



# E-NEWS

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**HAL bags fresh orders to supply 41 Advanced Light Helicopters**

**Driverless hover-taxi makes first 'concept' flight in Dubai**



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Bangalore 560 075  
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Telefax: +91 80 25273851  
Email: editoraesi@yahoo.com

### Publication Team

Dr R Balasubramaniam  
Dr S Kishore Kumar  
Dr P Raghothama Rao  
Dr Satish Chandra  
Mrs Chandrika R Krishnan  
Mr Hemanth Kumar R

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### Head Quarters

The Aeronautical Society of India  
13-B, Indraprastha Estate  
New Delhi 110 002, India  
Tel: +91 11 23370516  
Fax: +91 11 23370768

### NAL starts taxi trials of improved Saras

Saras, one of the first attempts at making small, short-haul planes in the country, is rolling on its wheels after eight years, warming up before it tests its wings again. A modified prototype of the 14-seater transport aircraft started making low-speed taxi trials in early August. Air Force pilots have completed five runs of around 45 minutes each and will next move on to high-speed taxi tests, according to Jitendra Jadhav, Director, National Aerospace Laboratories, under the Council for Scientific & Industrial Research (CSIR). Dr. Jadhav said, “We plan to fly the aircraft in the first week of October after the high speed taxi trials are completed. We made more than 10 modifications since the accident. The performance of the plane’s systems after the modification will be evaluated during the flights.” About 25 flights are planned in the first set of the modified prototype, the PT1N, he recently told. By the end of 2019, NAL plans to fly a production-standard version for air-worthiness certification. Except for minimum maintenance engine runs, the 14-seater aircraft has not taxied or flown since one aircraft version crashed near Bengaluru in 2009 killing all three crew members. In February this year, the Minister of Science & Technology — in whose purview NAL and other CSIR labs fall — said the government was intent on completing the plane’s development and making it flight worthy. The revival activities started with five ground-runs of its two Pratt & Whitney engines followed by the taxi trials. A few more LSTTs [low speed taxi trials] are due. The 10-odd modifications were made to make it more pilot-friendly, agile, or easy to control; and to enable it to fly higher. The final Saras is planned to be able to cover 1,600 km at a maximum speed of 425 kmph, have a service ceiling of 9-10 km and fly continuously for five hours. Dr. Jadhav outlined the roadmap: “After the trial flights, the design configuration of Saras is targeted to be frozen by March 2018 as production standard. By then we should have reduced the weight and drag issues. We would have made improvements in avionics, glass cockpit, environment control systems, cabin pressure control systems and a few changes in flight control systems. We then go in for funding [from the government] for two limited series production vehicles and a static specimen. “The current plan is that we start flying the LSPs by December 2019 for final certification,” he said. When ready, Saras, initiated in 1999 as a civil light transport plane, will first get certified for military use. The Indian Air Force has indicated a need for 15 of them. A civil variant is to follow. Full-scale production is scheduled to be taken up in 2020 at the Kanpur facility of Hindustan Aeronautics Ltd - where HAL produces its Dornier-228 transport aircraft. The project has used up around 1 500 crore. Dr. Jadhav said, “We need around 1 550-660 crore to produce two LSP versions. We will move the necessary papers after the first flight.”



Source: <http://www.thehindu.com/>

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### **HAL bags fresh orders to supply 41 Advanced Light Helicopters**

Defence PSU Hindustan Aeronautics Limited (HAL) has bagged fresh orders to supply 41 Advanced Light Helicopters (ALH)-40 to the Indian Army and one to the Indian Navy-that will boost its order books by Rs 6,100 crore. "The latest order reflects the trust on HAL's capabilities and gives an impetus to make-in-India campaign. It reposes faith of Indian Defence forces in indigenous ALH which has been serving them with distinction for a long time," HAL Chairman and Managing Director T Suvarna Raju said. The contracts for the supply of 41 ALHs will be executed in a period of 60 months and adds to the 32 ALH ordered by the Indian Navy (IN) and Indian Coast Guard (ICG) in March. The indigenously designed and developed chopper is a twin engine, multi-role, multi-mission new generation helicopter in the 5.5 tonne weight class. The helicopter has been certified for military operations by the Centre for Military Airworthiness Certification (CEMILAC) and civil operations by the Directorate General of Civil Aviation (DGCA). While the helicopter is currently being manufactured at the HAL Helicopter Complex in Bengaluru, the PSU will, in the future be using its proposed Tumakuru facility to make them. HAL, which is headquartered in Bengaluru has been vying to set up a helicopter complex, initially targeted at production of LUH in Tumakuru, and Raju had told TOI earlier that activities that support ALH will also be taken up. Over all, he said, the Gubbi Complex would concentrate on Helicopter manufacturing systems, assembly hangars, composites and component manufacturing factories and engine component manufacturing units.

Source: <http://timesofindia.indiatimes.com/>

### **BAE Systems will 'Make in India' howitzers, aircraft and more**

Both the United States and India are very keen that bilateral defence cooperation between the two countries be taken to the next level and have of late initiated several steps to meet this goal. Nik Khanna, Managing Director (India), BAE Systems recently spoke with this correspondent and defence expert on this issue with a particular focus on the benefits in terms of outcome to be expected by Prime Minister Narendra Modi's "Make in India" initiative. The interview was conducted in a question and answer format and runs as follows:

**Col. Anil Bhat: 1. BAE Systems has recently concluded a sale of 145 M777 Ultra-Light howitzers through the US Government Foreign Military Sales route. Could you elaborate on this landmark sale and delivery of the guns?**

**Nik Khanna:** Yes, we are delighted that India and the US agreed the Foreign Military Sale of 145 M777 Ultra-Lightweight howitzers in December 2016 and an order was placed on BAE Systems in January this year. The Company began working with the US Government and the Indian Army immediately. We committed first deliveries of the weapon system would begin within six months of the two Governments' agreement and we are very proud that the first two guns arrived in India ahead of schedule in May for an extensive range firing programme in close collaboration with the US Government and the Indian Army. The next batch, consisting of five guns, will arrive in India in September next year. Our focus is on delivering the programme well and supporting the Indian Army with test-bed and range trials as well as induction. India now joins the US, Canadian and Australian forces in gaining the superior artillery capability of the M777. This ultra-lightweight howitzer will remain at the forefront of artillery technology well into the future through the use of technical insertions, long-range precision guided munition developments and flexible mobility options.

