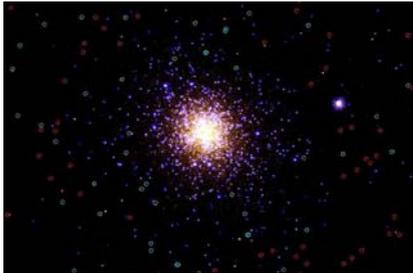




## CURRENT AFFAIRS



Astrosat Picture of the Month of Feb, 2019

HAL Ramps Up LCA Production and Looks to the Mk2.



### Publisher

Journal of Aerospace Sciences  
And Technologies  
Aeronautical Society of India  
Bangalore Branch Building  
New Thippasandra Post  
Bangalore 560 075  
Karnataka, INDIA  
Telefax: +91 80 25273851  
Email: editoraesi@yahoo.com  
Website: www.aerjournalindia.com

### Publication Team

Dr R Balasubramaniam  
Dr S Kishore Kumar  
Dr P Raghothama Rao  
Mrs Chandrika R Krishnan  
Mr Hemanth Kumar R  
Mr Kumaran A KM

### Advertisement – Tariff

A4 – 1 Full Page : Rs. 2000  
Draft Drawn in Favour of  
“Journal Office, The Aeronautical  
Society of India” Payable at  
Bangalore

### Head Quarters

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

### Successful anti-satellite missile test puts India in elite club

In an incremental advance, India successfully conducted an Anti-Satellite (ASAT) missile test, named Mission Shakti, becoming the fourth country in the world to demonstrate the capability to shoot down satellites in orbit. So far, only the United States, Russia and China have this prowess. “A short while back, our scientists have shot down a live satellite in the Low Earth Orbit (LEO) at 300 km in space,” Prime Minister Narendra Modi said, addressing the nation around noon. The satellite downed by the ASAT missile was Microsat-R, an imaging satellite which was launched into orbit on January 24, 2019 using a Polar Satellite Launch Vehicle (PSLV), a senior Defence Research and Development Organisation (DRDO) official said. India has built the broad capabilities and building blocks to develop ASAT missiles for some time as part of its Ballistic Missile Defence (BMD) programme. Mr. Modi said the aim of the test was to maintain peace, rather than war mongering. “A BMD interceptor missile successfully engaged an Indian orbiting target satellite in LEO in a ‘hit to kill’ mode”, the DRDO said in a statement. A DRDO official claimed that the ASAT missile was a modified exo-atmospheric interceptor missile of the BMD. A LEO of 300 km was chosen to “minimise” debris and it also won’t last more than a few months, the official said. Anti-satellite weapons provide the capability to shoot down enemy satellites in orbit thereby disrupting critical communications and surveillance capabilities. ASAT missiles also act as a space deterrent in dissuading adversaries from targeting the country’s satellite network. In March 2011, had reported the then Scientific Adviser to the Defence Minister Dr. V.K. Saraswat, who later became the DRDO Chairman, as stating after an interceptor test that India had “all the technologies and building blocks which can be used for anti-satellite missions.” Meanwhile questions are being raised on the manner of announcement of the ant-satellite capability. In 2007, a similar test by China at an orbit of 800 km above earth had drawn global condemnation. This test will make it increasingly difficult for India to present itself as exhibiting more strategic restraint and responsibility than China in matters pertaining to space security, and potentially other areas of defence policy as well, said Frank O’Donnell, South Asia expert at the U.S. Naval War College, in Newport, Rhode Island. “The timing of this test, and the degree of public communications coordination among the Prime Minister’s Office, DRDO, and Ministry of External Affairs, strongly suggests that this test was ordered and conducted for domestic political reasons with the upcoming elections in mind,” he said, expressing concern on the debris generated which “cannot be controlled in terms of its destination and impact regardless of the MEA statement suggesting otherwise.”



Source: The Hindu

## CURRENT AFFAIRS

### **ISRO, French space agency seal agreement on maritime security**

National space agency ISRO and its French counterpart CNES sealed an agreement to set up a joint maritime surveillance system in the country in May. The two nations will explore putting up a constellation of low-Earth orbiting satellites that will identify and track movement of ships globally – and in particular those moving in the Indian Ocean region where France has its Reunion Islands. Before that, they will initially share data from their present space systems and develop new algorithms to analyse them, according to the Paris based National Centre for Space Studies. The agreement comes a year after the broad collaboration plan the two governments initiated during French President Mr Emmanuel Macron's visit in March last 2018. Dr K.Sivan, Chairman of the Indian Space Research Organisation, and Mr Jean-Yves Le Gall, President of CNES of France, signed the agreement in Bengaluru. "The CNES-ISRO agreement [intends] to supply an operational system for detecting, identifying and tracking ships in the Indian Ocean. [It] provides for a maritime surveillance centre to be set up in India in May this year; sharing of capacity to process existing satellite data and joint development of associated algorithms," the CNES statement said. "For the next phase of the programme, studies for an orbital infrastructure to be operated jointly by the two countries are ongoing. CNES is working with its industry partners and with ISRO to devise the most appropriate technical solution." The two agencies have put up two climate and ocean weather monitoring satellites Megha-Tropiques (of 2011) and SARAL-AltiKa (2013) that are considered a model. "This fleet will be augmented with the launch of Oceansat-3-Argos mission in 2020 and a future joint infrared Earth-observation satellite under ," CNES said.

**Source:** <https://www.thehindu.com/>

### **ISRO and NASA can jointly work on India's first manned mission: Former NASA administrator**

The Indian Space Research Organisation and US's NASA can work together for India's first manned mission to space by allowing US private companies to train and select the astronauts, said a former head of the US space agency. While adding that the US can offer assistance for the Indian mission, Major General Charles Frank Bolden who was the 12th NASA Administrator suggested that India can follow what NASA does, which is not train its astronauts. He explained that NASA outsources the training of astronauts to private companies, which also provides services such as operators of space vehicles and flight contractors on a contract basis. Bolden explained that this is the 'quickest route' India can take. He added that until India doesn't develop a human space flight program, as an 'interim measure' it can collaborate with another country's existing program to train astronauts. These trained astronauts would then become the 'nucleus' of the manned space program and could contribute to training others. "India's ISRO and NASA can work together under the umbrella of agreements that we have right now to either put Indian experiments on station or Indian astronauts on station to actually do the experiments," said Mr Bolden, who was speaking in reference to the International Space Station program, at an interactive session at FICCI. The program is a joint project between five participating countries- NASA, Roscosmos (Russia), JAXA (Japan), ESA (Europe) and CSA (Canada). Mr Bolden who is on a tour to India said that he learnt about how ISRO is trying to understand the public-private partnership and added "do like we do in the US". "NASA doesn't train astronauts. We have contracts. We have been doing this for a long time...If you go to the control centre in Houston today, all flight controllers are SGT (team of contractors). The flight director is from NASA, but that NASA person is supervising a contractor team. Who was preparing the shuttle it was all the United States Alliance (conglomerate of Boeing and Lockheed Martin) people. Relying on commercial entities to operate our vehicles," he said, adding that the contractor team would have also worked with astronauts and trained them. "Assistance can be offered by the US by allowing some US private companies in astronaut selection and training...If India asks for help, this kind of engagement can be done," he said. Mr Bolden said that NASA can facilitate the training, by getting India in contact with such private companies. These companies have signed contracts with NASA to use NASA's facilities to train astronauts. "Hard part is you have to pay. The thing that people used to like about being member of international space station confederation was there was no exchange of funds. You bring something else and you get opportunity to fly a crew," he said. And pointed out that this was one of the obstacles to ISRO's attempts at astronaut flying, because there was nothing to offer in barter. "This was because the Indian industry hadn't decided with the government that we want to contribute. That is what he was fighting to get something to barter so that an Indian astronaut can go up," said Bolden in reference to Mr A.S. Kiran Kumar, who was the ISRO chairman from January 2015 till January last year. Mr Kumar was also present for the FICCI session. Bolden added that he and Mr Kumar were working together to get India to engage with member nations of the International Space

Station program. Bolden also pointed out that one should not be dependent on Russia to get astronauts to space. He explained that the US trains with Russia on the space program, but there are language issues. This comes in the backdrop of Russia having promised to train an Indian crew for the manned space mission. The Indian Air Force and ISRO are already working together to select astronauts by the end of this year.

