission will monitor Earth's vegetation using a camera capable of recording 12 narrow spectral bands.

The technological mission will [test](#) the operation of an innovative electric propulsion system based on the Israeli-designed Hall Effect Thrusters.

A Hall-effect thruster (HET) is a relatively low power device used to propel a spacecraft after entering orbit or farther out into space.

Venus' launch took [place](#) on board an Arianespace Vega launcher from Kourou, French Guyana, in a joint project between ISA and France's space agency CNES.

It will be inserted into a near polar sun-synchronous orbit at an altitude of 720 km with a two-day flyover revisiting time.

The microsatellite, which weighed 265 kg on launch, will send high-resolution photos to track climate change and aid efforts to tackle desertification, erosion, and pollution.

The first Israeli satellite will also be used for agricultural and environmental research with its innovative electric propulsion system allowing it to navigate more accurately than other satellites, according to ISA.

Venus will circle the planet 29 times every 48 hours and will remain in service for four and a half years, after which it will be parked into a lower orbit.

The first photos of the satellite are expected some five hours after the launch, but will only be available to researchers in November next year.

In addition, another Israeli-manufactured satellite was launched on Wednesday on a reconnaissance mission capable of taking very high-resolution images.

The ISA is part of the Israeli Ministry of Science and [Technology](#) which has invested around \$1.3 billion in research projects related to this satellite.

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## Isro to sign MoU with CSIR-NPL to make desi GPS a reality soon

NEW DELHI: Seeking to make desi GPS - indigenous regional positioning system named as [Navigation with Indian Constellation \( NavIC\)](#) - independent from the US clock system, the [Indian Space Research Organisation](#) (ISRO) will on Friday sign an MoU with CSIR-National Physical Laboratory (NPL) for time and frequency traceability services.

The move will help the desi GPS get formally synchronized with the Indian Standard Time (IST) which is being maintained by the Delhi-based NPL - the timekeeper of India.

The step will help in making the desi GPS fully operational in the market for commercial purposes as time synchronisation is essential for all kinds of services - be it financial transactions, stock handling, digital archiving, time stamping, national security or prevention of cyber crimes.

"We can't depend for ever on the US-based National Institute of Standards and Technology (NIST). After signing the MoU, the space clocks will be synchronised to that of the Primary National Atomic Clocks at National Physical Laboratory and therefore will have independence," said Dinesh Aswal, director of NPL.

Though India can source the IST from the US-based NIST, the accuracy of time may vary. Aswal told TOI, "Though millisecond or microsecond accuracy is sufficient for day-to-day activities, the ISRO needs accuracy up to nanoseconds level for navigation, surveillance and other national missions."

The NPL maintains accuracy of  $\pm 20$  nanoseconds and thereby gives the most accurate time which is essential for satellite navigation system. It has the "Primary Reference Clock", which is traceable to the Coordinated Universal Time (UTC) provided by International Bureau of Weights and Measures (BIPM) located in Sevres, France. The UTC consists of a time-scale that combines the output of more than 400 highly precise atomic clocks worldwide, including five at the CSIR-NPL.

Another scientist of the NPL explained that time has to be incredibly accurate as light travels 30 centimetres in one nanosecond (or 300 million metres in one second). "Any tiny error in the time signal could put you off course by a very long way," he said.

Ahead of signing of the MoU, the government on Thursday informed the Rajya Sabha about all the measures being taken by ISRO to popularise the desi navigation system at a time when the American GPS dominates the navigation system market across the world.

Minister of state for space and atomic energy [Jitendra Singh](#), in his written reply to a question in Parliament, said, "Various types of user receivers are being developed indigenously involving the Indian industry and discussions amongst government departments, user-receiver manufacturers, system integrators and service providers are taking place for the usage of NavIC system."

He, however, noted that the NavIC may take couple of years to become fully operational in the market.

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## India's first private missile production facility unveiled

India's first private sector missile sub-systems manufacturing facility, a joint venture between the \$2.5 billion Kalyani Group and Israel's Rafael Advanced Defence Systems Ltd., was inaugurated near Hyderabad on Thursday.

To begin with, the Kalyani Rafael Advanced Systems (KRAS) plant will make anti-tank guided missile (ATGM) Spike and the production is expected to begin in a few weeks, Kalyani Group chairman Baba N. Kalyani said. Besides supplying to the Indian Army, the plan is to export to South East Asian countries, he added.

### Advanced equipment

Formed in line with the 'Make in India' initiative of the Centre and the policy to encourage private sector participation in defence production, the 51:49 joint venture will develop a wide range of advanced capabilities.

These include command control and guidance, electro-optics, remote weapon systems, precision guided munitions and system engineering for system integration. The plant would employ more than 300 engineers and provide indirect employment to 1,000 people.

Addressing the media ahead of the inauguration, Mr. Kalyani said 60-70 crore had been invested in the plant.

Going forward, once orders start flowing, "we will invest more... also looking to [make] other products, he said, adding that Spice glider bombs used by the Air Force would be the next.

On the plant's ATGM capacity, Rafael Advanced Defence Systems president and CEO Maj. Gen. (retired) Yoav Har-Even said: "We are speaking in thousands of the air-to-surface missiles."

The localisation content is 90% and most of the vendors are in and around Hyderabad, Mr. Kalyani said and thanked the Telangana Government for "pulling out all stops" that led to the plant being set up in 10 months. The JV opted for Hyderabad in view of the defence eco-system it played host to and Telangana reigning on topping of the Ease of Doing Business rankings.

Telangana Industries and IT Minister K.T. Rama Rao, said that more than 30,000 researchers and scientists and 1,000 MSME units in and around the city were working in the areas of defence systems. "Hyderabad and Telangana have all the trappings to become the number one destination for defence investment and defence electronics in the country," he said.

KRAS, which aims to be a one-stop solution provider to locally re-design, develop, re-engineer and manufacture various land and airborne products and systems in India, has plans for expansion. The phase-II will be undertaken at another industrial location in Hyderabad, the company said.

Earlier, Mr. Rao inaugurated the 24,000 sq.ft. facility in the presence of Israeli Ambassador Daniel Carmon.

The service is available in Bengaluru, Kolkata and Chennai, operating 500 bicycles

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## Putting the sun to work

Solar power panels installed on a rooftop in Vijayawada. File | Photo Credit: [Ch. Vijaya Bhaskar](#)

A consortium of 12 Indian and British universities, including Oxford and Cambridge, has received a £7 million grant from the U.K. government to build self-sufficient solar-powered buildings in remote Indian villages.

The grant is part of a new solar project called 'SUNRISE' aimed at developing printed photovoltaic cells and new manufacturing processes which can be used to make solar energy products in India.

These will then be integrated into buildings in at least five villages of India, allowing them to harness solar power to provide their own energy and go off-grid.

The programme is part of a project led by the Swansea University, which has plenty of experience in the field.

"The energy-positive classroom we built shows that this technology works, successfully turning buildings into power stations. This funding will enable us to export this model to support India's plans to boost solar energy," said Professor Dave Worsley of Swansea University, leader of the SUNRISE team.

### Going off-grid

"Designed and built by the SPECIFIC project, the classroom can run off grid. Electricity is generated by a steel roof with integrated solar cells," the university said in a statement.

Prof. Worsley said, "The Swansea team will be working closely with our partner universities in the U.K. and in India. Our hope is that if we can show this works on five villages in India, then it could be rolled out to other buildings in India and around the world."

Swansea University says the project is in line with the Indian government's plans to turn the country into a solar energy leader, leap-frogging fossil fuels. Some of the other universities that are part of the consortium are Oxford, Cambridge, Brunel and Imperial College London. The £7 million award comes from the U.K. government's Global Challenges Research Fund (GCRF), which supports cutting-edge research that addresses issues faced by developing countries.

"From healthcare to green energy, the successful projects receiving funding highlight the strength of the U.K.'s research base and our leadership in helping developing countries tackle some of the greatest global issues of our time," said Jo Johnson, U.K. Minister for Universities and Science.

### An industrial strategy

"At a time when the pace of scientific discovery and innovation is quickening, we are placing science and research at the heart of our industrial strategy to build on our strengths and maintain our status as science powerhouse," Mr. Johnson said.

One of the key aims of the SUNRISE project for India is to provide a real-life example which proves that this technology works and that it is appropriate within communities.

The plan is that it will encourage local industries to manufacture affordable prefabricated buildings, adapted for their environment, that can generate, store and release their own power.

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

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## ISRO to develop full-fledged hyperspectral imaging satellite

A new set of future satellites called hyperspectral imaging satellites is set to add teeth to the way India is gleaned from about 600 km in space.

The Indian Space Research Organisation (ISRO) says it plans to launch a full-fledged niche Earth observation (EO) satellite — called the Hyperspectral Imaging Satellite or HySIS — using a critical chip it has developed.

There is no specific time-frame yet for its launch, an ISRO spokesman said, adding that meanwhile, the new chip, technically called an “optical imaging detector array,” that they have created for it would be tested and perfected.

“ISRO is endeavouring to enter the domain of operational hyperspectral imaging from earth orbit” with a satellite that can see in 55 spectral or colour bands from 630 km above ground,” the space organisation has said. It said it decided to develop the chip that suited Indian requirements.

Hyperspectral or hypspx imaging is said to be an EO trend that is being experimented globally. Adding a new dimension to plain-vanilla optical imagers, it can be used for a range of activities from monitoring the environment, crops, looking for oil and minerals all the way up to military surveillance — all of which need images that show a high level of differentiation of the object or scene.

About a decade ago, ISRO added another EO niche with microwave or radar imaging satellites RISAT-1 and 2 that could ‘see’ through clouds and the dark — an important feature useful for the military and security agencies.

‘Hypspx’ imaging is said to enable distinct identification of objects, materials or processes on Earth by reading the spectrum for each pixel of a scene from space.