**Col. Anil Bhat 2. What other opportunities is BAE Systems pursuing in India?**

**Nik Khanna:** India is amongst BAE Systems' most important markets. Our India strategy is anchored around working with the Indian defense industry across Air, Land, Sea, Cyber and Advanced Electronics, building on the solid foundations we have in our longstanding association with Hindustan Aeronautics Limited (HAL). We are now partnering with Mahindra and several other Indian companies on the M777 Ultra Lightweight howitzer programme. Building on the success of the Hawk Mk132, which has exceeded 100,000 flying hours with the Indian Air Force and the Indian Navy, we continue to stand by for a potential repeat order to fulfil the Indian Air Force's requirement for its prestigious aerobatic team, the Surya Kiran. BAE Systems and HAL continue to hold positive discussions around collaboration for the provision of fleet support services to India's Jaguar and Hawk fleets. The modernization of land systems including munitions is another area of focus which we are well poised and eager to support.

**Col. Anil Bhat 3. How do you see the Indian defence sector shaping up over the next few years?**

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Nik Khanna: The defence sector in India has embarked on an exciting phase with all three armed forces, focusing on modernization. The Government is continuing to provide a conducive environment with key policies such as Foreign Direct Investment, the new Defence Procurement Procedure including offset policies, and the recently unveiled Strategic Partnership policy towards realizing Prime Minister Modi's vision of Make in India. Over time, these will enable the industry to realise a shared commitment to develop next-generation technologies and platforms for India, in India and from India for the world.

Col. Anil Bhat 4. Make in India is now a critical driver in all defence procurements. As an international OEM, what is your approach to this platform?

Nik Khanna: Make in India has been central to our strategy throughout our long history in India. HAL's production line in Bengaluru where the Hawk aircraft is manufactured from raw material is a demonstration of the success of Make in India in defence manufacturing, and builds on seven decades of BAE Systems and HAL partnership. The Hawk programme is an outstanding success, as was the Make in India Jaguar programme that came before it. The M777 Ultra Lightweight howitzer is an important Make in India programme. We are well positioned partners for participation in the two other Make in India projects, the Futuristic Infantry Combat Vehicle (FICV) and Tactical Communication System (TCS) programmes. Powered by Make in India, we should expect a noticeable reversal of ratios in indigenous manufacturing and imports. Naturally this will require investments and innovation. As a founding partner of defence manufacturing in India, we will continue to invest and grow our footprint and our partnerships, both manufacturing and technology-based, across our capabilities in Air, Land, Sea, Cyber and Advanced Electronics.

Col. Anil Bhat 5. The purchase of a third batch of the Hawk advanced jet trainer for the Indian Air Force's aerobatics team has been on the anvil for some time now? When do you see that concluding?

Nik Khanna: BAE Systems responded to the Request for Proposal from HAL for a potential order to supply products and services for the manufacture of 20 Hawk Advanced Jet Trainer aircraft in 2013. BAE Systems has worked closely with the Indian Ministry of Defence and HAL to establish a production line in India where the aircraft is now manufactured from raw material. This third batch will sustain these high skill jobs in Bengaluru and ensure continuity of the supply chain which also affords improved efficiency in supporting the existing fleet in India. As a Make in India programme, HAL is the Prime Contractor for Batch 3 and BAE Systems stands ready to support HAL in securing this important order. This is a tremendous opportunity to build on the success of Hawk in India and together with HAL; we look forward to giving the Indian Air Force's display team a fantastic aircraft.

Col. Anil Bhat 6. What are your plans for building your base of local suppliers in India?

Nik Khanna: Developing domestic industrial capabilities and an in-country supply chain is a crucial part of our Make in India strategy. Indian companies have demonstrated their eagerness and potential to become part of our global sourcing programmes and we continue to work with them to further develop their capabilities to achieve their ambitions. We have qualified Indian companies into our Hawk global supply chain and also initiated sourcing of Mission Computing and Display System for the P-8 Poseidon aircraft from Kinco Kaman Composites India (KKCI) Private Limited. KKCI is the first supplier in India developed through P-8 industrial commitments by BAE Systems. Looking into the future, with an offset commitment of over \$200 million on the M777 programme, we will open opportunities for the Indian supply chain both locally and globally, creating jobs, enhancing skills and building advanced manufacturing capabilities in India. The establishment of the Assembly, Integration & Test facility with Mahindra will further grow the industrial capacity of India. This one-of-its-kind facility is a fundamental part of the M777 production line and will enable the Indian Army to access maintenance, spares and support for the M777 locally.

Col. Anil Bhat 7. Are you also interested in the Indian Navy's 20mm and 40mm guns programs? If so, what are your offers to meet these two requirements of the Indian Navy?

Nik Khanna: We are committed to partner India in modernisation of its forces in partnership with Indian industry. Our capabilities in maritime spread across design and manufacture of naval ships and submarines, as well as their combat systems and equipment, associated services such as training solutions, maintenance and modernisation programmes to support ships and equipment in service around the world and the management of supporting infrastructure. We are committed to share this expertise in the Indian Navy's programmes.

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Col. Anil Bhat 8. The Advanced Hawk made its debut at Aero India 2017 earlier this year. Has the Indian or any regional air force show any interest?