**Source:** <https://economictimes.indiatimes.com>

## **All you need to know about India's light combat aircraft Tejas**

The term Tejas means 'radiance'. Developed as a joint venture between Aeronautical Development Agency and Hindustan Aeronautics Limited, Tejas is a lightweight aircraft technically described as multi-role, single-engine tactical fighter. Specially manufactured for induction into the Indian Navy and Indian Air force, Tejas comes with two variations. Tejas is an indigenously manufactured Light Combat Aircraft (LCA). Notably this is among the world's smallest and lightest multi-role fighter aircraft belonging to the Supersonic class. The highlights of this tailless Aircraft include single-engine and a compound delta wing. In the mission of its development, we see ADA and HAL partner also making use of the expertise of DRDO, CSIR, BEL, DGAQA, IAF and IN. Upon its deployment, Tejas will meet the diverse requirements of the Indian Air Force (IAF) and Indian Navy (IN). Specifications and performance Tejas is known for its high degree of agility and maneuverability. These characteristics are achieved by virtue of its tailless compound wing delta configuration that is said to be aerodynamically unstable. Tejas is designed to satisfy the demands of the modernized air force. This multi-role aircraft is capable of challenging air defense roles and all-round air superiority. In the aerodynamic designing of this aircraft, a deep study and experimentation with the principles of computational fluid dynamics and wind tunnel studies have gone into. The most amazing aero-dynamic features of Tejas makes it stand for an excellent performance across a broader fighter envelope. The highly optimized wing of the aircraft shows up the right variation of thickness, twist and camber though its span. The designers have ably adjusted the cross-sectional area distribution for achieving remarkable high speed characteristics. The leading edge slats are particularly suitable for promising aerodynamic performance. In order to prevent buzz and to bring down distortion throughout the flight envelope, the makers have incorporated wing shielded and bifurcated air intake duct fitted with diverts. These aspects harmoniously match with the engine design. Dimensions Length: 13.20 meters; Height: 4.40 meters; and Wing Span: 8.20 meters Weights Empty: 9800 Kilograms; Take Off clean: 6500 kilograms; and External Stores: 3500 kilograms Aircraft Performance Altitude: 50,000 feet; Max Speed at all altitudes: Supersonic; and 'g' limits: +8/- 3.5 Power plant F404-GE-IN20 Size: Diameter 890 mm, Length 3.9 m Weight: Max Weight 1,035 kg (2,282 lb) Engines capability: Thrust 9,163 kg (20,200 lb) Weapons The efficiency and worth of any modern fighter aircraft depends on the weapons it is capable of delivering on the target. Tejas can carry a veritable plethora of air to surface, air to air, standoff and precision guided weaponry. In the air-to-air arena, Tejas can carry long range and beyond visual range weapons. It can also tackle any kind of close combat threat by handling highly agile and high off-boresight missiles. A broad range of air to ground munitions and a highly accurate navigation and attack system makes it possible for the aircraft to prosecute the surface targets both over the land or at the sea with the mission accomplished with high degree of accuracy. These features bestow the multi-swing role capabilities to this highly touted fighter jet aircraft Tejas.

**Source:** <https://www.businessinsider.in/>

## **ISRO awards 96 people, teams for their contributions to space projects, programs**

The Indian Space Research Organisation presented 96 individuals with awards at a ceremony held at its Antariksh Bhavan headquarters in Bengaluru. The awards were in recognition of various contributions made by individuals and organisations towards the success of ISRO's projects and programmes. The '**ISRO Awards**' were distributed by former Chairman Dr K Kasturirangan and present Chairman Dr K Sivan. This was the 12th edition of the Awards, the first of which were given away in 2007. "ISRO Awards have over the years become prestigious ones among the space fraternity. (The Awards) have been executed very well over the years," Dr Kasturirangan said, This year, four categories of contributions were recognised by ISRO: 50 **Young Scientist Awards**, 20 Merit Awards, 10 Performance Excellence Awards and 16 Team Excellence Awards. Recipients were chosen for their outstanding contributions to ISRO's efforts in the year 2017. The selection panel consisted of officials from various centres of ISRO across the country. In addition to the four main categories awarded this year, Outstanding Contribution and Life Time Achievement Awards are also given away biennially. Dr Sivan addressed ISRO employees at the ceremony, persuading them to take on challenges to come with single-minded devotion. "Congratulations to all the award winners," Dr Sivan said, I appreciate the self-

driven nature of employees which is taking ISRO to greater heights,” Dr Sivan **said**. Directors from various centres of ISRO, employees from ISRO’s headquarters and the Department of Space were present for the awards.

**Source:** <https://www.firstpost.com>

## **India’s First Three-Orbit Mission With Solar-Powered Fourth Stage: ISRO To Launch PSLV-C45 On 1 April**

In its first three-orbit mission that launches satellites into three different orbits, ISRO is set to launch PSLV-C45 on 1 April 2019, reports. ISRO will place advanced electronic intelligence satellite EMISAT along with 28 commercial satellites in the orbit. At first the launch was scheduled on 4 March but was delayed. Explaining the cause behind the delay, ISRO chairman Dr K Sivan said that internal system readiness and other technical factors were addressed as PSLV-C45 is the first three-orbit mission of ISRO and first to use solar panel in rocket fourth stage (PS4). Confirming the launch scheduled on 1 April, Vikram Sarabhai Space Centre (VSSC) director Mr S Somanath said that so far ISRO had only conducted two-orbit missions. “After launch of electronic intelligence satellite EMISAT into orbit at 780 km, it will inject 28 guest satellites into orbit at 504 km. Then rocket fourth stage (PS4) instead of burning out, will automatically reorient itself to establish an orbital platform at 485 km orbit to carry out scientific experiments,” he said. Following this mission, PSLV-C46 will launch Cartosat-3 and PSLV-C47 will launch RISAT-2BR 1. While former is a remote sensing satellite, latter is a radar imaging satellite for reconnaissance and strategic surveillance.