Another official described it as “another important development by ISRO in its quest for better and diverse Earth observation technologies.”

ISRO first tried it out in an 83-kg IMS-1 experimental satellite in May 2008. The same year, a hyperspectral camera was put on Chandrayaan-1 and used to map lunar mineral resources. Very few space agencies have such a satellite; a German environmental satellite called EnMAP is due to be launched on an Indian booster in 2018.

The payloads development centre, Space Applications Centre, Ahmedabad, designed the architecture of the chip which was made at ISRO’s electronics arm, the Semi-Conductor Laboratory, Chandigarh. The result was a detector array that could read 1000 x 66 pixels.

According to an EO expert who called it the ‘CATSCAN’ equivalent of Earth from space, hypspx technology was still an evolving science. It came with many challenges and, as such, space agencies were still ironing out its issues after many years.

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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## Now water used as propellant for tiny satellites

[Bengaluru](#), Aug 10 ( [IANS](#)) Engineers at [Purdue University](#) in the US have designed and tested a micropropulsion system that uses liquid water as the propellant for orbital maneuvering of tiny satellites called CubeSats.

With rapid developments in miniaturisation of technologies CubeSats -- which typically weigh about two kilograms -- are poised to take over the sky in the future to carry out tasks like imaging and remote-sensing currently performed by heavier satellites which are expensive to build and launch.

However, today's CubeSats cannot totally replace their larger counterparts as they are incapable of changing orbit or performing complex manoeuvres. For instance, none of the 101 nanosatellites that were launched aboard India's [PSLV](#) from the [Sriharikota Space Centre](#) in February 2017 had propulsion. A propulsion system would allow such tiny satellites to correct their orbit or maintain their altitude, thereby prolonging their operating life in space before becoming space debris.

A dedicated propulsion system that is also compact and not power hungry has been the aim of CubeSat builders in several laboratories to exploit their full potential.

The system developed at [Purdue](#) uses an innovative design of small thrusters that deliver bursts of water vapor to manoeuvre the spacecraft, its developers -- most of them undergraduate students -- reported at a recent "Conference on Small Satellites" held at Logan, Utah, in the US.

Pure water is chosen as the propellant since it is green, safe, easy to use and free from the [risk](#) of contaminating sensitive instruments by the backflow from plumes as in the case of thrusters using chemical propellants.

Called a "Film-Evaporation MEMS Tunable Array", or FEMTA thruster, it uses capillaries thinner than human hair through which the propellant water can flow. Small heaters located near the ends of the capillaries turn the water into vapor, which, on escape from these tiny tubes, provides the thrust. The minuscule capillaries act like valves that can be turned on and off by activating the heaters. The [technology](#) is said to be similar to the inkjet printer, which uses heaters that fire dots of ink at the paper.

CubeSats are usually made up of several units, each unit measuring 10 centimetres on a side. In the Purdue research, a single unit CubeSat prototype -- integrated with four FEMTA thrusters loaded with about a teaspoon of water -- was tested in a large vacuum chamber of the university's high vacuum facility.

The prototype contained electronics and an inertial measurement unit sensor to monitor the performance of the thruster system, which rotates the satellite using short-lived bursts of water vapor.

"We demonstrated that one 180-degree rotation can be performed in less than a minute and requires less than a quarter watt, showing that FEMTA is a viable method for attitude control of CubeSats," its developers reported in their paper.

Although the researchers used only four thrusters during the [test](#), which allowed the satellite to rotate on a single axis, a fully functional satellite would require 12 thrusters for 3-axis rotation. The team is confident this device can be developed for a CubeSat. "What we really want to do next is to integrate our system into a satellite for an actual space mission," the researchers said.

The NASA-funded research involved collaboration with the space agency's [Goddard Space Flight Center](#). A patent application for the concept has been filed.

(K.S. [Jayaraman](#) is a senior journalist who writes on scientific issues. He can be contacted at [killugudi@hotmail.com](mailto:killugudi@hotmail.com))

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## China: China uses a quantum satellite to transmit potentially unhackable data

In a major step towards building a hack-proof global quantum communication network, [China](#) has sent an unbreakable code from its [quantum satellite](#) to the Earth, marking realization of [quantum key](#) distribution technology for the first time.

The achievement based on experiments conducted with the world's first quantum satellite, Quantum Experiments at Space Scale (QUESS), was published in the journal Nature on Thursday, Xinhua news agency reported.

China launched the world's first quantum satellite, nicknamed "Micius" after a 5th Century Chinese philosopher and scientist, on August 16, 2016.

Quantum key technology is used in quantum communications to make eavesdropping impossible and to perfectly secure the communication.

The satellite sent quantum keys to ground stations in Xinglong, in north China's Hebei province, and Nanshan, near Urumqi, capital of northwest China's Xinjiang Uygur region, said Pan Jianwei, lead scientist of QUESS and an academician of the Chinese Academy of Sciences (CAS).

The communication distance between the satellite and the ground station varies from 645 km to 1,200 km, and the quantum key transmission rate from satellite to ground is up to 20 orders of magnitude more efficient than that expected using an optical fiber of the same length, he said.

When the satellite flies over China, it provides an experiment window of about 10 minutes. During that time, the 300 kbit secure key can be generated and sent by the satellite, according to Pan. "That, for instance, can meet the demand of making an absolute safe phone call or transmitting a large amount of bank data," Pan said.

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## Panel moots defence procurement fund

The Ministry of Defence (MoD) has gone back on its demand for a non-lapsable capital fund for defence procurements, even as the Parliamentary Standing Committee (PSC) on Defence on Thursday asked the Ministry of Finance to work out the modalities for the creation of such a fund in consultation with the MoD.

In its latest report presented in the Parliament, the Committee said: "Hence, the Committee would like the Ministry of Finance to work out the modalities for the creation of a 'non-lapsable defence capital fund account' in consultation with the Ministry of Defence and apprise the Committee of the progress made in this direction at the earliest, and not later than three months of the presentation of this report to Parliament".

However, it is surprising that the MoD is going back on its original demand for such a fund. It was earlier keen on such a fund to prevent the unspent amount in a financial year from being returned to the Finance Ministry as defence purchases generally tend to have long procurement cycles.

On February 2 this year, the MoD had sent a proposal for obtaining an 'in-principle' approval of the Finance Ministry on the creation of the account. But according to the report tabled in Parliament on Thursday, its stand has changed after consultations with the Finance Ministry.

The reasons for no longer seeking the fund are: the limited utility of such a fund, rules governing its creation that state the Government should have surplus funds (which is not so in the prevailing fiscal situation), and assurance from the Finance Ministry for additional funds, if required.

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## Indian Coast Guard ship 'Shaurya' commissioned in Goa

Indian Coast Guard ship "Shaurya", the fifth in the series of six 105-metre offshore patrol vessels (OPVs), was on Saturday commissioned in Goa by Union Minister for Petroleum and Natural Gas [Dharmendra Pradhan](#).

The OPV, which draws 2,350 tonne and is propelled by 9100 kilowatt diesel engine, has been designed and built indigenously by Goa Shipyard Ltd and is fitted with state-of-the-art navigation and communication equipment, sensors and machineries.

"The features include 30mm CRN 91 Naval Gun, integrated bridge system, integrated machinery control system, power management system and high-power external fire fighting system," a statement issued from the Indian Coast Guard said.

"The ship is designed to carry one twin engine light helicopter and five high-speed boats, including two quick reaction inflatable boats for swift boarding operations, search and rescue, law enforcement and maritime patrol. The ship is also capable of carrying pollution response equipment to contain oil spill at sea," the statement said.

The ship will be based at Chennai and operate under the operational and administrative control of Commander Coast Guard Region (East) and will be deployed extensively for Exclusive Economic Zone surveillance, apart from safeguarding India's maritime interests.

Presently, the Indian Coast Guard has a fleet of 129 ships and boats, and 72 ships and boats are at various stages of construction at different shipyards in India.

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## India, Russia to hold mega war games in October

In the midst of evolving security situation in the region, India and Russia will hold a mega war game in October involving their armies, navies and the air forces for the first time to further ramp up military ties. The exercise Indra, which will be held in Russia from October 19 to 29, will primarily focus on achieving coordination between forces of the two countries in a tri-services integrated theatre command scenario, military sources said. It will be for the first time India will participate in a tri-services exercise with a foreign country with such a large scale participation by the Navy, the Army and the Air Force, they said.

A total of 350 Indian Army personnel will participate at the mega exercise and the contingent will be led by a major-general rank official. The contingents by the Navy and the IAF will also be sizeable in numbers, the sources said.

The exercise is taking place at a time when India's ties with China have nosedived due to the simmering border dispute and its ties with Pakistan have deteriorated over cross-border terrorism and number of other issues.

The sources said the exercise will take place in three locations in Russia including in mountainous Vladivostok region.

The armies, navies and air forces of Russia are holding bilateral exercises separately but this is for the first time, both the countries will carry out a tri-services exercise.

Russia has been a long-standing defence partner of India and both the countries are now eyeing to further deepen the ties.

During Prime Minister [Narendra Modi](#)'s visit to Russia in June, both countries had decided to "upgrade and intensify" defence cooperation through joint manufacture, co-production and co-development of key military hardware and equipment.

A vision document, issued then had said that both the countries also decided to work towards a qualitatively higher level of military-to-military cooperation.

India has already decided to significantly ramp up its defence capability and has lined up billions of dollars of procurement proposals as part of military modernisation.

The armies, navies and air forces of Russia are holding bilateral exercises separately but this is for the first time, both the countries will carry out a tri-services exercise.