Nik Khanna: The Advanced Hawk aircraft is an industry-funded concept demonstrator, the purpose of which is to stimulate the market by showing the Lead in Fighter Trainer capability that can be provided in a Hawk aircraft. The Advanced Hawk introduces several new features in the aircraft - an upgraded cockpit with a large area display, slatted wing, defensive aids suite, stores capability, being some of the primary enhancements. Training currently being performed on high cost front line fighters can be downloaded to Advanced Hawk, where it can be performed at a fraction of the cost, in a safer training environment whilst also making frontline capacity available. HAL and BAE Systems have a longstanding association on the highly successful "Make in India" Hawk programme which today benefits from technology transfer around the airframe and engine, with local build and in-country support. For the Advanced Hawk, this joint development under 'Make in India' will strengthen the partnership and provide further opportunities for technology transfer. The aircraft was one of our key displays at Aero India this year, generating active interest and since then flight trials have commenced in the UK at our Warton test facility. This is enabling engagement with operators in all regions to discuss capability requirements either through new build or upgrade to existing aircraft.

Col. Anil Bhat 9. What is your view of the Strategic Partnerships policy?

Nik Khanna: The Strategic Partnerships policy has been long awaited and we're pleased it is now issued. The strategic partnership policy is an important building block of the Make in India platform and further formalizes and incentivizes the desired participation of the Indian private sector in defence manufacturing. Partnership being a key pillar of BAE Systems' strategy in India, we are watching its early implementation with keen interest.

Col. Anil Bhat 10. BAE Systems has always been a keen supporter of Corporate Social Responsibility (CSR) programmes and now the Company's Act also mandates it. Tell us what are your programmes for India?

Nik Khanna: Our community investments in India support the efforts of the Government and the development sector. Our investment in India in partnership with Smile Foundation in 2012 was in advance of the Company's Act that mandates companies like ours to invest and engage in Corporate Social Responsibility programmes. The multi-year partnership successfully concluded having provided quality education to more than 1,000 children annually across six locations in five Indian states. It also delivered primary healthcare services to over 50,000 individuals in underprivileged areas of Bengaluru city. In 2016, support was extended to Swachh Bharat Abhiyan (Clean India campaign) and Digital India campaigns. The current phase of our investment in the community focuses on "Beti Bachao, Beti Padhao Yojana" or Save the Girl Child, Educate the Girl Child platform through our partnership with Room to Read, a global non-profit organization focused on improving literacy and gender equality in education. We provide comprehensive support to 300 school-going girl children through Room to Read's Girl Education Programme aligned with United Nations' Social Development Goal (UNSDG) of Gender Equality and Women's Empowerment.

Source: <http://www.business-standard.com/>

## **CSIR's artificial leaf creates fuel from sunlight, water**

The device consists of semiconductors stacked in a manner to simulate the natural leaf system. The ultra-thin wireless device mimics plant leaves to produce energy using water and sunlight. Scientists have developed an artificial leaf that absorbs sunlight to generate hydrogen fuel from water, an advance that may provide clean energy for powering eco-friendly cars in the future. The ultra-thin wireless device mimics plant leaves to produce energy using water and sunlight. "It is known that hydrogen generation from renewable resources will be the ultimate solution to our energy and environment problems," said Chinnakonda S Gopinath, a senior principal scientist at the Council of Scientific and Industrial Research (CSIR)-National Chemical Laboratory in Pune. Gopinath said that his team had been working in the area of water splitting to generate hydrogen for nearly a decade. "Hydrogen burning gives energy and water as a side product, underscoring its importance and relevance to the present day world," he told PTI. Though India basked in sunlight, not enough had been done to translate it into energy, he said. "This line of research is very relevant to our country. India is blessed with plenty of sunlight through the year that is not exploited significantly to produce energy or hydrogen," he said. The device consists of semiconductors stacked in a manner to simulate the natural leaf system. When visible light strikes the semiconductors, electrons move in one direction, producing electric current. The current almost instantaneously splits water into hydrogen - which researchers believe is one of the cleanest forms of fuel as its main byproduct is water. At present, hydrogen is produced from fossil fuels by steam reforming and in this process

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emits a large amount of carbon di-oxide (CO<sub>2</sub>) – a green house gas that promotes global warming. In view of pressing energy and environmental issues, it was important to produce hydrogen from natural resources such as sunlight and water, Gopinath said. “In the present work, we have made an attempt to generate solar hydrogen. The preparation method reported is simple and practicable and hence there is a very good possibility of scaling it up,” he said. The research, published in the Scientific Reports, an online, open-access journal from the publishers of Nature, states that the device of an area of 23 square centimetres could produce 6 litres of hydrogen fuel per hour. The work has been produced in the lab so far and a lot was still needed on the project, he said. “But in the not-so-distant future, we could expect to see a car fuelled by hydrogen generated from the artificial leaf process on-board or stored during the day time,” Gopinath said. In the recent past, automakers have been offering cars powered by hydrogen fuel cells. To improve the light-absorbing efficiency of the artificial leaf, researchers used gold nanoparticles, titanium dioxide and quantum dots. Quantum dots are semiconductor crystals of nanometre dimensions with properties that depend on the size of the dots. When exposed to sunlight for 25 hours, the device retained its efficiency. The cell does not need any external voltage and performs better than existing solar cells, he said. “We have patented our work and looking for industrial partners to move ahead, especially to make bigger-sized devices towards different applications,” said Gopinath.

Source: <http://indianexpress.com/>

## **IISc leads Indian institutions, IITs slip; Oxbridge in top two slots**

Forty-two Indian institutions figure in this year’s list of the world’s best universities, put out by The Times Higher Education World University Rankings 2018. But the highest ranked, the Indian Institute of Science, Bengaluru, weighs in only in the 251-300 range. The IITs at Delhi, Bombay, Kanpur, Kharagpur and Madras follow, though all their ranks have fallen, some significantly. The table of 1,102 institutions is topped by two UK universities. While Oxford University remains in No 1 spot for the second year in a row, University of Cambridge has jumped from fourth to second place. California Institute of Technology, which was No 2, now shares third place with Stanford University. Overall, European institutions occupy half of the top 200 places, with the Netherlands and Germany joining the UK as the most-represented countries. Italy, Spain and the Netherlands each have new number ones. Though 62 US institutions still make the top 200, against last year’s 63, 29 of them have fallen in rank — a direct outcome of drops in their research income per academic staff member and doubts regarding future levels of federal research income under the Trump administration.