**Source:** <https://swarajyamag.com/>

## **Boeing 737 Max crash raises tough questions on aircraft automation**

Mr Tom Enders just couldn’t resist the swipe at the competition. It was June 2011, and the chief executive officer of Airbus SE was on a stage at the Paris air show after the planemaker won in a matter of days an unprecedented 600 orders for its upgraded A320neo airliner, while Boeing Co. stood on the sidelines. “If our colleagues in Seattle still maintain we’re only catching up with their 737, I must ask myself what these guys are smoking,” Mr Enders blurted out, to the general amusement of the audience, while Boeing representatives at the back of the room looked on. Boeing had wavered on its decision whether to follow Airbus’s lead and re-engine the 737 or go with an all-new aircraft. Customers were willing to wait for “something more revolutionary,” as Mr Jim Albaugh, at the time Boeing’s head of commercial aircraft, said then. But the European manufacturer’s blow-out success with the A320neo, essentially a re-engineered version of its popular narrow-body family, would soon force Boeing’s hand. As the A320neo became the fastest-selling plane in civil aviation history as Airbus picked off loyal Boeing customers like American Airlines Group, the US company ditched the pursuit of an all-new jet and responded in July 2011 with its own redesign, the 737 Max. “The program was launched in a panic,” said Mr Sash Tusa, an analyst at Agency Partners, an equity research firm in London. “What frightened Boeing most of all was losing their biggest and most important customer. American Airlines was the catalyst.” It turned out that Chicago-based Boeing wasn’t too late to the party in the end: While the Max didn’t quite replicate the neo’s order book, it did become the company’s fastest seller as airlines scrambled to cut their fuel bills with new engines that promised savings of 20 per cent or more. All told, the Max raked in about 5,000 orders, keeping the playing field fairly level in the global duopoly between Airbus and Boeing.

### **Close scrutiny**

Now the 737 Max is grounded globally, after two almost factory-fresh jets crashed in rapid succession. As a result, the repercussions of Boeing’s response to Airbus’s incursion are under the microscope. Getting particular scrutiny are the use of more powerful, fuel-saving engines and automated tools to help pilots control the aircraft. After the grounding, Boeing said that it “continues to have full confidence in the safety of the 737 Max, and that it was supporting the decision to idle the jets “out of an abundance of caution.” The company declined to comment beyond its public statements. In late October, a plane operated by Lion Air went down minutes after taking off in Jakarta, killing all 189 people on board. Then on March 10, 2019 another 737 Max crashed, this time in Ethiopia en route to Kenya. Again, none of the 157 people on board survived the impact. There are other similarities that alarmed airlines and regulators and stirred public opinion, leading to the grounding of the 737 Max fleet of more than 350 planes. According to the Federal Aviation Administration, “the track of the Ethiopian Airlines flight was very close and behaved very similar to the Lion Air flight.” After decades of steadily declining aircraft accidents, the question of how two identical new planes could simply fall out of the sky minutes after takeoff has led to intense scrutiny of the 737 Max’s systems. Adding to the chorus in the wake of the crash was President Donald Trump, who lamented the complexities of modern aviation, suggesting that people in the cockpit needed to be more like nuclear physicists than pilots to command a jet packed with automated systems. “Airplanes are becoming far too complex to fly. Pilots are no longer needed, but rather

computer scientists from MIT,” the president said in the first of a pair of tweets on March 12, darkly warning that “complexity creates danger.”

## **Analog machine**

Automation plays a limited role in the 737 Max. That’s because the aircraft still has essential analog design and layout features dating back to the 1960s, when it was conceived. It’s a far older concept than the A320, which came to market at the end of the 1980s and boasted innovations like fly-by-wire controls, which manipulate surfaces such as flaps and horizontal tail stabilizers with electrical impulses and transducers rather than heavier hydraulic links. Upgrading the 737 to create the Max came with its own set of issues. For example, the 737 sits considerably lower to the ground, so fitting the bigger new engines under the wings was a structural challenge (even with the squished underbelly of the engine casing). In response, Boeing raised the front landing gear by a few inches, but this and the size of the engines can change the plane’s center of gravity and its lift in certain manoeuvres. Boeing’s technical wizardry for the 138- to 230-seat Max was a piece of software known as the Manoeuvring Characteristics Augmentation System, or MCAS. It intervenes automatically when a single sensor indicates the aircraft may be approaching a stall. Some pilots complained, though, that training on the new system wasn’t sufficient and properly documented. “The benefits of automation are great, but it requires a different level of discipline and training,” said Mr Thomas Anthony, director of the Aviation Safety and Security Program at the University of Southern California. Pilots must make a conscious effort to monitor the plane’s behavior. And reliance on automation means they will take back control only in the worst situations, he said.

## **Errant sensor**

With the Lion Air crash, data from the recovered flight recorders points to a battle in the cockpit between the software and the pilots who struggled in vain to keep control. The data showed that an errant sensor signaled the plane was in danger of stalling and prompted the MCAS to compensate by repeatedly initiating a dive. The pilots counteracted by flipping a switch several times to raise the nose manually, which temporarily disabled MCAS. The cycle repeated itself more than two dozen times before the plane entered its final deadly dive, according to the flight data. With the flight and cockpit voice recorders of the Ethiopian plane now in France for analysis, the interaction between the MCAS system and the pilots will again be under close scrutiny, probably rekindling the broader debate about who or what is in control of the cockpit. That man-versus-machine conundrum has been central to civil aviation for years. Automation has without doubt made commercial flying much safer, as planemakers added systems to help pilots set engine thrust, navigate with greater precision and even override human error in the cockpit. For example, automation on modern aircraft keeps pilots within a so-called flight envelope to avoid erratic manoeuvres that might destabilize the aircraft. Analyses of flight data show that planes have more stable landings in stormy, low-visibility conditions when automation is in charge than on clear days when they land by sight.

## **Sully’s miracle landing**

The most daring descent in recent memory, Chesley “Sully” Sullenberger’s landing of US Airways Flight 1549 in the Hudson River in early 2009, is Exhibit A of how an interconnected cockpit worked hand-in-hand with an experienced pilot. Automatic pitch trim and rudder coordination assisted manual inputs and kept the Airbus A320 steady on its smooth glide into the icy water. The drama showed that automation can play a crucial support function, provided a pilot is fully trained and the aircraft properly maintained. “Some people are saying modern aircraft such as the 737 Max are too complex,” said Mr Dave Wallsworth, a British Airways captain on the Airbus A380 double-decker. “I disagree. The A380 is a far more complex aircraft and we fly it very safely every day. Pilots are capable of understanding aircraft systems so long as the manuals contain the information we need.” Airbus traditionally has pushed the envelope on automation and a more modern cockpit layout, with larger screens and steering by joystick rather than a central yoke, turning pilots into something akin to systems operators. Boeing’s philosophy, on the other hand, has been to leave more authority in the hands of pilots, though newer designs also include some computerized limits. Like Airbus planes, the latest aircraft from Seattle —where Boeing makes most of its jetliners — are equipped with sophisticated autopilots, fly-by-wire controls or systems to set speed during landings. “The big automation steps came in the 1980s with the entry into service of the A320 and the whole fly-by-wire ethos,” said Mr John Strickland, an independent aviation analyst. “I don’t think automation per se is a problem, we see it in wide-scale use in the industry, and as long as it is designed to work hand-in-hand with pilots and pilots understand how to use it, it shouldn’t be an issue.”