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## Telemedicine: Odisha shows the way

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A telemedicine project started by an Odisha-based social entrepreneur is slowly going national after the Central government adopted it as a model project two years ago. Started in 2009, the unique model that focusses on sustainability involves training of local youth in e-medicine services and enables them to set up e-health centres in government-run primary health-care centres (PHC), community health centres (CHC) and subdivisional hospitals. These centres have created job opportunities for over 500 youth in Odisha and reached out to over five lakh patients.

For jobs and health

“There are two main problems that ail us — unemployment and bad health. Through this micro-entrepreneurship programme we have attempted to tackle both,” says Kedarnath Bhagat, managing trustee of Odisha Trust of Technical Education and Training (OTTET) under the aegis of which the telemedicine model was conceptualised. At OTTET, local youth are trained for a month in an e-health assistance programme, after which they can apply for a bank loan to start an e-health centre in PHCs and CHCs. “On average, the cost of starting a telemedicine centre goes up to 6 lakh. A centre needs a staff of four people, including the entrepreneur,” explains Mr. Bhagat, adding that typically a centre is equipped with a laptop with video camera and basic diagnostic testing facilities like blood glucose meter, urine analyser, heart rate monitor, etc. So far, 127 such centres have been opened in Odisha at the village and district level (*see picture*).

“At no cost to the government, these centres help in offering basic testing facilities. Patients suspected to have major illness get the benefit of the telecommunication facility for consultations with senior doctors,” says Mr. Bhagat. The OTTET has tie-ups with government hospitals as well as private hospitals such as Apollo, Global and Narayana Hrudayalaya.

These telemedicine centres also create a database of personal health records of every patient walking in for future reference. Mr. Bhagat says for a centre to be viable, the PHC or CHC should have a footfall of about 50 patients a day. “The revenue comes from charges for tests and tele-consultation fees. In case patients are covered under any health scheme for the poor, these charges are borne by the scheme,” he says. The charges for tests and consultation are fixed by the government; a basic consultation costs 100 while that with a super-specialist costs 300.

Across other States

In 2015, a team of government consultants termed this project as one of the eight “best practices globally”. The World Health Organisation too believes telemedicine to be particularly beneficial for rural and underserved communities in developing countries.

While the OTTET plans to cover all 51,000 villages in Odisha, pilot programmes have begun in Gujarat, Jharkhand, Bihar, Himachal Pradesh and Uttar Pradesh while four other States are also in line. “Telemedicine offers phenomenal opportunities to doctors to reach out to patients,” says Dr. Devi Shetty of Narayana Hrudayalaya. “It acts as a good bridge.”

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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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**85 lakh milk producing animals identified and their data uploaded on INAPH data base.**

**85 lakh milk producing animals identified and their data uploaded on INAPH data base.**

Pashu Sanjivni component under National Mission on Bovine Productivity scheme was initiated by the Government in November 2016. 88 million milk producing animals out of 300 million cattle and buffaloes are being identified using polyurethane tags with 12 digit unique identification (UID) number. Data of the identified animals is being uploaded on Information Network on Animal Health and Productivity (INAPH) data base. As on date 85 lakh milk producing animals have been identified and their data has been uploaded on INAPH data base.

The Pashu Sanjivni is crucial for control and spread of animal diseases, scientific management of animals, enhanced production and productivity, improvement in quality of livestock & livestock products, increase in trade of livestock and livestock products by meeting out sanitary and phytosanitary issues.

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## MasterCard mulls using blockchain tech

Open to change: “We are not obsessed with cards,” says Amitabh Tewary of MasterCard.

Mastercard is looking to incorporate blockchain technology into its operations and would like a clear regulatory framework in India that lays down what blockchain can be used for.

“We are working with blockchain,” Amitabh Tewary, vice president at Mastercard told *The Hindu* in an interview. “There are quite a few pilots on in MasterCard on the various aspects of our business where blockchain will be useful.”

“Blockchain is an emerging technology and like many other companies, we continue to explore the implications and opportunities in this space,” he added. “We believe that there is a role [for] blockchain in the future of commerce. This future needs to be developed in partnership with banks, merchants and industry participants.”

In India, an inter-ministerial committee is currently looking at how best to regulate blockchain technology, if it is allowed at all. One of the proposals is to bring it under market regulator Securities and Exchange Board of India (SEBI).

According to Mr. Tewary, one option that could be considered is bringing blockchain regulation under the proposed Payments Regulatory Board in the Reserve Bank of India. The Board is to have three members each from the central bank and the Centre.

Blockchain is the technology behind crypto-currency such as Bitcoin, which is a purely electronic currency that can also be traded on exchanges. Demand for Bitcoin globally as well as in India has skyrocketed in recent years, with one Bitcoin worth about 1.75 lakh currently, increasing from 5 in 2010.

Mastercard Labs, the company’s R&D arm, is working on a network that can incorporate the benefits of blockchain technology while meeting the requirements of a globally distributed financial network.

“This platform will support a wide range of use cases, including but not exclusive to B2B inter-bank payments, tracking trade finance obligations along the value chain, exchanging KYC (Know Your Customer) or AML (Anti Money Laundering) data between trusted parties, and more,” Mr. Tewary said.

However, the fact that some blockchain technologies like Bitcoin have recently been associated with ransomware attacks means that regulation must be even more careful when legislating the use of these technologies, he said.

“That’s one of the reasons why Bitcoin, which uses blockchain technology, has not yet been recognised around the world, because the anonymity it offers,” Mr. Tewary explained. “You can anonymously ask for this kind of ransom, and the nature of the currency allows that,” according to Mr. Tewary.

“However, it is something that is going to grow, and we are working on several pilots which are based on blockchain,” he added. “One of the core jobs that we do is to settle the money between institutions.

“There is an issuing institution and one acquiring institution, and we are trying to incorporate

blockchain there. That is one aspect. We can do some of the aspects of business, speed them up, with blockchain. We are not obsessed with cards.”

“One of the things blockchain presupposes is that it is an open protocol, an open ledger system, and minimum regulation,” Mr. Tewari said.

“I guess the regulation will have to come from the perspective of what you can and can’t do, which is where the crux of the problem lies. While you say that you have created this technology that can be used in one manner, how do you stop people from using it in another manner?” according to Mr. Tewary.

The service is available in Bengaluru, Kolkata and Chennai, operating 500 bicycles

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**Cabinet approves MoU between India and Sweden on IPRs****Cabinet approves MoU between India and Sweden on IPRs**

The Union Cabinet chaired by the Prime Minister Shri Narendra Modi today has given its approval to the Memorandum of Understanding (MoU) between India and Sweden on cooperation in the field of Intellectual Property (IPRs).

The MoU establishes a wide ranging and flexible mechanism through which both countries can exchange best practices and work together on training programs and technical exchanges to raise awareness on IPRs and better protect intellectual property rights.

**Impact:**

The MoU will enable India to exchange experiences in the innovation and IP ecosystems that will substantially benefit entrepreneurs, investors and businesses on both sides. The exchange of best practices between the two countries will lead to improved protection and awareness about India's range of Intellectual creations which are as diverse as its-people. It will be a landmark step forward in India's journey towards becoming a major player in global Innovation and will further the objectives of National IPR Policy, 2016.

**Features:**

A Joint Coordination Committee (JCC) with members from both sides will be formed to decide cooperation activities to be taken under the MoU in following areas:

- a) Exchange of best practices, experiences and knowledge on IP awareness among the public, businesses and educational institutions of both countries;
- b) Collaboration in training programmes, exchange of experts, technical exchanges and outreach activities;
- c) Exchange and dissemination of best practices, experiences and knowledge on IP with the industry, universities, R & D organisations and Small and Medium Enterprises (SMEs) through participation in programs and events in the matter, organized singly or jointly by the Parties;
- d) Exchange of information and best practices for disposal of applications for patents, trademarks, industrial designs, copyrights and Geographical Indications, as also the protection, enforcement and use of IP rights;

- e) Cooperation in the development of automation and implementation of modernization projects, new documentation and information systems in IP and procedures for management of IP;
- f) Cooperation to understand how Traditional Knowledge is protected; and the exchange of best practices, including traditional knowledge related databases and awareness raising of existing IP systems;
- g) Exchange of information and best practices regarding Intellectual Property law infringements in the digital environment, especially regarding Copyright issues; and
- h) Other cooperation activities as may be decided by the Parties with mutual understanding.

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## Getting charged up - OPINION

Piyush Goyal, Union Minister of State with Independent Charge for Power, Coal, New & Renewable Energy and Mines, recently announced that only electric vehicles (EVs) will be sold in India from 2030. The current National Electric Mobility Mission Plan (NEMMP) has set a sales target of only 5-7 million EVs and hybrid electric vehicles annually by 2020. On the other hand, the Indian automobile market, which includes two-, three- and four-wheelers, is expected to clock an annual sales figure of around 23 million by 2030. Replacing these with EVs would require a significant push as far as vehicle-charging infrastructure and batteries are concerned.

### Vast opportunities

The transition would require a battery capacity of about 400 GWh (gigawatt hours) each year, equivalent to increasing the current global EV battery production by a factor of five, just to cater to the Indian EV market. This gigantic demand for batteries is an ideal opportunity for the domestic manufacturing industry and job creation. However, India has missed many such opportunities to be integrated in the global value chain for solar cells and wafers and electronics manufacturing due to a lack of suitable policy support. This has led to an ever-increasing import bill for electronics products, currently the highest after oil and gold. The annual EV battery market is expected to be around \$30-55 billion and India cannot afford to fulfil the demand solely through imports.

Different variants of lithium-ion batteries are predominantly used in electric vehicles. Manufacturing lithium-ion batteries would require critical minerals such as cobalt, graphite, lithium and phosphate. Among them, lithium is of particular importance.