## **Teaching, research**

A notable trend is the continued rise of China, home to two universities in the top 30: Peking and Tsinghua. Seen to have improved in terms of their reputations for teaching and research this year, these two Beijing varsities now outrank several prestigious institutions in the Europe and the US. Almost all Chinese universities have improved, indicating that the country’s commitment to investments is paying off. Asia’s top university, the National University of Singapore, has risen two places to joint 22nd, along with the University of Toronto and now outranks Carnegie Mellon University. Meanwhile, though Australia has maintained its performance, its position may suffer if the government goes ahead with plans to cut funding by 2.5 per cent, which would result in an A\$2.8 billion (£1.7 billion) loss in income across the sector.

## **Balanced comparisons**

In all, 77 countries feature in the table. According to the Times Higher Education website: “It is the only global university performance table to judge research-intensive universities across all of their core missions: teaching, research, knowledge transfer and international outlook. We use 13 carefully calibrated performance indicators to provide the most comprehensive and balanced comparisons, trusted by students, academics, university leaders, industry and governments.” The rankings for 2018 have been subject to independent audit by PricewaterhouseCoopers (PwC), making these the only global university rankings to receive full, independent scrutiny of this nature.

Source: <http://www.thehindubusinessline.com/>

## **Need to develop IPR in aerospace sector: Air Force Vice Chief S B Deo**

India is “lazy” in developing intellectual property rights in the aerospace sector and will be at the mercy of foreign manufacturers if it does not work on indigenous technologies, a top Air Force official said today (7 September). S B

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Deo, Vice Chief of the Air Force, said the newly launched strategic partnership model is a step forward in this direction. “India is lazy in developing. You have no choice, but to generate intellectual property rights here. If you don’t generate IPR, you are doomed to ‘built to print’ and you are at their mercy,” Deo said. Under the built to print process, manufacturers have been making equipment or components as per the designs provided to them, which according to critics does not allow technology absorption and innovation in the country. Deo lamented the contradiction that India manufactures fighter jets helicopters, but has to import UAVs (Unmanned Ariel Vehicles). He was speaking at a conference on Energising Indian Aerospace Industry: Gathering Momentum by the Air Force, CII and Centre for Air Power Studies. “The quicker we dispense this built to print idea, the quicker we start generating IPR in India, the better it will be. The only way to sustain the momentum is to start manufacturing here,” he said. Deo noted that creating IPR will open Indian companies a door to the outside world. Highlighting the problems in developing IPRs within the country, Deo pointed out that the expertise of retired Air Force officers in avionics is not used properly by the industry. Instead, they are hired by private defence agencies and used for “fixing appointments” in the defence ministry, he lamented. Under the SP model select private firms will be roped in to build military platforms like submarines and fighter jets in India in partnership with foreign entities. Air Marshal R Nambiar, the Deputy Chief of the Air Staff, said through the Make in India programme, the Air Force is looking at creating a robust aerospace ecosystem in India. This, he stated, will offer opportunities for the private sector in a number of areas such as flight listing and associated infrastructure, production efficiency, technology absorption and indigenisation. Hindustan Aeronautics Ltd Chairman and MD T Suvarnaraju highlighted that in the past years a series of steps have been taken by the government to make defence manufacturing economically viable in India. The HAL this week has signed an Rs 6,100-crore contract to supply 41 Advanced Light Helicopters (ALH) to the Indian Army and one to the Navy.

Source: <http://businessworld.in/>

## **Rolls-Royce claims world’s most powerful aerospace gearbox record**

A successful test has seen Rolls-Royce claim the world record for the world’s most powerful aerospace gearbox with its Power Gearbox. The unit is capable of handling the power from around 400 regular family cars running at full throttle and will form a key part of Rolls-Royce’s next-generation UltraFan engine, allowing it to operate efficiently through the full range of thrusts. The Power Gearbox was first tested last year, but power wasn’t the focus. Engineers used the Rolls-Royce Attitude Rig to simulate climbing, descending and banking, and find out how each maneuver affected the oil system. The latest tests were more rigorous. Paul Stein, CTO at Rolls-Royce, used a speech at the International Society for Air Breathing Engines (ISABE) to announce 70,000 hp (52,199 kW) had successfully been run through the ‘box at the company’s German facility. It will eventually channel 100,000 hp (74,570 kW), at which point Rolls-Royce says each pair of teeth on the gearbox will be transmitting more power than the entire F1 grid. Why? Well, fitting bigger fans to aircraft engines delivers more power, but it also necessitates the fitment of bigger turbines – and there comes a point where turbines would need to be prohibitively large for any meaningful power gain. UltraFan is designed to avoid this problem, using the (planetary) Power Gearbox to keep the turbine and fans spinning at the ideal speed throughout a flight for more power and better efficiency. “Setting this record is a great achievement for the team and I’m proud we’ve managed to get there so quickly,” says Paul Stein, CTO at Rolls-Royce. “Our Power Gearbox technology is central to the success of the next generation of Rolls-Royce jet engines and I’m pleased to see us pushing back engineering boundaries with this work.” When it arrives in 2025, the UltraFan engine is expected to be around 25 percent more efficient than current-generation Rolls-Royce Trent engines.

Source: <http://newatlas.com/>

## **Ancient Mars supported liquid water: study**

A region of Mars named Aeolis Dorsa contains some of the most spectacular and densely packed river deposits seen on the planet, researchers said. Mars had a surface environment that supported liquid water about 3.5 billion years ago, according to a study of river deposits spread across the red planet. A region of Mars named Aeolis Dorsa contains some of the most spectacular and densely packed river deposits seen on the planet, researchers said. These deposits are observable with satellite images because they have undergone a process called “topographic inversion,” where the deposits filling once topographically low river channels have been exhumed in such a way that they now exist as ridges at the surface of the planet, they said. With the use of high-resolution images and topographic data from cameras on orbiting satellites, B T Cardenas and colleagues from the Jackson School of Geosciences in the U.S. identified fluvial deposit stacking patterns and changes in sedimentation styles controlled by a migratory coastline.