## **Erratic movements**

But the counter-argument is that increasingly complex systems have led computers to take over, and that many pilots may have forgotten how to manually command a jet — particularly in a moment of crisis. That criticism was leveled at Airbus, for example, after the mid-Atlantic crash of Air France Flight 447 in 2009 that killed all 228 people on board. Analysis of the flight recorders showed the crew was confused by stall warnings and unreliable speed readings, leading to erratic manoeuvres that ended in catastrophe. “I grew up on steam gauges and analog, and the modern generation on digital and automation,” said Mr Jon Weaks, president of the Southwest Airlines Pilots Association and a Boeing 737 captain for the Dallas-based airline. “No matter what you grew up on, you have to fly the plane. If the

automation is doing something you don't want it to do or that you don't understand, you have to disconnect it and fly the plane." A 2013 report by the FAA found more than 60 percent of 26 accidents over a decade involved pilots making errors after automated systems abruptly shut down or behaved in unexpected ways. And the 2016 inspector general's report at the FAA noted that as the use of automation increases, "pilots have fewer opportunities to use manual flying skills." "As a result, the opportunities air carrier pilots have during live operations to maintain proficiency in manual flight are limited and are likely to diminish," the report found.

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

## NASA Wants to Put a Rover on the Moon by 2023

THE WOODLANDS, Texas — NASA's timeline for lunar exploration has tended to jump from sending small commercial landers as soon as possible to getting human missions there by 2028, but on (March 18), agency officials offered a target date for a key intermediate step: They want to put a rover on the moon by 2023. Those comments came during a NASA town hall at the Lunar and Planetary Science Conference being held here this week. During the event, leaders emphasized the current focus on the moon, both from the science perspective and from the human-exploration perspective. They also walked through the timeline expected for some of these milestones. NASA had already announced that it was hoping to place science instruments on the surface with commercially built landers as soon as this year, and that its end target was to land humans by 2028. But intermediate steps hadn't been discussed in much detail. During presentation, that changed. "We're trying to get to the moon with a rover as soon as possible, we're really trying to target 2023," Mr Steve Clarke, the deputy associate administrator for exploration within the Science Mission Directorate, said during the event. Clarke added that such a rover could be important for studying volatile compounds on the moon, a class of chemicals that includes water. He also suggested such a rover could clock in between 660 and 1,100 lbs. (300 and 500 kilograms). He also discussed advanced capabilities rovers could take on. "Certainly, we'll be going to one of the poles," Mr Clarke said. "And long-duration operation, we'd like to be able to go and operate for a period of months, not just weeks." Mr Clarke did not specify whether developing these capabilities would be feasible by the 2023 schedule goal, or whether they would be included only in a second generation of lunar rovers. Throughout the event, NASA personnel seemed to emphasize the agency's desire to make sure scientists feel included in the quest to return humans to the moon, which can sometimes feel like a separate endeavor directed toward separate goals. That science focus included the major piece of infrastructure within NASA's moon plans, a space station nicknamed Gateway, which would serve as a base camp for both science projects and astronaut missions. "For us to understand how to develop the Gateway, we need to understand how you'd like to utilize it," Mr Jake Bleacher, acting chief exploration scientist in the Human Exploration and Operations Mission Directorate, said during yesterday's event. Of course, NASA isn't just waiting around for scientists' wish lists; the agency has its own as well. "Ultimately, I think we would all like to get more pieces of the moon back to Earth," Bleacher said. "I think Gateway might play a role in that."

Source: <https://www.space.com/>

## Young Scientist Programme Launched

Indian Space Research Organisation has launched a special programme for School Children called "**Young Scientist Programme**" from this year, in tune with the Government's vision "Jai Vigyan, Jai Anusandhan". The Program is primarily aimed at imparting basic knowledge on Space Technology, Space Science and Space Applications to the younger ones with the intent of arousing their interest in the emerging areas of Space activities. The program is thus aimed at creating awareness amongst the youngsters who are the future building blocks of our Nation. This will further help them to appreciate what they are being taught in the school and its real application in Space Science & Technology. ISRO has chalked out this programme to "Catch them young". The programme will be of around two weeks duration during summer holidays and the schedule will include invited talks, experience sharing by the eminent scientists, facility and lab visits, exclusive sessions for discussions with experts, practical and feedback sessions. It is proposed to select 3 students each from each State/ Union Territory to participate in this programme every year covering CBSE, ICSE and State syllabus. Those who have finished 8<sup>th</sup> standard and currently studying in 9<sup>th</sup> standard will be eligible for the programme. ISRO has approached the Chief Secretaries of the respective States/ Administrators of Union Territories in India to arrange for the selection of three students from each of their State/UT and communicate the list to ISRO. The selection is based on the academic performance and extracurricular activities, which is clearly mentioned in the selection criteria already circulated to Chief Secretaries of States/ Administrators of UTs. Students belong to the rural

area have been given special weightage in the selection criteria. The selected students will be accommodated in ISRO guest houses/hostels. Expenditure towards the travel of student (II AC fare by train from nearest Railway Station to the reporting centre and back), course material, lodging and boarding etc., during the entire course will be borne by ISRO. II AC fare will also be provided to one guardian/parent for drop and pick up of student from the reporting centre.

**Source:** <https://www.isro.gov.in/>

## **Astrosat Picture of the Month of Feb, 2019**

### **New population of Ultraviolet stars in the Globular Cluster NGC 2808**

The Sun is a constant presence in our lives and is about 5 billion years old. But will the Sun itself change in the millions of years to come? Any such change will occur so far into the future, that astronomers need to look to alternate places in the sky to understand this. Globular clusters are the best laboratories to study the fate of stars. This month, APOM brings forth a globular cluster called NGC 2808 located at a distance of about 47,000 light years in the constellation Carina. This is the third globular cluster in APOM, after NGC 1851 and NGC 288. NGC 2808 is one of the most massive globular clusters that we know, with a stellar membership of more than a million stars. Being nearly 11 billion years old, stars like the Sun and heavier stars have evolved to later stages of evolution. Due to the large number of stars present in globular clusters, stars with different masses, and in different evolutionary stages can be studied together. This is because it is believed that all stars in the cluster formed from the same material at approximately the same time. NGC 2808 is unique because very recent optical studies have shown that it houses many distinct populations of stars (five in this case) within it, the maximum found in any globular cluster till date. Stars at the same evolutionary stage but having similar masses in this cluster seem to have other properties (eg. brightness, material from which it is made) that are slightly different. These are then said to belong to different populations. The stars that are bright in ultraviolet in this globular cluster have been studied using UVIT on-board AstroSat by a group of researchers from the Indian Institute of Space science and Technology (IIST), Trivandrum and Tata Institute of Fundamental Research, Mumbai. Using ultraviolet light from different wavebands (filters), these authors have identified stars belonging to later stages of stellar evolution, eg. Horizontal Branch stars, hot stars that have passed through the Asymptotic Giant Branch phase. They have also established the presence of four different populations of stars that are seen in the UV, including a new population for the first time. These UV populations of stars are related to the five groups of optical stars mentioned above. Earlier studies had shown the presence of a certain group of UV stars called the Red Horizontal Branch stars in the cluster. The current study has utilized the capabilities of UVIT to report that it is not one group, but rather a mixture of two different populations. This study of the UV populations in the cluster would help in refining our understanding of the formation of multiple populations in globular clusters.

The paper describing the results is accepted for publication by the Monthly Notices of Royal Astronomical Society and can be found here. Accompanying science story is here.