The resource endowment is limited to only nine countries and 95% of global lithium production comes from Argentina, Australia, Chile and China. The recent demand surge in the electric mobility market has already resulted in a twofold increase in lithium prices from \$4,390 per tonne (in 2013) to \$9,100 per tonne currently. It is estimated that India would require about 40,000 tonnes of lithium to manufacture EV batteries in 2030, considerably higher than the current annual global lithium production of 32,000 tonnes. To meet India's demands amid a global surge in electric vehicle demand, the entire mineral supply chain needs to be overhauled and expanded.

### China and U.S. in the lead

China and the U.S., which have ambitious electric mobility targets, are way ahead in the race to secure lithium supplies. China, with the second largest reserves of lithium, is making strategic moves to control the majority of international lithium mining assets. China's Tianqi Lithium holds a majority share in the expansion of the Talison Lithium plant in Australia, which would make it the single largest producer of lithium globally upon completion. Also, its equity investors are planning to buy stakes in Chile's lithium mining companies.

Similarly, U.S.-based lithium mining companies have already secured mines in Chile and also hold significant shares in several upcoming mining projects in Australia. Tesla, which plans to manufacture half a million EVs annually by 2020, is investing in R&D to reduce supply risks. It has partnered with Pure Energy Minerals to extract high-purity metal from Nevada, using radically different and cost-efficient production technology.

In order to avoid a scenario like the one that played during the oil crises of the 1970s and the price shocks of 1980s and 2000s, it is imperative that India secure mineral supplies for its domestic industry by acquisition of overseas assets such as mineral reserves and the associated production.

India has long-term trade relations with lithium-producing countries in Latin America through preferential trade agreements (PTAs). A recent extension of the PTA with Chile provides India some tariff concessions for lithium carbonate imports. India needs to further diversify the supply risk by including lithium in existing PTAs or establishing new PTAs with other lithium-producing countries. However, the move will only enable and not ensure risk-free mineral supplies to India.

### **Trade links, R&D, recycling**

There is a need to formulate policies incentivising domestic public and private mining companies to invest in overseas lithium mining assets.

Simultaneously, India must focus on creating a vibrant battery research and development ecosystem domestically. Currently, the domestic battery market is largely dominated by lead-acid battery technologies. Research should focus on developing alternative technologies containing minerals with low supply risks and battery recycling techniques to recover associated minerals and materials. Recycling lithium batteries present in the waste stream will significantly reduce the burden in procuring fresh resources.

Mr. Goyal has repeatedly highlighted 'fuel security' as a key driver in the push for electric vehicles. However, given India's limited hold on critical lithium reserves and concentration of production in the hands of a few, fuel security concerns could still be the same with 'white gold' lithium, replacing 'black gold'. Policies that incentivise domestic manufacturing, address the need for virgin resources and recycling of used batteries, while constantly pushing R&D for substitutes and alternatives are vital to secure electric mobility.

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## New dialogue format to help shift India-US ties to a higher plane

**New Delhi:** India and the US are reworking a key dialogue framework in place since 2015 in a bid to shift bilateral ties to a higher strategic plane.

The India-US Strategic and Commercial Dialogue, once described by the US State Department as the “signature mechanism for advancing the United States’ and India’s shared priorities,” is to be replaced by a dialogue in which the foreign and defence ministers will participate.

The shared priorities include job creation, improving the business and investment climate and sustaining a rules-based global order.

The two countries will have a separate dialogue on commercial issues, which will not include the foreign ministers, two people familiar with the development said separately. Till last year, trade and commercial issues were discussed in the Strategic and Commercial Dialogue and the Trade Policy Forum.

The first Strategic and Commercial Dialogue was held in 2015 in Washington and the second in New Delhi last year. It was seen as an elevation of the US-India Strategic Dialogue in place since 2009 and which focused on regional security, economic cooperation, defence, trade and climate challenges.

The new “two plus two” ministerial dialogue was announced earlier this week in a White House readout of a telephone call between US President Donald Trump and Prime Minister Narendra Modi on the eve of India completing 70 years as an independent country on 15 August.

“The leaders resolved to enhance peace and stability across the Indo-Pacific region by establishing a new 2-by-2 ministerial dialogue that will elevate their strategic consultations,” the readout said without elaborating.

One of the two people familiar with the matter cited above said the new dialogue format will involve the Indian foreign minister and the US secretary of state as well as the Indian defence minister and the US defence secretary.

“It helps us because our strategic and defence interests reinforce each other. So a combined dialogue would be useful for India. The previous Congress-led United Progressive Alliance government was not too keen on having a foreign and defence ministers’ dialogue,” said former Indian ambassador to the US Lalit Mansingh.

On the other hand, “balancing commercial and strategic issues could be difficult now”, Mansingh said, especially as the Trump administration has focussed on trade issues with India including reducing the US deficit that stands at some \$30 billion.

The US has strategic consultations in this format with key partners and allies including Australia, Japan and the Philippines.

India has had a dialogue in the two-plus-two format with Japan with secretaries or senior-most bureaucrats from the foreign and defence ministries engaging each other.

Interestingly, the announcement of the new two-plus-two dialogue to “enhance peace and stability across the Indo-Pacific region” comes against the backdrop of a spike in tensions between India and China with the Asian giants engaged in a military face-off on the Doklam plateau in Bhutan. It

also comes amid reports of American disenchantment with China over its inability to rein in North Korea's nuclear and ballistic missile programmes.

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## NASA's latest communications satellite arrives in orbit

[Washington](#), Aug 18 ( [IANS](#)) [NASA](#) on Friday said its third and final in a series of next generation communications satellites has successfully been placed into orbit.

The Tracking and Data Relay Satellite-M (TDRS-M), launched aboard a [United Launch Alliance](#) (ULA) Atlas V rocket with a liftoff at 8:29 a.m. EDT from [Cape Canaveral Air Force Station's](#) Space Launch Complex 41.

NASA said it will conduct additional tests before putting the Boeing-made TDRS-M into service early next year.

When ready, TDRS-M will become part of NASA's [Space Network](#) providing navigation and high-data-rate communications to the International Space Station, NASA's [Hubble Space Telescope](#), rockets and a host of other spacecraft.

"The [TDRS](#) fleet is a critical connection delivering science and human spaceflight data to those who can use it here on [Earth](#)," said [Dave Littmann](#), the TDRS project manager at NASA's [Goddard Space Flight Center](#) in Greenbelt, Maryland.

"TDRS-M will expand the capabilities and extend the lifespan of the Space Network, allowing us to continue receiving and transmitting mission data well into the next decade," Littmann said.

TDRS-M's predecessors, TDRS-K and TDRS-L, also launched on Atlas V rockets from the same launch complex in January 2013 and January 2014, respectively

More than an hour and a half after launch, the TDRS-M spacecraft separated from the rocket's Centaur upper stage, heralding the end of the launch effort and the mission's beginning.

Following several months of calibration and testing, TDRS-M will be renamed TDRS-13, and it will be eligible to begin supporting NASA's Space Network.

--IANS

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## 'New state of matter' discovered

A file photo of the Los Alamos National Laboratory. | Photo Credit: [AFP](#)

Scientists have discovered a potential new state of matter that may help explain phenomena like superconductivity.

Superconductivity is extensively used in magnetic resonance imaging (MRI), particle accelerators, magnetic fusion devices, and microwave filters.

Researchers from the Los Alamos National Laboratory in the U.S. showed that among superconducting materials in high magnetic fields, the phenomenon of electronic symmetry breaking is common.

The ability to find similarities and differences among classes of materials with phenomena such as this helps establish the essential ingredients that cause novel functionalities such as superconductivity.

The high-magnetic-field state of the heavy fermion superconductor CeRhIn5 revealed a state in which the material's electrons aligned in such a way to apparently reduce the symmetry of the original crystal, something that now appears to be universal among unconventional superconductors.

Unconventional superconductivity develops near a phase boundary separating magnetically ordered and magnetically disordered phases of a material.

The study was published 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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## NHAI launches mobile App MyFASTag and FASTag Partner

### NHAI launches mobile App MyFASTag and FASTag Partner

#### Apps will facilitate the availability of FASTags for Electronic Toll Collection

National Highways Authority of India launched two mobile Apps – MyFASTag and FASTag Partner in New Delhi today, to facilitate the availability of FASTags for Electronic Toll Collection. Speaking on the occasion the NHAI Chairman Shri Deepak Kumar said the cumbersome method of purchase and recharge of FASTags has been one of the major challenges with the ETC project. The mobile Apps launched today will ease the process, making it possible to buy or recharge FASTags at the click of a mobile button.

MyFASTag is a consumer App that can be downloaded from the App Store for both Android and iOS systems. A consumer can purchase or recharge FASTags on this App. The App also helps to keep track of transactions and provides for online grievance redressal.

FASTag Partner is a merchant App. Agencies like Common Services Centre, banking partners and vehicle dealers can sell and enroll FASTag through this App. In addition to this, the App can also be used to activate the RFID tags that came built in with around 74 lakh cars in the country following the 2013 Gazette Notification in this regard. These RFID tags are already fixed on the cars but are dormant. This App will convert these RFID tags into ETC Tag (FASTag).

Shri Deepak Kumar also informed that from 1<sup>st</sup> October 2017, all lanes of all 371 NHAI toll plazas in the country will become FASTag enabled. One lane in every toll plaza will be a dedicated FASTag lane where no other form of payment will be accepted. The other lanes, though FASTag enabled, can accept other forms of payment too. The dedicated FASTag lanes will become operational on all 371 NHAI toll plazas from 1<sup>st</sup> September 2017, he said.

In addition to the above, NHAI has also come up with Online sale of FASTags and offline sale through Common Services Centre (CSC) near toll plazas. FASTag can now be purchased online from Issuer Banks websites / NHAI website / IHMCL website and will be delivered by courier at the door step of the purchaser. Beginning tomorrow, 18<sup>th</sup> August, 2017, FASTags can also be bought from sale points of **Common Services Centre (CSC)** to be set up near toll plazas. CSC has a proven track record of making 20 crore Adhar Cards and achieving many other milestones of Digital India in short duration due to their vast network. It is expected that the association with CSC will give the ETC ecosystem a further boost.