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They also developed a method to measure river paleo-transport direction for a subset of these ridges. Together, these measurements demonstrate that the studied river deposits once filled incised valleys. On Earth, incised valleys are commonly cut and filled during falling and rising eustatic sea level, respectively. Cardenas and colleagues conclude that similar falling and rising water levels in a large water body forced the formation of the paleo-valleys in their study area. Cross-cutting relationships are observed at the valley-scale, indicating multiple episodes of water level fall and rise, each well over 50 metres, a similar scale to eustatic sea level changes on Earth, researchers said. The conclusion that such large water level fluctuations and coastline movements were recorded by these river deposits suggests some long-term stability in the controlling, downstream water body, which would not be expected from catastrophic hydrologic events, they said.

Source: <http://www.thehindu.com/>

## **ISRO working on substitute navigation satellite**

Work has begun in Bengaluru to assemble a substitute navigation spacecraft, which became essential after the main backup was lost in a failed launch on August 31, 2017. IRNSS-1I was earlier approved as a ground spare, to be sent to space in an emergency. The Indian Space Research Organisation has been training a team from an industry consortium to assemble this spacecraft and its lost fellow satellite, IRNSS-1H. Will there be another backup, an IRNSS-1J, and if so, who would assemble it? M. Annadurai, director of ISRO Satellite Centre (ISAC), Bengaluru, said the current approval is for seven navigation spacecraft (all of which are in orbit) and two spares — IRNSS-1H and IRNSS-1I. Should a new backup be sought and approved, it may be part of another model of outsourcing of its satellites to the Indian industry. ISRO has just begun the process of identifying a set of external partners who would assemble its future satellites, he noted. Until now all Indian spacecraft have been assembled at ISAC by its engineers. Is the Assembly of 1I being advanced? Back in December, the consortium of six industries was given six months to work on each spacecraft. The deadline for IRNSS-1I was around May 2018. Dr. Annadurai said that as of now, the timeline was the same. The launch of 1I, when it was ready, would also have to align with ISRO's other missions, he said. ISRO awaits the report of the failure analysis committee, which is looking into reasons why the launch failed, before it returns to launch its next missions. The seven IRNSS spacecraft, from 1A to 1G, are part of the <sup>1</sup> 1,400-crore GPS-like fleet for India, called NavIC (Navigation in Indian Constellation). They were put in orbit between July 2013 and April 2016 and have a life of 10 years each. Soon after all of them were in place, all three atomic clocks in IRNSS-1A failed, warranting its replacement. IRNSS-1H was sent up on a PSLV rocket but was not released from the upper heat shield of the rocket. It has been falling slowly to Earth in the same state, embedded in the heat shield. Which is where 1I enters — as a backup to both IRNSS-1A and IRNSS-1H. The atomic clocks on the other satellites are being used sparingly to extend the clocks' life in space. ISRO chairman A.S. Kiran Kumar recently said there was no urgency as the remaining six are working as planned.

Source: <http://www.thehindu.com/>

## **India's Mars Orbiter Mission completes 3 years in orbit**

India's rendezvous with the red planet continues as its celebrated Mars Orbiter Mission (MOM) completes three years in orbit. "As the country's low-cost Mars Orbiter Mission completes three years in its Martian orbit, the satellite is in good health and continues to work as expected," the Indian Space Research Organisation (ISRO) said. The scientific analysis of the data received from the Mars Orbiter spacecraft is in progress, ISRO public relations director Deviprasad Karnik told PTI. The country had on 24 September 2014 successfully placed the Mars Orbiter Mission spacecraft in the orbit around the red planet, in its very first attempt, thus breaking into an elite club. ISRO had launched the spacecraft on its nine-month-long odyssey on a homegrown PSLV rocket from Sriharikota in Andhra Pradesh on 5 November 2013. It had escaped the earth's gravitational field on 1 December 2013. On the occasion of completion of three years of MOM in its Martian orbit on 24 September 2017, the space body released MOM second year science data from 24 September 2014 to 23 September 2016. The space agency had earlier launched MOM announcement of opportunity (AO) programmes for researchers in the country to use MOM data for research and development. Citing surplus fuel, ISRO had in March 2015 announced that the spacecraft's life had been extended for another six months. Later in June 2015, its chairman A.S. Kiran Kumar had said it had enough fuel for it to last "many years". The Rs450-crore MOM mission aims at studying the Martian surface and mineral composition as well as scan its atmosphere for methane (an indicator of life on Mars). The Mars Orbiter has five scientific instruments—Lyman Alpha Photometer (LAP), Methane Sensor for Mars (MSM), Mars Exospheric Neutral Composition Analyser (MENCA), Mars Colour Camera (MCC) and Thermal Infrared Imaging Spectrometer (TIS). The Mars Colour Camera, one of the scientific

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payloads onboard MOM, has produced more than 715 images so far, ISRO had said. During its journey so far, the mission went through a communication 'blackout' as a result of solar conjunction from 2 June 2015 to 2 July 2015. It had also experienced the 'whiteout' geometry phenomenon (when earth is between the sun and Mars and too much solar radiation makes it impossible to communicate with the earth) from 18 May to 30 May 2016. An orbital manoeuvre was also performed on MOM spacecraft to avoid the impending long eclipse duration for the satellite, ISRO said. The government had in November last said the space organisation was seeking scientific proposals for Mars Orbiter Mission-2 to expand inter-planetary research.