**Source:** <https://www.isro.gov.in/>

## **Tracking enemy aircraft data from IAF pilot's HMD**

In a dogfight with an enemy aircraft, an Indian Air Force (IAF) pilot looks straight ahead without one look at the altimeter, the altitude indicator or magnetic compass. For his helmet projects all that data, in real time, on the visor. Reports indicate that the MiG-21 Bison that Wing Commander Abhinandan Varthaman flew to shoot down an F-16, was fitted with this Helmet-Mounted Display (HMD). The IAF had procured a big number of these display systems from Israeli firm Elbit. At the recently concluded Aero India 2019 airshow here, a similar HMD system showcased by British Aerospace (BAe), had turned a big crowd-puller. Beyond speed, altitude and direction data projected onto the visor, the helmet had critical colour-coded information on aircraft ahead. Once the pilot wears it, the twin projectors fixed above the visor beams the data. Enemy aircraft is displayed in red, friendly plane in blue and unknown in yellow. Aviation experts say this could prove extremely useful in a dogfight with multiple aircraft engaged. The entire HMD data could be customised by the squadron concerned. "The information is transmitted directly from the mission computer to the visor. The Strike 1 version for Typhoon and Gripen jets had just one colour. We have demonstrated the Strike 2 to the Army for its helicopters," a BAe official told DH. The System is now under consideration for Army Aviation pilots of the Light Utility Helicopter (LUH) and Light Combat Helicopter (LCH) made by the State-owned Hindustan Aeronautics Limited (HAL). The HMD also comes with integrated night vision cameras with 40 Degrees field of view. Pilots could shed their NV goggles that add to the overall weight. Since every critical data is flashed on the

visor, the pilot is not required to look down at the dashboard. "This gives a much wider situational awareness." Sensors inside the cockpit track the pilot's head movement through Infra-Red LEDs mounted on the helmet. This helps the data on the helmet visor align exactly with the pilot's viewpoint. Every helmet is customised to fit the pilot's head perfectly, a process fine tuned by a head scan and 3D model generation.

**Source:** <https://www.deccanherald.com>

## **More Firepower for IAF Against China, Pakistan! Sukhoi-30 MKIs to get 5 Next Generation BrahMos NG Missiles**

Indian Air Force (IAF) to get unprecedented combat power with the next generation BrahMos missile! A new lighter version of the BrahMos, world's fastest anti-ship cruise missile, is set to be integrated on IAF's frontline fighter jet, the Sukhoi 30-MKI. Financial Express Online learns that the next-generation missile, also called the BrahMos NG, will meet the future requirement of the IAF and serve to be a formidable deterrent for both Pakistan and China. BrahMos NG is a lighter version of the original missile which was developed jointly by India and Russia. The BrahMos supersonic cruise missile with a range of 300 kms and speed of 2.9 mach has already been successfully integrated and test-fired from an IAF Sukhoi-30 MKI. However, given the fact that BrahMos NG will be a lighter version of the lethal missile, India plans to integrate up to 5 such next-generation missiles on the frontline fighter jet, giving the country unmatched fire power. The BrahMos NG will first be integrated on India's indigenous Light Combat Aircraft (LCA) Tejas. Subsequently, up to 5 BrahMos NG missiles will be fitted on the Sukhoi-30 MKI fighter jets of IAF. At Aero India 2019, BrahMos Aerospace displaced a model of the LCA Tejas with two BrahMos NG missiles integrated under its wings. The maximum speed of the BrahMos NG missile will be 3.5 mach. Speaking to Financial Express Online, Dr Sudhir Mishra the CEO and MD of BrahMos Aerospace said, "The new BrahMos NG missiles will provide future-ready air dominance to the Indian Air Force. The design and development of the BrahMos NG is being done by the DRDO." "While some technology will come from Russia, since the BrahMos is an Indo-Russian Joint venture, the new BrahMos NG will large be a Make in India product," Mishra told Financial Express Online at Aero India 2019. According to the BrahMos Aerospace CEO & MD, the cost of the new BrahMos will be half that of the existing missile. How will a lighter BrahMos help? There is a weight limitation for integrating BrahMos on the LCA Tejas. According to Mishra, only 1,250 kg can be adjusted under the wings of Tejas including the launcher. "There is also a limitation of space with the landing and takeoff to be taken into consideration...so the mathematics modeling was carried out and the system was studied. Finally we decided to develop a lighter BrahMos with a range of 300 kms," Mr Mishra told Financial Express Online. Mr Mishra is positive that the new BrahMos NG missile will provide India formidable air-to-air precision strike capability. BrahMos NG when fired from Tejas and Sukhoi-30 MKI will attack the "radar in the air" capability of the enemy. It is being developed with the aim to take down the AWACS (Airborne Warning and Control System), refuelling and transport aircraft of the enemy. With a 300-km range, the BrahMos NG will give India BVR (Beyond Visual Range) firing capability. According to Mishra, BrahMos NG like its predecessor, will be a multi-platform missile with the capability of being fired from submarines and torpedo tubes as well.

**Source:** <https://www.financialexpress.com/>

## **ISRO offers two-week summer training to students**

This year, the Indian Space Research Organisation (ISRO) start a new programme to train school children in space technology, science and applications. Students from class IX in a state, CBSE or ICSE board school can be selected for the programme. Under the programme, called YUva Vigyani KARYakram (YUVIKA), three students from each state and union territory will be selected by the chief secretaries based on their academic and extracurricular performance. Students from rural schools will get special weightage in the selection process. It will be a two-week residential programme that inducts the first batch this year during the summer vacations. "The programme is aimed at catching them young. It will run during the summer vacations in two - three major ISRO centres like in Bangalore, Thiruvananthapuram and Ahmedabad. The list of selected candidates from the states are expected by the end of this month," said an ISRO official, on condition of anonymity. This is a part of a series of outreach programmes being undertaken by the space organisation. Samwad with Students, where children are told about the country's space programme, was also launched on the New Year's Day in Bangalore. The programme entails a series of lectures by ISRO researchers in different parts of the country. This year, the fourth stage of the Polar Satellite Launching Vehicle was also used as a platform for experimentation by students. The first student satellite — KalaamSat — was launched on January 25, 2019. Seven more applications have been received for the programme. ISRO also plans to open up a viewing gallery that can accommodate 10,000 people in Sriharikota, Andhra Pradesh, near India's only launch site, before the April launch of Chandrayaan II. The gallery will also double up as a space museum.

## **What is YUVIKA?**

A two-week residential training programme for students on space science, technology and applications.

## **Who is eligible?**

Any class IX student from a state, CBSE, or ICSE board school.

## **What is the selection process?**

Students will be selected based on their academic and extra-curricular performance by chief secretaries. Students from rural schools will get special weightage.

## **How many students will be selected?**

Three students from each state and union territory.

## **When will it start?**

The first batch will start during the summer vacations of 2019.

## **Where will it happen?**

At major ISRO centres in Bangalore, Ahmedabad or Thiruvananthapuram.

**Source:** <https://www.hindustantimes.com/>

## **Open Day at IISc.**

From an autonomous drone that can find its way to a recharging pad to computer systems that can build other systems for human use, the 'Open Day' at Indian Institute of Science, Bengaluru, was a veritable display of cutting-edge technology and simplified concepts for students and science enthusiasts. IISc. officials said over 38,000 visitors, including school and college students, made their way to the open day. The day commemorates the foundation of the premier science institute. However, this year, it was deferred from March 3 to 23 due to board examinations held earlier this month. The campus was abuzz with activity including lectures, experimental demos, poster presentations, quiz contests, scientific competitions, and exhibitions being conducted around the premises. "The event is organised especially for schoolchildren to realise the importance of science and benefits of research in future years," said Mr Munmun Bhasin, a student of IISc. Among the attractions was a robot that can move from one place to another. The Centre for Brain Research showed how cognitive tests (identification of parents or people around a 1-year-old) are done and also showed the visualisation of genetic variations in DNA. The Aerospace Research Department was crowded by those wishing to witness rocket launch demos, while the 'Kids Zone' remained popular among young students.