More than 6 lakh FASTags have been sold so far. It is expected that these initiatives for improving the availability and access to FASTags will encourage more and more people to buy them. This will give the much needed push to the ETC project that aims to make travel more convenient, faster and environment friendly for people.

[To access the presentation on the mobile Apps click here.](#)

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**Commissioning of Second Ship of Landing Craft Utility MK-IV****Commissioning of Second Ship of Landing Craft Utility MK-IV  
'IN LCU L52'(GRSE Yard 2093) at Port Blair**

Dr. Jagdish Mukhi, Lieutenant Governor, Andaman and Nicobar Islands, commissioned **IN LCU L52** into the Indian Navy today at Port Blair. IN LCU L52 is the second Landing Craft Utility (LCU) Mk-IV class to be inducted into the Indian Navy. The ship has been indigenously designed and built by Garden Reach Shipbuilders and Engineers, Kolkata. The commissioning of L-52 is yet another manifestation of the potential of the country's indigenous design and ship building capability.

LCU MK-IV ship is an amphibious ship with the primary role to transport and deploy Main Battle Tanks, Armoured Vehicles, troops and equipment from ship to shore. These ships would be based in the Andaman and Nicobar Command and can be deployed for multirole activities like beaching operations, search and rescue, disaster relief operations, supply and replenishment and evacuation from distant islands.

The ship, commanded by Commander Kaushik Chatterjee, has a complement of 05 officers, 46 sailors and is capable of carrying 160 troops in addition. The ship, displacing 830 Tons, is capable of transporting various kinds of combat equipment such as Main Battle Tanks Arjun, T72 and other vehicles. The ship is fitted with state-of-the-art equipment and advanced systems like Integrated Bridge System (IBS) and Integrated Platform Management System (IPMS).

The remaining six ships of the same class are in advanced stages of construction at M/S GRSE, Kolkata and are scheduled to be inducted in the next two years. The induction of these ships will contribute to the nation's maritime security needs and is in consonance with the Hon'ble Prime Minister's drive for 'Make in India'.

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## ICMR inks deal to promote vaccine development

The Indian Council of Medical Research (ICMR) has signed an MoU with the International Vaccine Institute (IVI) for collaborating on vaccine research and development.

India will commit \$5,00,000 (3.20 crore) annually for a stake in IVI— an amount approved during a Cabinet meeting in January.

### Boost to medicine

The MoU was signed between Soumya Swaminathan, the Director General of ICMR and Secretary, Department of Health Research, Manoj Jhalani, Additional Secretary and managing director, National Health Mission, and IVI Director General Jerome H. Kim.

### Successful project

IVI has been partnering with Indian vaccine manufacturers, research institutes, government, and public health agencies on vaccine development, research, and training. One of the most successful collaborations was with Shantha Biotech on the development of Shanchol, the world's first low-cost oral cholera vaccine.

The vaccine was licensed in India in 2009 and WHO-prequalified in 2011.

Dr. Swaminathan said: "We have been working closely with IVI in India for more than a decade now. We are confident that this collaboration will elevate the vaccine R&D capacity at IVI as well as benefit Indian labs and the vaccine industry."

### Affordable vaccines

Dr. Kim said the MoU was a step towards providing affordable vaccines across the globe.

"India is a vaccine industry powerhouse that supplies 60% of the world's vaccines. The signing of the MoU is a continuation of our partnership with India to provide safe, effective and affordable vaccines for people around the world," he said.

Despite the National Green Tribunal's orders on construction dust and open burning of waste, there is little compliance on the ground. Ashok Kumar talks to residents of the Millennium City who are getting fed up with the administration's apathy in implementing rules that help curb air pollution

Data reveal injuries were more common among children belonging to the age group of 1-5 years

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## Dogged by delays, but cloud seeding project is finally up and cruising

A special fitted aircraft which will spray chemical to induce rainfall, as part of the cloud seeding project "Varshadhari", taking off from Jakkur airfield, after the inauguration, in Bengaluru on August 21, 2017. The cloud seeding project, taken up by Rural Development and Panchayat Raj (RDPR) department at three places including Bengaluru, Gadag and Yadgir, at the cost of state's exchequer a whopping Rs 35 crore. Photo: K. Murali Kumar | Photo Credit: [K MURALI KUMAR](#)

While the Goods and Services Tax (GST) regime and Central clearances delayed Project Varshadhari, a cloud seeding initiative, by at least 10 days, a government ceremony and the frills accompanying it saw a weather modification aircraft miss its date with the clouds.

On Monday, the 60-day, 35-crore programme was launched at Jakkur Aerodrome with the hope of seeding clouds in a 20-sq. km area at Magadi. Though the modified flight was scheduled to take off at 2.45 p.m., by the time the photo-ops were done and the last-minute decision to flag off with the 'Kannada' flag fulfilled, the aircraft — carrying three State Ministers — had lost its clearance window for take-off.

It then had to wait for more than an hour until trainee aircraft from the nearby Air Force base at Yelahanka finished their sorties.

According to members of the project monitoring committee, Magadi was chosen as there was an expectation of conducive cloud formation on Monday afternoon. But it was only at 4.50 p.m. that the flight took off, and most of the clouds had passed by then. In the end, three flares of chemicals were fired and two clouds seeded.

"The best time for seeding is generally between 1 p.m. and 4 p.m. With the function and the delays, the clouds dissipated. But this was just an experimental flight to show how the system works," an official said.

### Behind schedule

Over the next 60 days, a small plane will spray chemicals on 'growing clouds' in the hope of condensing water particles and increasing precipitation.

Though the project has been launched to capitalise on monsoons clouds, H.K. Patil, Minister for Rural Development and Panchayat Raj, said it was 10 days behind schedule. "There were delays in getting Central clearances and because of GST," he said.

As reported by *The Hindu*, three weather-monitoring radars were stuck at the Kempegowda International Airport for over a week because of confusion over GST. The aircraft and radars were being imported from the United States and this required clearance from numerous Central agencies.

However, Mr. Patil said there was still enough time to increase rains in the seeded areas by 15-20%.

### Full system within a week

With the weather-monitoring radars still being commissioned, cloud seeding will commence fully within the next four days, said H.P. Prakash Kumar, chief engineer, Rural Development and Panchayat Raj Department, and project in-charge. "For the next few days, we will try to seed

clouds in southern Karnataka, based on where rain-bearing clouds are and if the areas to benefit are rain-deprived. Once the radars are set up, we will extend this to the three basins,” he said.

### **Better equipment**

It was in 2003 that Project Varuna, a cloud seeding project, was launched by the then Minister for Water Resources H.K. Patil. While the results of that project have been subject to debate, this time around the monitoring committee of meteorologists and cloud physicists expects better results. “The radars and the aircraft are more sophisticated and whether clouds are seeded can be assessed within 10 or 15 minutes. This will increase the success rate of seeding,” said Ram Sagar, senior scientist at the Indian Institute of Astrophysics.

Mature sandalwood trees in Bengaluru to have anti-theft sensors to alert guards

Local magistrate has remanded Siddalinga Swamy in judicial custody for 10 days

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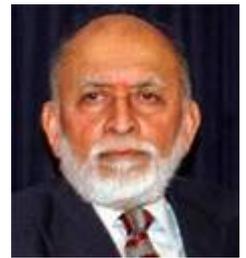
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70 years of Independence

Special Feature – I-Day 2017

## India's Atomic Energy Programme



**\*Dr. M.R. Srinivasan**

India entered the atomic age, more correctly the nuclear age, on 4<sup>th</sup> August 1956 when Apsara, India's first nuclear reactor, went into operation. This reactor was designed and built by India with the nuclear fuel supplied from the United Kingdom under a lease agreement. Our second reactor for research purposes, CIRUS, was built with cooperation with Canada and went into operation in the early 1960's. The research reactors were platforms for conducting research in neutron physics, studies in the behaviour of materials under neutron irradiation and for production of radio isotopes. The latter are very useful for diagnostics and treatment of various ailments, especially cancer, and also very useful in industrial applications, especially for the purpose of non-destructive testing.

Electricity production using nuclear energy commenced in October 1969 when the two reactors at Tarapur were put into service. The Tarapur Atomic Power Station (TAPS) was built by General Electric of USA and is now in its forty-eighth year of service. Tarapur supplies the lowest cost non-hydro electric power in the country. India's second nuclear power station came up in Rajasthan, near Kota, the first unit of which went into operation in August, 1972. The first two units at Rajasthan were built in collaboration with Canada, who pioneered reactors that could use natural uranium as fuel. They, however, required heavy water, present in extremely small quantities in ordinary water and can be extracted through complex processes.

India's third nuclear power station came up at Kalpakkam, near Chennai. This station was designed and built by India, on its own. All the material and equipment were produced in the country. This was a huge challenge as Indian industry at that time, had no experience in making complex equipment required for nuclear applications. Special materials like nuclear fuel, zirconium components and heavy water production required extensive work in the laboratories of the Bhabha

Atomic Research Centre (BARC). Pilot plants were built and later scaled up to industrial plants. Industry had to be trained in special manufacturing processes and novel quality testing procedures introduced. Thus, when the first unit of the Madras Atomic Power Station (MAPS) started up in July 1983, India joined a small group of countries which could design and build nuclear power units on their own.

Our fourth nuclear power station came up at Narora, on the banks of river Ganga. This site has experienced earthquakes in the vicinity. So we evolved designs capable of withstanding any foreseeable earthquake that could visit the site. We also standardized the design of a 220 MW unit that could be built at a number of sites in the country. The first unit of Narora started up in October 1989. In the next twenty years, India built and commissioned eleven 220 MW units and two 540 MW units, all based on its own technology called 'Pressurised Heavy Water Reactors'. To accomplish this task, India also built up a strong heavy water production capability and fuel production, including mining of uranium in Jharkhand. Indian industry was mobilized to produce the entire range of equipment and materials to support the nuclear power programme.