Source: <http://www.deccanchronicle.com/>

## Space missions to watch out for

Now that Cassini has gone out in a blaze of glory, you are probably wondering what cosmic missions you can get excited about next. Though NASA is reviewing proposals that may include a return to Saturn to seek signs of life on ocean worlds like its moons Enceladus and Titan, other endeavours into deep space are on the calendar. Here are a variety of space missions worth keeping tabs on over the next decade or so. A rendezvous with the red planet Humanity has had a long love affair with Mars. We have launched about 20 successful missions to study the planet since the 1960s, including the still operational Opportunity and Curiosity rovers. It is also a source of intrigue for scientists seeking clues to where life may have once existed. In May 2018, NASA will launch the Interior Exploration using Seismic Investigations, Geodesy and Heat Transport (InSight) mission. This project will drop a stationary lander on Martian soil with the goal of understanding what happened at the rocky planet's very beginning. "It's a mission to map out the deep interior of Mars all the way down to the very centre of the planet," said W Bruce Banerdt, with NASA's Jet Propulsion Laboratory, USA. Joining Curiosity and Opportunity will be Mars 2020 Rover. This rover will land on the planet that year. Unlike its predecessors, this mission is intended to send samples from the Martian surface back to Earth to help with the search for evidence of ancient life on Mars. Looking for life on Jupiter's moons The Europa Clipper mission will sail past Jupiter's icy moon Europa on 40 to 45 flybys sometime in the 2020s. Scientists believe Europa has an ocean of salty water beneath its crust, and the NASA mission will help determine if the moon has the recipe for life. Also eyeing Jupiter's satellites is the European Space Agency's (ESA) JUICE mission, which stands for Jupiter Icy Moons Explorer, and is planned for launch in 2022. In addition to Europa, the space probe will study Ganymede, the largest moon in the solar system, and Callisto, which has more impact craters than any other object in the solar system. "We want to go to Jupiter and explore its moons for two basic reasons," said Giuseppe Sarri, project manager for JUICE, "First to understand our solar system how it was built how it works, and second to see and understand the probability of having life outside our planet." Drop me off at 162173 Ryugu Although navigating an asteroid belt is not nearly as precarious as it appears in movies, it is still a calculated operation. There are three upcoming asteroid missions to be on the lookout for. Already on its way, the Japan Aerospace Exploration Agency's Hayabusa-2 mission will arrive at asteroid 162173 Ryugu next year. The mission will land a small probe on the surface, as well as three hopping minirovers, according to NASA. After the lander drops from the Hayabusa-2 mother ship, it will collect samples. But the main goal of Hayabusa-2 is to return to Earth with those samples in December 2020, after exploring the asteroid for more than a year. In August 2018, NASA's Osiris-Rex will approach the asteroid Bennu, a 1,650-foot-wide, carbon-rich rock. After catching up with the asteroid, which speeds around the sun at about 63,000 mph, Osiris-Rex will survey it for about a year. Then in 2020, it will perform a touch-and-go manoeuvre with a robotic arm to collect a sample from its surface. It will come in contact with the asteroid for only about five seconds. Then the spacecraft will leave Bennu in March 2021, arriving at Earth in 2023. The samples will tell us about the composition of the asteroid as well as help reveal mysteries about the origin of our solar system. In 2022, NASA's Psyche mission will launch on a journey to investigate 16 Psyche, a huge chunk of metal in the belt between Mars and Jupiter. Seeing beyond our solar system Cosmic exploration is not constrained to our solar system. There are several missions aimed at observing the worlds outside our sun's grasp. Launching in the mid-2020s, the Wide Field Infrared Survey Telescope will be as powerful as the Hubble Space Telescope, but with a field of view that is 100 times larger. According to NASA, it could spot thousands of exoplanets and one billion galaxies. It will also try to unveil some of the mysteries behind dark energy and dark matter. The Characterising Exoplanet Satellite, operated by the ESA, will also be searching for exoplanets. It should launch next year and will orbit the Earth, hunting for rocky planets as they pass in front of bright stars. In 2026, ESA's Plato spacecraft will also look for transits of Earth-like planets that may reside in 'goldilocks' zones in other stellar systems. The golden-winged James Webb Space Telescope will take flight late next year. It will be the most powerful space telescope ever constructed. It is an \$8.8 billion endeavour to piece together the 13.7 billion-year-old puzzle of how the universe came into existence after the Big Bang. Reaching out to the stars Launching in summer 2018, NASA's Parker Solar Probe will become Earth's first spacecraft to ever reach a star. It will fly within about four million miles of the sun's surface, braving the brutal heat and destructive radiation of its outermost atmosphere, known as the corona. But the probe will be well-protected from the



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scorching environment thanks to its heat shield, a 4.5-inch-thick carbon composite wall. The Parker Solar Probe will study the corona and investigate the solar wind, a constant gust of charged particles that streams deep into the solar system, and gather data on what causes it to accelerate. Meandering around Mercury Compared with Mars, Venus and Earth, Mercury is the inner solar system's most overlooked world. Only NASA's Mariner 10 and MESSENGER missions have observed it up-close. But in 2018, that will change as the ESA and the Japan Aerospace Exploration Agency launch the BepiColombo mission to explore the tiny planet. It is a joint venture that consists of two spacecraft: the Mercury Planetary Orbiter and the Mercury Magnetospheric Orbiter. After arriving at Mercury in late 2025, the pair will enter separate orbits. There, they will both collect information about Mercury's composition, atmosphere, magnetosphere and geophysics.

Source: <http://www.deccanherald.com/content/634904/space-missions-watch-for.html>

## **Driverless hover-taxi makes first 'concept' flight in Dubai**

Dubai has edged closer to its goal of launching a pioneering hover-taxi service, with the authorities announcing a successful "concept" flight was made without passengers. Safety features for the two-seater air taxi include emergency parachutes and nine independent battery systems, according to Dubai's Road and Transport Authority (RTA). It said the prototype, supplied by Germany-based Volocopter, can fly for 30 minutes at a maximum speed of 100 kilometres per hour (62mph). The RTA envisions that the hover-taxi will eventually be integrated into the city's existing public transport network, which includes a metro system, tramway and buses. Passengers would be able to book their "autonomous air taxi" and track its arrival and route using an app. Authorities anticipate five years of testing to put in place safety procedures and legislation governing the cutting-edge mode of transportation. Home to Burj Khalifa, currently the world's tallest tower, Dubai is a leading tourist destination in the Gulf, attracting a record 14.9 million visitors last year.