**Source:** <https://www.thehindu.com/>

## **The History of Migs with Indian Air Force**

Indian Air Force has been operating Migs for the last 5 decades and this has seen over 5 Mig-types to have seen service with Indian Air Force, in various roles ranging from Air Superiority, High Altitude Interception, Reconnaissance Roles to Air Defence. In this post, I will discuss the Migs of Indian Air Force including the failed bids which did not allow more Migs to enter service with Indian Air Force.

### **A. Mig-21:**

The glorious history of Mig-21 with Indian Air Force started with the induction of 9 Mig-21 (Type 74 and Type 76) in 1963-64, prior to the 1965 Indo-Pak War. They were first inducted into the No.28 Squadrons "First Supersonics" whose pilots were trained at Russia in operating this highly specialized aircraft which was to serve as a superfast high-altitude interceptor, but for Indian Air Force, the Mig-21 was customized even better. India has used almost 900 Mig-21 of

varying types with the Bison variant being the latest of all of them which still persists in Indian service even though the base variant was inducted almost 5 decades back. Mig-21 Type 77 saw extensive service in 1971 Indo-Pak War where it scored multiple aerial victories against PAF F-86 "Sabres", Shenyang F-6 and F-104 "Starfighter". It was also used in the classic ground attack raid against the Governor's house in Dacca after which he was forced to find refuge under UN Office. Mig-21 MF saw service during the Kargil War where their performance was lacklustre after a Mig-21 was shot down by a Pakistani Stinger Man-Portable Air Defense Missile. Mig-21 yet again proved its worth after the "Bis" variant intercepted and shot down a Pakistan Navy Atlantique Reconnaissance Aircraft with an R-60 missile. The most modern iteration of Mig-21 was used once again during the recent India-Pakistan Standoff after Balakot airstrike where a Mig-21 Bison shot down a PAF F-16 Fighter Jet before being itself shot down after it crossed the LoC. Currently, more than 80% of all Indian Pilots have flown or trained on Mig-21 and the platform has been wrongly taunted as the "Widow-Maker" or "Flying Coffin" which has been attributed to it due to its high crash rate.

## **B. Mig-25:**

On May 1997 the peaceful skies over Islamabad, the vibrant capital of Pakistan were buzzed by an unwelcomed guest. The unwelcomed guest buzzed through the skies at a speed of Mach 2 (Twice the Speed of Sound) flying at an altitude of 65,000 ft. (where air pressure is 17 times lower than at sea level). The Pakistan Air Force immediately scrambled up their F-16 Falcon Fighter Jets to take on the cheerful intruder only to realize they were not competent enough. The intruder powered up by two massive Tumansky R-15BD-300 engines putting out ~7500 kgf thrust immediately put itself on the full throttle speeding up away into the skies and by the time F-16s could get up to that altitude the intruder had speeded up away towards the Indian Sky, some 125 km away. An observer would not have even spotted the aircraft but only heard the loud repeated thunderclap heard due to the sonic boom caused by the intruder. The intruder was none other than the "Garuda" or the designation of the Mig-25RB Supersonic Interceptor/ Reconnaissance Aircraft which discreetly entered service with Indian Air Force in 1981 and was kept as a closely guarded secret by No.102 Squadron, nicknamed Trisonics, with Wg Cdr A. Singh as its first Commanding Officer (CO). Only a few handpicked pilots were allowed to fly this lean and mean Flying Machine The Garudas could climb up to such a height where you could see the curvature of the Earth and higher than any aircraft in the enemy inventory could and fly faster than any enemy aircraft. This led to IAF flying multiple top-secret reconnaissance missions over hostile territory over enemy skies taking on their interceptors and Air Defense Batteries with impunity and tapping on High-Resolution Pictures of Military Establishments and Electronic Emissions. Mig-25 had no match in South Asia and even after it was retired by Indian Air Force almost a decade back, its legacy and legendary with Indian Air Force still survives as an All-Watching Eye who would be snooping on you without ever letting you know.

## **C. Mig-23:**

Indian Air Force operated two versions of Mig-23. The Mig-23BN was called the "Vijay" while the Mig-23MF was called the "Rakshak". Mig-23BN was the ground attack version with a laser rangefinder in the nose, a raised seat, cockpit external armour plate and large low pressure tires while Mig-23MF was the air defence variant fitted with an R-29 jet engine, a J-Band radar, a Sirena-3 RWR system, Doppler navigation and a smallIRST sensor pod under the cockpit. Mig-23 were originally bought by India to combat the Pakistani F-16 Fighter Jets as it was the first jet in Indian Service to be equipped with Beyond Visual Range Capabilities. Mig-23 took part during the Operation Safed Sagar after which they were phased out in favour of Mig-27 and Mig-29.

## **D. Mig-27:**

Mig-27 has been one of the main strike aircraft of the Indian Air Force. With its sophisticated avionics and weapon computers, it is capable of delivering a variety of loads in different modes of attack. A very stable weapons platform with good forward visibility and all around view, it can carry precision munitions guided by TV/laser and also A4Ms for self-defence. Mig-27 is a direct step up of the older Mig-23 platform and also was a problem-child of Indian Air Force being the direct reason of over 10% crashes within a span of 1996–2001. In 1985 first HAL assembled Mig-27M Strike aircraft was officially handed over to the Indian air force in its Nashik Plant where the jets were assembled. Over 120 Mig-27 were upgraded by HAL with Radar warning receiver (RWR), Multi-function display & HUD, Auto-pilot, Laser ranger and target market seeker (LRTMS), for dropping laser-guided bombs, Identification Friend or Foe (IFF) system, for identifying friendlies (and letting friendlies know about your presence), and Israeli (ELTA) jammer & counter-measures (flares) dispensing system. Currently, only the Mig-27 UPG variant remains in service with Indian Air Force which will be replaced the next decade. It saw service during Operation Safed Sagar where one Mig-27 flamed out and the pilot had to eject.

## **E. Mig-29:**

The MiG-29 is one of the IAF's premier Air Defense fighters. Whilst always appreciated for its raw performance, the MiG-29 was not acquired in bulk or series produced in India. Among the primary reasons were the inability of MiG-MAPO to properly support the IAF during its initial service and their continued reluctance to share design data later (design data since the IAF intended to use for optimizing its operation in Indian conditions). Plus there were the spares parts issues caused by the fall of the Soviet Union. With UPG upgrades, it has new databus 1553B standard to incorporate newer avionics, new mission computers, navigation system (RLG-INS w/GPS + possible Glonass module – Sagem's Sigma95N), Stores Management System, new VRS (Video Recording System) plus DMG (Display Map Generator). Mig-29 have seen operational service during Operation Safed Sagar where they were used to provide air defence to Mirage 2000 Fighter Jets who were dropping precision munitions over Pakistani Positions. Apart from that, it has been used in various exercises like Iron Fist and Vayu Shakti.