Since India was keen to augment the nuclear capacity rapidly, it entered into a collaboration with the former Soviet Union in 1988 to build two 1000 MW reactor power units using enriched uranium as fuel. Due to the implosion of the Soviet Union in 1990 and the economic difficulties India faced at the time, the Indo-Russian project was put on the back burner. In 1998, India and Russia decided to embark on this project, and work at site commenced in 2003. When the commissioning activities on the first unit were in progress, the accident in Fukushima, Japan, occurred in March 2011. This triggered a strong opposition to the project amongst people living in the neighborhood. It took considerable time and patient explaining to inform the public at large about the safety features at Kudankulam and also how the site conditions there were completely different from those at the Japanese site. The first unit at Kudankulam went into operation in 2014 and the second in 2016.

India now has twenty-one reactor units in service. The first unit at Rajasthan supplied by Canada has been out of service due to some equipment deficiencies. The other units with a total capacity of 6700 MW have been operating reliably. The plant load factor for the five years from 2011 to 2016 has been about 78%. The nuclear power units have been supplying power at Rs. 2 to Rs. 3.50 per kwh (Kilowatt hour). In fact the cost of power from Tarapur has been less than Rs. 1/kwh. For Kudankulam units 1 and 2, it is about Rs. 4 per kwh.

The cost of installing Indian designed and built nuclear power unit is about Rs. 16.5 crores/MW. For the Russian reactors, the cost is about Rs. 22 crores/MW. Since the fuelling cost of the Russian reactors is lower than those of the Indian reactors, both of them produce power at about Rs. 5/kwh. This cost, when escalated to the time horizon of 2023-24, will come to about Rs. 6.5 per kwh. Coal based power in regions far away from coalfields would cost more in the same time horizon. Solar power for recent projects costs about Rs. **2.5/kwh**, but an expenditure of Rs. 2 /kwh is needed to connect the solar units to the grid system, taking the total cost to **Rs. 4.5/kwh**.

India signed cooperation agreements with the USA and France in 2008 and they provided for building nuclear power units designed in these countries to be set up in India. Negotiations have been going on from then on. However, the leading nuclear power plant builder in the US, namely Westinghouse filed for bankruptcy a few months ago. AREVA of France lost a lot of money on their nuclear fuel business following the Fukushima accident. The French government allocated the nuclear reactor business to their national electric utility, Electricite' de France. There is considerable uncertainty, therefore, with regard to cooperation with USA and France.

Given this scenario, the Government of India decided to build ten India designed 700 MW Pressurized Heavy Water Reactors in June 2017. The Nuclear Power Corporation had scaled up the 540 MW size units to 700 MW and started work, two at Kakrapara (Units 3 and 4) and two at Rajasthan (Units 7 and 8). This is one of the biggest single commitments in nuclear power, after the Fukushima accident of 2011. This programme will provide Indian industry with sustained workload for a period of a decade and establish India firmly as an important player in this field.

Work has commenced on Units 3, 4, 5 and 6 at Kudankulam. Russia has offered to build six 1200 MW units at a second site to be identified by India. As a parallel activity, India has designed the 'Indian Pressurised Water Reactor' of 900 MW capacity, using enriched uranium as fuel. Work on two such units may be taken up soon, to be followed thereafter by series building. At Kalpakkam, the Prototype Fast Breeder Reactor of 500 MW is in the process of commission. Two reactors of 600 MW of similar design may follow. The Bhabha Atomic Research Centre has completed the design of a 300 MW reactor called 'Advanced Thermal Reactor' which would use thorium. Our long term plans to use thorium depend on fast reactors and thorium based systems.

Not elaborated in this article are activities in the field of research, reprocessing of spent fuel, development of accelerators and so forth. The department of Atomic Energy has been actively engaged in supplying radio isotopes to hospital and industry, in the use of radiation technologies for preventing spoilage of marine foods, spices and for enhancing the shelf life of onions, mangoes and other food articles, as well as in sterilization of medical products.

We may thus foresee, in the decades ahead, nuclear energy making an important contribution as carbon-free energy, and nuclear technologies offering benign solutions in enhancing the quality of life of our people.

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*\*The author is Former Chairman and presently Member, Atomic Energy Commission.*

*Views expressed in the article are author's personal.*

*(The feature has been contributed by PIB Chennai)*

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**India carves a unique place in space****\*K V Venkatasubramanian**

More than 53 summers ago, India had successfully put its first signature on space by launching the US-made 'Nike-Apache' two-stage sounding rocket (the first rocket) from Kerala's obscure fishing hamlet Thumba.

There were no buildings at the Thumba Equatorial Rocket Launching Station (TERLS) on Thiruvananthapuram's outskirts. The bishop's house doubled up as the Director's office, the ancient St. Mary Magdalene church building became the control room and naked eyes tracked the smoke plume on November 21, 1963. Bullock carts and bicycles carried rocket parts and payloads to the launch pad.

About 12 years later, in 1975, India launched its first-ever experimental satellite, Aryabhata, on a Russian rocket. Lacking infrastructure, scientists at the Indian Space Research Organisation (ISRO) in Bangalore converted even a toilet into a data receiving centre.

From taking its first baby steps in Thumba, the Indian space odyssey has traversed numerous landmarks. ISRO has emerged as a key player in global satellite launches and the manufacturing industry. The nation has earned global recognition for launching lunar probes, built satellites, for others too, ferried foreign satellites up and even succeeded in reaching Mars.

Through these decades, India's space programme has focused on national imperatives, and social and economic well-being of society—specifically in earth observation and application for management of natural resources in agriculture, water, fisheries, and watershed mapping and development. Space-based applications like tele-education and tele-medicine have enabled greater access to rural population to these basic needs.

Space exploration missions have surged ahead during the past three years. India's latest communication satellite GSAT-17 on board an Ariane 5 rocket lifted off from French Guiana on June 28. It will strengthen ISRO's current fleet of 17 operational telecom satellites and provide meteorological and satellite-based search and rescue services--earlier provided by the Indian National Satellite System (INSAT).

In a boost to Prime Minister Narendra Modi's vision to project India as a global low-cost provider of services in space, ISRO launched on June 23 the PSLV C38 carrying 712 kg Cartosat-2 satellite for earth observation and 30 other tiny satellites, several of them for European countries. This

was PSLV's 39th consecutively successful mission.

India entered the big league of space technology on June 5 this year with the launch of its most powerful, homegrown and heaviest-ever rocket---the Geosynchronous Satellite Launch Vehicle Mark-III (GSLV Mk-III D 1)--carrying GSAT-19 communication satellite. The high-tech 3,136 kg workhorse established ISRO's capability to transport four-tonne satellites and test a homegrown cryogenic engine, and also paved the way to send humans, one day, beyond Earth's atmosphere. Now, Indian communication satellites can be lofted into space from within the country. So far, only the USA, Russia, Europe, China and Japan have launched space satellites weighing 4,000 kg and more.

Earlier on May 5, India catapulted the first-ever South Asia Satellite (SAS) to boost communication and improve disaster links among its six neighbours--Afghanistan, Bangladesh, Bhutan, the Maldives, Nepal and Sri Lanka. Following the launch of the 2,230-kg GSAT-9, built by ISRO and funded entirely by India, on board the GSLV-F09 rocket, the prime minister had said the "unprecedented" development sent out a message that "even sky is not the limit when it comes to regional cooperation".

In February, India scripted a new chapter in the history of space exploration and grabbed world headlines by hurling 104 satellites, a record, including the Cartosat-2 series satellite, in one mission—aboard a Polar Satellite Launch Vehicle (PSLV C-37). The rocket carried payloads from six different countries. The master stroke established India as the launch service provider for small satellites.

These spectacular achievements have placed ISRO in a commanding position in the space race. The prime minister's soft spot for space and ISRO were reflected in a substantial 23 per cent increase in this year's budget allocation for the Department of Space.

In 2016, among the major achievements were the successful launching of the remote sensing satellite RESOURCESAT-2 in December, a record lobbing of 20 satellites in a single payload in June and three navigation satellites and the GSAT-18 communication satellite.

ISRO hoisted the GSAT-15 communication satellite and the Multi Wavelength Space Observator ASTROSAT in 2015. It also ground tested the indigenously developed high thrust cryogenic rocket engine. Besides, five satellites were launched in July by PSLV and the IRNSS-1D, the fourth satellite in the Indian Regional Navigation Satellite System (IRNSS), in March.

In December 2014, the communication satellite GSAT-16 was launched. PSLV hoisted the country's third navigation satellite IRNSS-1C in October and the second dedicated navigation satellite IRNSS-1B in April.

In the years ahead, ISRO scientists have a busy schedule. A series of satellite launches is in the works. In early 2018, the space agency will launch two lunar missions, Chandrayaan-2, an advanced version of Chandrayaan-1. The indigenous initiative comprises an orbiter, lander and

rover, which are expected to perform mineralogical and elemental studies of the lunar surface. The other is in collaboration with Team Indus, a group of space enthusiasts.

The next grand project is the scientific mission to the Sun for observing the solar corona (with a Coronagraph--a telescope), photosphere, chromosphere (Sun's three main outer layers) and solar wind. To be launched by PSLV-XL by 2020, Aditya-L1 satellite will probe why solar flares and solar winds disturb the communication network and electronics on earth.

Further, ISRO will return to Mars, probably during 2021-2022, with a second Mars Orbiter Mission (MOM) spacecraft, Mangalyaan 2. Come September 24, India's first-ever interplanetary robotic probe, Mangalyaan 1, still going strong, will celebrate three years of landing on the Red Planet. India had created history by becoming the first nation to enter the Mars orbit on a maiden mission--also the cheapest such mission till now.