Source: <http://www.deccanherald.com/>

## **TECHNOLOGY**

### **New record: aerospace gearbox reaches 70,000 horsepower**

Rolls-Royce announced that it has set a new record for the world's most powerful aerospace gearbox, just months after testing began. Speaking at the International Society for Air Breathing Engines (ISABE) conference in Manchester, UK, Paul Stein, Chief Technology Officer at Rolls-Royce, confirmed that the Power Gearbox had successfully reached 70,000 horsepower while on test at Rolls-Royce's dedicated facility in Dahlewitz, Germany. The Power Gearbox will play a central role in the company's next-generation UltraFan engine, helping to deliver improved efficiency over a wide range of thrusts. Testing of the first demonstrator gearbox began on a specifically designed rig in May and having proven that the Power Gearbox is capable of managing the equivalent power of around 400 family cars at full throttle, testing will now focus on lower power functions such as endurance and reliability. Rolls-Royce's Power Gearbox is designed to run all the way up to 100,000 horsepower and future demonstrators are expected to achieve these levels. When running at maximum power, each pair of teeth on the gearbox will transmit more power than an entire grid of Formula 1 cars between them. The Power Gearbox has a planetary design, with each 'planet' capable of holding the force of a Trent XWB engine at full throttle. It is designed to allow the shafts at the core of the engine to run at very high speeds while allowing the fan at the front of the engine to run at a slower speed. The associated improvement in efficiency and reduction in weight will allow the UltraFan engine to offer a 25 percent fuel efficiency improvement over the first generation of Rolls-Royce Trent engines. Commenting on the milestone, Paul Stein, Rolls-Royce – Chief Technology Officer, said: "Setting this record is a great achievement for the team and I'm proud we've managed to get there so quickly. Our Power Gearbox technology is central to the success of the next generation of Rolls-Royce jet engines and I'm pleased to see us pushing back engineering boundaries with this work." Arndt Schoenemann, Managing Director, Liebherr-Aerospace Lindenberg GmbH commented: "Reaching this milestone and impressive performance is proof of the great co-operation of all parties involved and especially of the expertise that accumulates in our joint venture with Rolls-Royce. Together, we are writing aerospace history." As well as high power testing, the Power Gearbox is also undergoing Attitude Rig testing, which simulates the effect of the gearbox being on the wing of an aircraft in flight, through phases such as take-off, climb, banking and descent. Rolls-Royce is working in partnership with Liebherr-Aerospace, through the Aerospace Transmission Technologies joint venture, to develop manufacturing capability and capacity for the new Power Gearbox. Rolls-Royce leads the design definition and design integration of the project, as well as testing activities.

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The UltraFan engine, available from 2025, will feature:

- Maximum fuel burn efficiency and low emissions through a new engine core architecture
- Reduced weight through the use of Carbon Titanium (CTi) in fan blades and a composite casing
- Increased efficiency through the use of ceramic matrix composites (CMCs) which are heat resistant and require less cooling air
- Efficient power for high by-pass ratio engines of the future through a geared design

Source: <http://www.dpaonthenet.net/>

## BUSINESS

### Israel Aerospace Industries looks to expand presence in India

Israel Aerospace Industries (IAI) is looking to secure further expansion in India through partnerships with local firms, Shalom Revivo, IAI's executive director of international sales and marketing, has told *Jane's*. Earlier in 2017 IAI announced a host of partnerships in the country with companies including Wipro, Kalyani Group, Dynamatic Technologies, and Taneja Aerospace in areas such as composite structures, air defence, unmanned aerial vehicles (UAVs), and military aircraft seats. However, Revivo confirmed that IAI is working towards additional alliances in India that will not only support IAI's efforts to expand its profile within the country but will also boost Indian involvement in the company's international supply chains.

Source: <http://www.janes.com>

### Trump regime supports sale of F-16 and F-18 to India

The Trump administration has told the U.S Congress that it "strongly supports" the sale of F-18 and F-16 fighter planes to India, built by American companies Boeing and Lockheed Martin respectively. Both companies have offered to assemble these planes in India, should New Delhi decide to buy them. President Donald Trump is in principle against companies relocating facilities abroad and a written submission to a Congressional subcommittee by Alice Wells, acting Assistant Secretary of State for the South and Central Asian Affairs, clarifies the administration's position on the issue. U.S lawmakers and bureaucrats in general have been enthusiastic supporters of selling these fighters to India, and are now presenting them as deals that could reduce America's trade deficit with India and create more jobs in America than they relocate — issues that are top on Mr. Trump's agenda. Ms. Wells mentioned the strategic significance of defence cooperation with India — "defence cooperation with India is so vital to US interests because we need India to be a net security provider in the Indo-Pacific" — but also added that America needs to do more to reduce the deficit. She added US exports to India support more than 260,000 American jobs "across all 50 states." F-16 and Gripen, built by Swedish company Saab, are in competition for the proposed single-engine fighter acquisition for the Indian Air Force. French Rafale and Boeing's F/A-18 are competing for the contract for Indian Navy's twin engine fleet for its aircraft carriers. Lockheed Martin and Tata have announced a joint venture to manufacture F-16, while Saab announced a JV with Adani last week for Gripen. Best choices: Ashley Tellis Strategic expert Ashley Tellis recently argued in a paper that F-16 and F-A/18 are the best choices for India in their respective categories. According to him, India will become the hub of Lockheed Martin's F-16 manufacture for the entire world — there are more countries exploring purchase — and in supporting the 3,200 F-16s that continue to be in service in 25 countries. The U.S military no longer buys F-16 but the 950-odd F-16s will remain in US Air Force (USAF) service for another two decades, Mr. Tellis said. For F-A/18 the argument has been based more on technological superiority, though Boeing also has offered manufacturing in India and transfer of technology. Concerns for India India has several concerns to be addressed before it moves ahead. "What is the depth of the technology transfer that these companies will offer to India? How will they help India's aspirations for the domestic defence manufacturing capabilities? When they say they will make in India, what exactly will they make in India - as components are manufactured world over, and mostly in America," a source familiar with the Indian position told. There are also questions about the ammunition supplies and American assurances in the event of a conflict with Pakistan. Pakistan also has a fleet of earlier generation F-16s supplied by America. India is also unclear about the future market for F-16s outside of India