## **Failed Bids:**

### **A. Mig-31:**

Mig-31 were once offered to Indian Air Force when India retired its MiG-25RB/RUs which Indian Air Force used extensively for ELINT and SIGINT Operations sometimes in Pakistan Airspace and Chinese Airspace also. Indian Air Force was the first Air Force to have its pilots evaluate the Mig-31 "Foxhound" as a High-Speed Interceptor Aircraft. These Mig-31 were offered to India in 1999 and Air Marshal Anil Chopra became the first pilot outside Russia to fly this type at the at Nizhnie Novgorod in Russia. However, Indian Air Force showed a lack of interest and instead focussed on the Flanker platform out of which the Su-30MKI was born.

### **B. Mig-35:**

Though meeting all the ASQR requirements during the botched MMRCA Competition, Mig-35 which were once evaluated by Indian Air Force were not inducted. Mig-35 is a step-up of the Mig-29 platform and even though it is contending for the new 110-fighter jet contract for Indian Air Force, it is less likely that they would secure the order as IAF seems to go with more Rafales rather than be compliant on an untested Battle Platform.

**Source:** <https://defenceupdate.in/>

## **Military Development: India must catch up in the fighter aircraft race**

Following the Balakot surgical strike by the Indian Air Force on a Jaish-e-Muhammed terror training camp, there has been talk of a new proactive Indian defence doctrine. I have alluded to this in my previous articles as India possibly shifting from 'defensive defence' to 'active defence' as its fundamental military approach. While I do question the shift – pursuing active defence in India's specific regional situation would mean we are seen as the aggressors and lose the moral high ground; plus we don't face an existential crisis like Israel on account of Pakistan-based terrorism – the Balakot episode has put the spotlight on India's military preparedness. And one thing that has become clear is that we do face a problem in procuring and inducting cutting-edge weapons platforms in a timely fashion. In the post-Balakot air skirmishes, our ageing MiG-21 Bisons had to go up against Pakistan Air Force's F-16s. This gap in hardware quality is unacceptable for a country of India's size and aspirations. Today the Indian military is looking to operate in informationalised theatres where modern technology and real-time data processing in the battlefield will be key to victory. Yet, we are hamstrung by outdated military hardware and slow pace of indigenous development. For example, in a few years' time the number of fighter squadrons of the IAF will be down to 26 from a sanctioned strength of 42. Meanwhile, Pakistan's fighter squadrons will be up to 25 by 2021. In other words, the 36 Rafale fighter jets being purchased by India will make little difference to the IAF's acute shortage of aircraft. In any case, the Rafale deal effectively took almost two decades to materialise. And in the end of it we will get a fourth-generation fighter when China already has an indigenous fifth-generation fighter and is looking to move on to the sixth-generation. Essentially, India is playing catch up. This not only compromises our defence preparedness but also puts a strain on our defence budget. And India is not Saudi Arabia that it has billions of petro-dollars to buy state-of-the-art military hardware off the shelf. However, our defence PSUs too have been extremely tardy in churning our quality weapons platforms. The development trajectory of the Tejas Light Combat Aircraft is a case in point where it took more than three decades to produce a plane that met standards and has only now reached induction phase. Things have come to this pass only because India has lacked a coherent defence procurement strategy. We are literally falling between the two stools of indigenisation and defence imports. As a result, there is no continuous development trajectory in our defence PSUs. What we need is a military-industrial complex that includes private players working alongside defence PSUs. This will

keep the latter on their toes and simultaneously enable exchange of ideas and experiences between the defence PSUs and their private counterparts. And clearly, one area where we need to get cracking is modern fighter development. It is unfortunate that India's Fifth Generation Fighter Project with Russia has stalled. The project envisaged joint development of a fifth-generation fighter with equal rights to the parties in terms of intellectual property over the technology. This was a unique model of defence cooperation. But inability to seal the deal for a variety of reasons – including design demands and cost overruns – has put India at a disadvantage. Russia, meanwhile, proceeded with its own independent development of the fifth-generation fighter Su-57. Thus, perhaps it is time to jump-start things and have a relook at the fifth-generation fighter deal with Russia. India has already shown boldness in defying the threat of US's CAATSA sanctions in inking a deal for the Russian S-400 Triumf air defence system. It has further now inked a deal for the lease of a Russian nuclear-powered attack submarine. And with China's fifth-generation fighter J-20 already in service, India can't lag behind in the aerial theatre. The Indo-Russian joint fighter project could provide the right tonic for India's own indigenous modern fighter development.

**Source:** <https://defenceupdate.in/>

### **Indian Army To Induct Dhanush Howitzers Next Week In A Testament To Make In India Artillery Might**

The Indian Army would induct four made-in-India Dhanush howitzers on 26 March, ANI has reported. These artillery guns have been designed and manufactured in India. The guns would be inducted in the army following a ceremony at the ordinance factory in Jabalpur. The army has ordered a total of 110 such guns which would play a big role in modernising its artillery. The design of Dhanush is based on the Bofors howitzer inducted back in the 1980s. The howitzer gun will fire a NATO 155mm ammunition and can be fitted with a bi-modular charge system (BMCS), thereby increasing its range. The artillery gun had successfully completed its tests at Pokhran in June 2018. As per a statement released by the Defence Acquisition Council (DAC) on 20 February, the gun is equipped with features like inertial navigation-based sighting system, an advanced day and night direct firing system, onboard ballistic computation and an auto laying facility. It is also a self-propulsion unit which can be easily deployed in mountainous terrain, deserts and other testing locations.

**Source:** <https://defenceupdate.in/>

### **India To Get US Made Chinooks That Will Help Send Troops To Pakistan, China Borders Quickly**

India will next week induct its first modern heavy-lift helicopter, the iconic American Chinook chopper capable of transporting howitzers and troops to forward and high-altitude areas with China and Pakistan, after a wait of over three decades. The first four of the 15 CH-47F Chinooks, ordered from Boeing in the Rs 8,048 crore deal inked in September 2015, will be commissioned into IAF's 126 Helicopter Unit at Chandigarh. The unit, ironically nick-named "Featherweights", currently has only two operational Mi-26 choppers inducted from Russia in the late-1980s. "The Mi-26s, which airlifted artillery guns to the Kargil heights during the 1999 conflict as well as bulldozers during the Uttarakhand floods in 2013, are slated to go for Russia for an upgrade and overhaul to prolong their operational life," said an official. The Mi-26s are even bigger than the Chinooks, with a maximum payload capacity of 20 tons and a seating capacity for 82 combat-ready soldiers as compared to 11 tons and 45 troops of the latter. Similarly, while Mi-26s have an under-slung load capacity for howitzers and other equipment of 20 tons, the Chinooks can carry only 10 tons. But the defence ministry-IAF combine favoured the US chopper over the Russian one, which led to some criticism from the CAG, because the former had a lower operating cost and a relatively compact size to fly through narrow valleys and land at small helipads. With all the 15 Chinooks to be delivered by March 2020, their second unit will come up at Dinjan (Assam) to cater for the eastern front. Equipped with powerful contra-rotating tandem rotors, the Chinooks will be used to lift M-777 ultra-light howitzers – 145 are being inducted under the over Rs 5,000 crore deal inked with the US in November 2016 – to "threatened areas". IAF will also induct 22 of the equally famous American AH-64E Apache attack helicopters at its Pathankot and Jorhat airbases in the July 2019-March 2020 timeframe under another Rs 13,952 crore deal inked in September 2015. The Apache, armed with Stinger air-to-air missiles, Hellfire Longbow air-to-ground missiles, guns and rockets, had also upstaged the Mi-28 Havoc, leaving Russia highly miffed at India's preference for US weapon systems. The \$2 billion acquisition of 24 naval multi-role MH-60 'Romeo' helicopters from the US, which has already notched up military sales worth over \$17 billion to India since 2007, is also in the final stages now. But Russia has strongly reasserted its position as India's biggest arms supplier. Just since last October, India has inked the \$5.43 billion contract for S-400 Triumf missile systems and the \$3 billion deal for the lease of a

nuclear-powered Akula-1 class submarine with Russia. Moreover, a joint venture with Russia was also inked in February to manufacture around 7.50 lakh AK-203 Kalashnikov assault rifles in India, in a project which would eventually be worth around \$2 billion.