For the first time, India will have a date with Venus, beyond 2020. The Venusian orbiter mission will study the planet's atmosphere.

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*\*The author is an independent journalist and columnist, with four decades of experience in all media streams--print, online, radio and television. He writes on developmental issues.*

*Views expressed in the article are author's personal.*

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## Demystifying Science: What is Vaccinia?

The Vaccinia virus (VACV or VV) is a large, complex, enveloped virus belonging to the poxvirus family. It has a linear, double-stranded DNA genome approximately 190 kbp in length, and which encodes approximately 250 genes. The vaccinia was at the heart of the modern smallpox vaccine. History has it that Edward Jenner isolated a cowpox virus and injected it into a boy. This protected him from small pox and birthed the vaccination era. However, recent work finds that Jenner may not have just used a cowpox virus. What he used may have contained even the horsepox virus and slivers of other viruses too. This cocktail makes up vaccinia and there are new investigations into its genetic structure to make it amenable to new kinds of vaccines. A new article in the journal *Lancet Infectious Diseases* suggests that the smallpox vaccine might actually have come from horses.

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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## IISER Mohali: Spider silk, a material for the future

Multifaceted: Spiders can make seven types of silk from different glands, each tuned to a special task | Photo Credit: [K R DEEPAK](#)

Spider silk is a biomaterial that has come to intrigue many in recent times. With five times the strength of steel of comparable weight, it offers immense possibilities for applications, however the difficulty in processing it and also welding it with other excellent materials were posing a challenge. Now, researchers at IISER Mohali have demonstrated how to overcome these challenges using a femtosecond laser pulse. They have succeeded in cutting and manipulating spider silk and making tiny objects of complex geometries such as braids and Mobius bands out of it. Their research is published in *Nature Materials*.

The early use of spider silk material was in microscopes, telescopes, guns and bomb-guiding systems as cross hairs in the optical elements. Since then, its extraordinary properties have been discovered. During spinning of the silk, amino acids arrange themselves as tiny nanocrystals embedded in a soft amorphous matrix of molecular nanosprings. While the amorphous regions provide elasticity, the nanocrystalline domains are optimized to provide great strength, explains Kamal P. Singh, School of Physical Sciences, IISER Mohali, who has carried out the research with Mehra S. Sidhu, a Post Doctoral Fellow at the department and first author of the paper.

“We collect spiders from gardens near Mohali and Chandigarh and grow them in large plastic boxes... to collect silk, we make the spider jump from a stick. It immediately suspends its body with a silk known as dragline silk. This is typically a few micrometer in diameter and is the strongest type of silk,” says Prof. Singh. Spiders can make seven types of silk from seven different glands. Each is tuned to perform a special task. For instance, capture silk is much more elastic with glue drops to trap the prey. The silk it makes to hold its babies can be softer, he explains in an email.

The researchers' key innovation was that femtosecond (fs) laser pulses of duration about 10 fs can effectively process the silk fibre with minimal damage to its properties. They have also shown that these pulses can be used to weld the silk fibre with metals, glass and polymers to produce combinations that come in useful.

“The femtosecond pulses in our study were produced with commercial lasers. But we had to design our own experimental setup to target these pulses on the fine silk fibre precisely,” says Prof. Singh. A femto second is a millionth of a billionth of a second. “The mechanism of interaction of the silk with sub-10 femtosecond pulses was not known previously,” he adds.

The high strength and elasticity of the material makes many applications possible. They can be used, the researchers explain, in building radiation pressure meters. Radiation pressure can be felt when the momentum carried by photons is transferred to objects in its path. This is the operating principle of optical tweezers for instance. “With NASA trying to build tiny satellites and space vehicles that can be propelled in space by the pressure of sunlight (without burning fuel), it is important to develop sensors that can measure these tiny forces accurately,” says Prof. Singh.

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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## Biomarker tells of tongue cancer spread

Researchers Amit Dutt, left, and Sudhir Nair of the Tata Memorial Centre.

Researchers at the Tata Memorial Centre in Mumbai have identified a biomarker that will help doctors decide whether patients with early-stage tongue cancer should undergo neck surgery to remove 20-30 lymph nodes. Patients negative for the biomarker can be spared of neck dissection.

Studies were carried out on 57 patients. In nearly 70% of patients with early-stage tongue cancer, the tumour does not spread to the lymph nodes.

But in the absence of a reliable biomarker capable of pointing out in which patients the disease will recur, doctors routinely remove the affected part of the tongue and the lymph nodes in all patients with early-stage tongue cancer.

Nearly 80% of patients survive and are disease-free if tongue cancer is detected early. But once cancer spreads to the lymph nodes, the survival rate reduces to 40%.

“Currently, surgical removal of lymph nodes and studying them is the only way of knowing if the cancer has spread,” says Dr. Sudhir Nair from the division of head and neck oncology at the Tata Memorial Centre and one of the authors of the paper.

“The discovery of the biomarker — MMP10 protein — potentially fills this gap. Only those patients who have higher level of this protein [overexpression] are likely to have cancer spread to the lymph nodes. So the biomarker will help doctors to decide which patients could be spared of complex surgeries to remove the lymph nodes,” says Dr. Amit Dutt from the integrated genomics laboratory at the Tata Memorial Centre and the leader of the research team. The results were published in the journal *Oral Oncology*.

The biomarker can be identified using a simple immuno histochemical analysis, a method to locate proteins in tissue sections.

The researchers validated their findings using data of 253 patients from the Cancer Genome Atlas and other studies.

“The MMP10 biomarker was significantly higher in four of the five data sets,” Dr. Dutt says. “We will be further validating our finding using 500 samples collected by our hospital during an earlier trial.”

The 57 patients studied were negative for human papillomavirus (HPV) but were habitual users of chewing tobacco.

Although chewing tobacco has been associated with oral cancer, there has been no direct evidence linking the two at the genome level. This study has for the first time shown a direct link between chewing tobacco and tongue cancer.

Those chewing tobacco had a classic signature in the genome in the form of a specific type of mutation (transversion mutation). “In our study, 53% of all patients have this tobacco signature. This mutation is driven by tobacco usage,” says Dr. Pawan Upadhyay, the first author of the study.

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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## Commerce and Industry Minister Sets up Task Force on Artificial Intelligence for Economic Transformation

### Commerce and Industry Minister Sets up Task Force on Artificial Intelligence for Economic Transformation

Commerce and Industry Minister Smt. Nirmala Sitharaman has constituted a Task Force on Artificial Intelligence (AI) for India's Economic Transformation. The Minister said with rapid development in the fields of information technology and hardware, the world is about to witness a fourth industrial revolution. She said driven by the power of big data, high computing capacity, artificial intelligence and analytics, Industry 4.0 aims to digitise the manufacturing sector. Smt. Sitharaman said the panel will comprise of experts, academics, researchers and industry leaders and will explore possibilities to leverage AI for development across various fields.

The task force will submit concrete and implementable recommendations for government, industry and research institutions .

The task force will have the following members

- |     |  |                 |
|-----|--|-----------------|
| 1.  | Dr. V. Kamakoti, IIT Madras  | Chairpers<br>on |
| 2.  | Mr. Anuj Kapuria, High Tech RoboticSystemz Ltd.  | Member          |
| 3.  | Dr. Anurag Agarwal, Institute of Genomics & Integrative Biology, CSIR  | Member          |
| 4.  | Dr. Ashish Dutta, IIT Kanpur   | Member          |
| 5.  | Ms. Ashwini Asokan, Mad Street Den, Chennai  | Member          |
| 6.  | Mr. Gautam Shroff, Vice President & Chief Scientist, TCS Innovation Labs, Tata Consultancy Services, Gurgaon | Member          |
| 7.  | Mr. G. H. Rao, HCL Technology  | Member          |
| 8.  | Mr. G. Madhusudan, IIT Madras  | Member          |
| 9.  | Mr. G. V. N. Apparao, Ex-Chief Technology Officer (CTO), Cognizant   | Member          |
| 10. | Ms. Komal Sharma Talwar, Founder, XLPAT  | Member          |
| 11. | Mr. Kunal Nandwani, Founder & CEO, uTrade Solutions  | Member          |
| 12. | Dr. Shantanu Chaudhary, IIT Delhi, Department of Electrical Engineering                                      | Member          |
| 13. | Mr. Vijay Kumar Sankarapu, Founder & CEO, Arya.in  | Member          |
| 14. | Mr. Ajay Kumar, Additional Secretary, Ministry of Electronics & IT   | Member          |
| 15. | Mr. Amandeep Gill, Ambassador/PR to CD, Geneva   | Member          |
| 16. | Mr. K. Nagaraj Naidu, Joint Secretary (ITPO), Department of Economic Affairs, Ministry of Finance            | Member          |
| 17. | Dr. Alope Mukherjee, DRDO  | Member          |
| 18. | Mr. Ravinder, Joint Secretary, DIPP, Ministry of Commerce & Industry   | Convenor        |

In addition to regular members, official participation from the following organizations shall also be requested:

1. NITI Aayog,
2. Ministry of Electronics and Information Technology

3. Department of Science & Technology
4. UIDAI
5. DRDO.

**MJPS**

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## Ultra-thin carbon nanotubes can separate salt from seawater

Increasing demands for fresh water pose a global threat to sustainable development, resulting in water scarcity for four billion people, researchers said. | Photo Credit: [Reuters](#)

Scientists have developed carbon nanotubes over 50,000 times thinner than a human hair which can separate salt from seawater, an advance that may help solve the global water crisis.

Increasing demands for fresh water pose a global threat to sustainable development, resulting in water scarcity for four billion people, researchers said.