Source: <http://www.thehindu.com/>

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## **ISRO-Nasa joint team confirms presence of aerosol over Asia**

A joint study by the Indian Space Research Organisation (ISRO) and National Aeronautics and Space Administration (Nasa) of the US, which had commenced after satellite images showed the presence of an aerosol layer over the Asia region, has confirmed the same and has also found the presence of nitrate, which is a new finding. Aerosol, the sub-micron size particles suspended in air are produced from a variety of man-made and natural processes such as vehicle exhaust, waste-burning, wind blown dust, volcanic eruptions et al, are mostly restricted to the first few kilometers from the surface of Earth's atmosphere—Upper Troposphere and Lower Stratosphere (UTLS). According to ISRO, measurements by the joint team has “confirmed the presence of aerosol layer seen in satellite measurements over the Asian region and it also shows a sharp increase of aerosol concentration near 16.5-18.5 km (from Earth's surface).” This layer, ISRO says, has distinct size distribution as opposed to that from background mineral aerosol dust that is naturally present in the atmosphere. “This layer contains particles of size less than 0.25 micron and are 90 per cent volatile. It appears the aerosol is formed from precursor pollutant gases which are transported via convection from the ground,” ISRO has said. Preliminary chemical analysis of samples collected in this campaign indicates dominant presence of nitrate, which is a new finding and the converging air masses over northern part of India during Asian Monsoon which is generally active during July and August is found to be the main forcing for vertical transport of the aerosols and trace gases to the UTLS region along with long-range transport from northern parts of India. However, detailed analysis yet to be carried out with all the data collected during the campaign. Aerosols, Radiation and Trace Gases Group (ARTG) of National Atmospheric Research Laboratory, ISRO, and a team from Nasa have been studying air quality around India as part of this campaign. According to the joint team, one additional campaign during winter months for obtaining the background conditions is planned. Presence of different pollutants which results from interplay of different circulation patterns and pollutant source regions also necessitates multiple campaigns spread over a few years (until 2020) to comprehensively characterise the aerosol layer in the UTLS region and study its impact on radiation budget and ozone chemistry. Additionally, this campaign seeks to use balloon-borne measurements of aerosol, water vapor, and ozone to validate measurements from Nasa's Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) satellite and Nasa's Stratospheric Aerosol and Gas Experiment (SAGE) III instrument along with Cloud-Aerosol Transport System (CATS) on the International Space Station.

Source: <http://timesofindia.indiatimes.com/>

## **ISRO hold talks with ArianeGroup**

Collaboration being the global buzzword these days in space exploration, the ISRO is turning its gaze Europe-wards. Top VSSC officers and Paris-based ArianeGroup met at VSSC, Thumba, and held discussions to identify areas for possible collaboration. ArianeGroup builds and operates the Ariane family of launch vehicles and is the European Space Agency's (ESA) primary contractor for the futuristic Prometheus rocket engine. VSSC director K Sivan, who called his meeting with Marc Vales, head, Future Programmes, ArianeGroup, a “brainstorming session”, said a couple of possible areas for collaboration were explored, including the Reusable Launch Vehicle (RLV) programme. “Our RLV programme is in its preliminary stages. They too have a similar one. It will be of use for both groups,” he said. Vales was here for the two-day ASET 2017 international conference organised by the Aeronautical Society of India (AeSI). Among other things, ISRO also has shown interest in the ESA's planned Prometheus rocket engine which uses methane as propellant along with liquid oxygen (LOX). Sivan attributed ISRO's interest to the reusability potential of the engine. He declined to divulge more details about discussions but stressed nothing has been finalised. “We discussed potential areas where collaboration was possible. The details will be passed on to the ISRO management,” he said. Vales told Express both agencies have identified topics for collaboration. ArianeGroup builds and operates the Ariane 5 rocket, one of the best-known of its type, for ESA. Currently, it is developing the Ariane 6. The Prometheus project began as a collaboration between French space agency CNES and ArianeGroup in 2015, but has since then taken on a wider, more European character. India's collaboration with France in space-related matters goes back to the Viking engine, which was the model for the Vikas engine used in the PSLV and GSLV.

Source: <http://www.newindianexpress.com/>

## **Airfares to West Asia touch rock bottom**

Low prices are due to off-season, arrival of Saudi Airlines Airfares of scheduled airlines and low-cost carriers, including foreign ones, to destinations in West Asia have touched rock bottom. Seats are available in the range of 1 5,300 to 1

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15,480 from Thiruvananthapuram, Kochi, and Kozhikode. On October 8, a seat in economy class to Dubai is available for ₹ 5,300 from Thiruvananthapuram, ₹ 5,100 from Kochi, and ₹ 6,700 from Kozhikode in the low-cost airline IndiGo. Besides Dubai, similar fares are available to Sharjah, Abu Dhabi, Muscat, Dammam, Riyadh, and Kuwait. The low fares have been effected weeks after the airlines steeply hiked the airfares, five to 10 times, to West Asia in view of the demand from NoRKs returning after Bakrid and Onam. On September 5, the fares were in the range of ₹ 29,260 to ₹ 41,250 to Dubai from the State. The airfare to Jeddah was in the range of ₹ 42,700 to ₹ 99,350 and ₹ 51,250 to ₹ 85,550 to Riyadh. Only Air India Express came up with additional flights to select destinations to provide some succour to the flyers following an appeal by Chief Minister Pinarayi Vijayan. "The decision of the airlines to roll down the prices is due to the off-season and commencement of classes in educational institutions, during which the NoRKs prefer not to travel," airline sources said. The arrival of Saudi Airlines (Saudia) to the State capital from October 1 has also resulted in the other airlines reducing the fares to Riyadh, Jeddah, and Dammam.

## Likely till November

A city-based tour operator said that the low fares would continue till November with a sudden hike likely during the forthcoming festive season

Source: <http://www.thehindu.com/>

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