Current water purification technologies can benefit from the development of membranes with specialised pores that mimic highly efficient and water selective biological proteins.

Scientists, including those from Northeastern University in the U.S., developed carbon nanotube pores that can exclude salt from seawater.

The team found that water permeability in carbon nanotubes (CNTs) with diameters of 0.8 nanometre significantly exceeds that of wider carbon nanotubes.

The nanotubes, hollow structures made of carbon atoms in a unique arrangement, are more than 50,000 times thinner than a human hair.

The super smooth inner surface of the nanotube is responsible for their remarkably high water permeability, while the tiny pore size blocks larger salt ions.

“We found that carbon nanotubes with diameters smaller than a nanometre bear a key structural feature that enables enhanced transport,” said Ramya Tunuguntla, a postdoctoral researcher at Lawrence Livermore National Laboratory (LLNL) in the U.S.

“The narrow hydrophobic channel forces water to translocate in a single-file arrangement, a phenomenon similar to that found in the most efficient biological water transporters,” said Tunuguntla.

Computer simulations and experimental studies of water transport through CNTs with diameters larger than one nanometre showed enhanced water flow, but did not match the transport efficiency of biological proteins and did not separate salt efficiently, especially at higher salinities.

The key breakthrough achieved by the LLNL team was to use smaller-diameter nanotubes that delivered the required boost in performance.

“Carbon nanotubes are a unique platform for studying molecular transport and nanofluidics,” said Alex Noy principal investigator at LLNL.

“Their sub-nanometre size, atomically smooth surfaces and similarity to cellular water transport channels make them exceptionally suited for this purpose, and it is very exciting to make a synthetic water channel that performs better than nature’s own,” said Noy.

The research was published in the journal *Science*.

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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*70 years of Independence*

*Special Feature – I-Day 2017*

## The Urge to Make Own Science after 1947



**Ratnadeep Banerji**

The inception of modern science in India and its passage has left its lasting imprint for the posterity to dwell upon the subsequent proliferation of science. Indian scientists were not given the credits of discoveries which were passed on to British officers even if they didn't have anything to do with the discovery. Scientific fingerprinting was born in India but the laurels were heaped on others, the naming of Everest was not justified among many such other instances. The Indian Independence in 1947 brought the urge to explore, indigenize and also usher in modern science and nurture sophisticated technologies. And now Indian detection of gravitational waves opens up new frontier for understanding of universe!

During the period of Independence, Particle physics in India was highly developed and the world recognition followed. Bose-Einstein collaboration and findings of Meghnad Saha are some exemplary instances. The study of natural sciences was on full swing. The Botanical Society of India and Zoological Society of India came forward with the uncharted flora and fauna of the planet. Paleobotany flourished under Birbal Sahni. The Geological Survey of India and the Survey of India had laid its modicum of research areas that later bore results at the hands of people like D.N Wadia and Radhanath Sikdar respectively.

Meghnad Saha ushered in stellar astrophysics. He started the physics department in Allahabad University and Institute of Nuclear Physics, National Academy of Science in 1930, Indian Physical Society in 1934 and the Indian Institute of Science in 1935, Saha Institute of Nuclear Physics in 1943, and the Indian Association for the Cultivation of Science in Kolkata. Meghnad Saha was also the chief architect of river planning in India. He made the original plan for Damodar Valley Project. C.V. Raman excelled in astrophysics while working at the Indian Association of Cultivation of Science, the cornerstone of modern science in India founded in the earlier century by Mahendralal Sircar.

S.N.Bose became an advisor to the newly formed Council of Scientific and Industrial Research (CSIR). He was the President of Indian Physical Society and the National Institute of Science. CSIR has been ranked 12<sup>th</sup> in the world, amongst the government institutions, improving its position after being at the 14<sup>th</sup> position for three consecutive years, with an overall global ranking of 99 in the world during 2016, according to the report of SCImago Institutions Rankings. On an average, CSIR files about 250 Indian patents and 300 foreign patents per year. About 13% of CSIR patents are licenced, that remains above the global average. The indelible ink used during the General Elections in India was developed by CSIR in 1952. This innovation of CSIR is now exported to more than 25 countries including Canada, Turkey and South Africa. Subsequently, the

Indian Institutes of Technology came up in Kharagpur in 1951 and charted a seminal course of Indian research and technology.

## **Global Exploration**

Indian Arctic program started in 2008 with the setting up of Indian research base, Himadri. In 2012, India became a member of the International Arctic Science Committee and in 2013, India was accorded permanent observer state in the Arctic Council. So far, there have been 42 expeditions, 5 teams per year. In 1981, Indian scientists had reached the Antarctic and set up Bharati station. In 2014, India's first moored observatory was deployed in the Arctic. In 2015, India became a part of International Ocean Drilling Program in the Arabian Sea.

## **Science for Societal Benefit**

*Science without Humanity [is sin]*, maintained Gandhiji. One apt instance of science benefiting livelihood is the Potential Fishing Zone Services for all 14 sectors of the Indian coastline. It has increased the net profit of fishermen by 3-4 times in the range of 34,000 to 50,000 crore. From one village of 32 fishing boats, there is diesel saving of 70,000 litres per month. 40% users are small craft fisher folk who have witnessed an average increase of 16,000 Rs in their income when fishing in Potential Fishing Zones. Earthquake monitoring, cyclone predictions and Tsunami Warning System are safeguards against vagaries of nature.

Rural Technology Action Group (RuTag) of IIT Delhi at behest of the Ministry of Human Resource Development (MHRD) has launched a programme called Unnat Bharat Abhiyan with an aim to connect institutions of higher education, including Indian Institutes of Technology (IITs), National Institutes of Technology (NITs) and Indian Institutes of Science Education & Research (IISERs) etc with local communities to address the development challenges through appropriate technologies.

In the latest trend, India has caught up with interdisciplinary studies benefiting health sciences and agriculture in a profound way. The Indian scientists prodded by the present government have taken up the daunting task of scientific validation of Ayurvedic formulations to be brought under the category of standardized medicine in the ambit of modern science. There are dozens of institutes under different ministries working in this direction. There are efforts to do the same for folk medicines of North East India and some other places too. Similar steps have been taken for Tibetan medicine and Unani medicines too. A national facility for Current Good Manufacturing Practice (cGMP) pilot plant for extraction, formulation and packaging of traditional herbal medicines has come up at CSIR-Indian Institute of Integrative Medicine (CSIR-IIM), Jammu. Here WHO guidelines are adhered with. The whole Genome Sequencing of basil has also been achieved to better understand traditional knowledge around it. The creation of Traditional Knowledge Digital Library to fight against bio-piracy is a victory.

Department of Biotechnology has become a cynosure for becoming a leading vaccine manufacturing hub. One out of six children over the world receives vaccines manufactured in India. India is among the top 12 biotech destinations in the world and ranks third in the Asia-Pacific region. An act has been passed in 2016 towards the setting up of Regional Centre for Biotechnology under UNESCO.

India once faced the scourge of brain drain that has now turned into brain gain with technocrats preferring to work in India than immigrating offshore. Schemes like New Millennium Indian Technology Leadership Initiative are bolstering entrepreneurship as well as R&D heralding new technologies.

*\*The author is a senior journalist and a radio documentary maker.*

*Views expressed in the article are author's personal.*

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## U.S. approves first gene therapy for cancer

An IV bag of the drug Kymriah.

The United States approved the first gene therapy in the nation on Wednesday — a treatment that uses a patient's own immune cells to fight childhood leukaemia.

The treatment is made by Novartis and is called Kymriah (tisagenlecleucel).

This type of immunotherapy, known as a CAR-T cell therapy, was known by the term CTL019 until now.

It was approved by the U.S. Food and Drug Administration for children and young adult patients up to age 25 with a form of acute lymphoblastic leukaemia.

'Historic action'

The FDA described the approval as "a historic action" that would usher "in a new approach to the treatment of cancer and other serious and life-threatening diseases," said a statement.

Studies have shown that 83% of patients responded to the treatment, achieving remission within three months.

The treatment is not a pill or a form of chemotherapy. It uses a patient's own immune cells, called T-cells, along with white blood cells.

These cells are removed from a patient, sent to a lab, and encoded with a viral vector, reprogrammed, and returned to the patient.

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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## ISRO's IRNSS-1H satellite launch unsuccessful

Launch of PSLV-C39/IRNSS-1H is scheduled on August 31, 2017 at 19:00 hrs from Satish Dhawan Space Centre, SHAR, Sriharikota. Photo: ISRO

India's attempt to launch its eighth regional navigation satellite failed on Thursday. The satellite IRNSS-1H didn't come out of the heat shield as it should have, though the rocket's lift off was as planned.

Confirming that the launch was unsuccessful, ISRO chief A.S. Kiran Kumar told mediapersons, "There was no problem in any of the stages. But the heat shield has to separate. And once that happens the satellite gets into the orbit. It got separated internally. But it's enclosed within the heat shield in the fourth stage."

"We are getting into the details of what has happened," he added.

IRNSS-1H was being sent to space to back up — and mostly replace — the functions of India's first navigation satellite. IRNSS-1A was launched four years back. Indian Space Research Organisation had to quickly get two back-ups ready when all three rubidium atomic clocks on 1A failed around mid-2016. Mr. Kumar had earlier said 1H had atomic clocks that had been corrected and improved.

Between 2013 and 2016, ISRO put up seven IRNSS satellites to form the Indian Regional Navigation Satellite System, since called NavIC or Navigation with Indian Constellation.

NavIC is the Indian regional version similar to the U.S. Global Positioning System GPS. It will drive all position-based activities on ground, sea and air, by giving near accurate location details of persons or objects. It will be used for military, commercial and common everyday uses.

An earlier version of the article incorrectly mentioned the launch was successful. Actually it was the PSLV lift-off that was successful. The error is regretted.

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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