**Source:- India Times**

## **'Bulk production of 'Dhanush' to strengthen nation's security soon'**

"JABALPUR is the only city in the world which has the most advanced artillery expertise to develop world class weapons. Collaboration of efficiency and skills in Jabalpur based defence establishments, Gun Carriage Factory, Central Ordnance Depot, 506 Army Base Workshop, Controller Quality Assurance (Weapons) is unmatched in the world. Efficiency of state-of-art Dhanush gun can be imagined by the export order of its barrels placed by Bofors Company, Sweden, for its own research and development. Dhanush Gun system being manufactured in GCF Jabalpur is best gun in the world for its longest range and finest accuracy which has successfully accomplished Inspection Note to start its bulk production to strengthen national security," said Mr Hari Mohan, Member (Weapon, Vehicle and Electronics), Ordnance Factory Board, Kolkata. OFB member Mr Hari Mohan informed this while talking to the media persons after Inspection Note handing over ceremony at GCF. He informed that the Indian Army has requirement of total 414 guns and it has already placed order for production of 114 guns in next three years. GCF has successfully handed over six guns and six are ready for dispatch. Efforts are being made to provide 18 guns in next one year in the first phase. Handing over of Inspection Note as quality certification from Director General Quality Assurance (DGQA) will bring pace in bulk production of Dhanush. The 45-calibre/155-mm Dhanush Gun has longest firing range upto 38-kilometres with electronic control system to improve its response time of firing 6 rounds in a minute and ballistic computer system to enhance high level firing accuracy. GCF has acquired new machineries and developing new production units to ensure bulk production of Dhanush Gun in near future. Successful development of state-of-art gun system is a major achievement of Ordnance Factory Board and Ministry of Defence to strengthen artillery power the Indian Army for national security. INDIGENOUSLY developed Dhanush Gun system finally accorded quality certification from Director General Quality Assurance (DGQA) to kickstart its bulk production. DGQA handed over the Inspection Note to Gun Carriage Factory in a graceful ceremony at Dhanush Production Unit, GCF. Ordnance Factory Board member Mr Hari Mohan and Gun Carriage Factory, General Manager, Rajnish Johri received the Inspection Note from DGQA after inaugurating bulk production of Dhanush Gun amidst changing of ritual rhymes. On the occasion, Gun Carriage Factory, General Manager, Bangotra, CQA(W), Controller Brigadier, Mr Ravi Bharadwaj, SQA(O) Colonel Gupta, 506, Officer in-charge, Rao, Finance Controller, Mr Choudhary, AGM, Mr Randhir Sinha, MR R K Pandey, Mr D C Shrivastava and employees and representatives of employees' unions and associations were specially present. AGM MR Ranbir Sinha and Rajbhasha Officer Anupam Sinha convened the programme and informed about the ceremony. Addressing the programme, OFB member Hari Mohan termed the quality certification of Dhanush-155 as biggest milestone for GCF, Central Ordnance Depot, 506 Army Base Workshop and other agencies involved in successful development of Dhanush Gun system. He congratulated the Team Dhanush for 10 years' rigorous research and development in developing most advanced gun system. He applauded work culture and collaborative efforts made by different defence establishments include GCF, DGQA, DDRT, 506 Army Base Workshop, COD Jabalpur, Proof Range as an ideal team work to make the country proud on state-of-art gun. The achievement has synergized the entire defence production mechanism to continue the production of most advanced defence products in future. Speaking on the occasion, GCF, General Manager, Mr Rajnish Johri detailed about challenges faced by GCF and other concerned departments in indigenous production of Dhanush Gun system and expressed gratitude towards all the officers, employees and other defence establishments for achieving the complicated task.

**Source:- The Hitavada**

## **HAL Ramps Up LCA Production and Looks to the Mk2.**

Government-owned Hindustan Aeronautics Ltd (HAL) will deliver 16 Light Combat Aircraft (LCA) in the final operational clearance (FOC) configuration to the Indian Air Force (IAF) by the end of this year, said HAL chairman Mr. R. Madhavan. He added that 16 LCAs have been delivered in the Initial Operation Clearance (IOC) configuration already. An additional eight are being produced as trainers. The LCA received its FOC last month during the Aero India show in Bangalore, for induction into the Indian Air Force as a fully weaponized fighter. Following the major Vayu Shakti Air Force exercise in February, the Chief of the IAF, Air Marshal B.S. Dhanoa, reported, "It is a fighter jet and behaved like a fighter. It did

well both in air-to-air combat, as well as air-to-ground combat.” HAL has been waiting for the past six months to receive an order from the IAF for 83 LCA Mk1As to enable it to expand its production capacity. The version will have line-replaceable units (LRU) for ease of maintenance, and enhancements that include an Elbit radar and Cobham probe for in-flight refueling. The number of single-seaters and two-seater trainers has not yet been specified. It will take three years for the first flight from the time of signing the contract, Madhavan said. While HAL’s technical bids have been evaluated, the commercial bids have yet to be opened. Following a price negotiation, a formal contract will be signed with HAL. Madhavan noted that with HAL now involved only in integration, and production of components outsourced to private companies, it was likely that production would speed up in the future. “After that [Mk1A], we should take up LCA Mk2... which in the long term would replace the Jaguar, the Mirage, and MiG-29s,” said Mr Dhanoa. The Mk2—a medium-weight fighter version of the supersonic LCA with a maximum all-up weight of 17.5 tonnes, a delta wing, and close-coupled canard, and a payload of 6.5 tonnes—will be powered by a General Electric F414 engine with advanced digital control. It will have an advanced sensor suite and be capable of firing beyond-visual-range (BVR) air-to-air missiles beyond 100 km (62 miles). The addition of an infrared search and track system will allow the fighter to track aircraft through their heat signature. Based on the IAF LCA, the naval version of the LCA Mk2 will require an increased-thrust engine, reduced weight, an increased wing area, and a tailhook. “We have to move on towards a twin-engined deck-based CATOBAR [catapult assisted take-off but arrested recovery] fighter,” chief of naval staff Mr Sunil Lamba told **AIN**. Beyond the LCA program, the Advanced Medium Combat Aircraft (AMCA) is India’s fifth-generation fighter planned for production once the LCA Mk2 design is frozen. It is said to be designed for swing role, with BVR and close-combat capability, and precision strike. Mr. Madhavan said that a manufacturing partner would be sought for the AMCA.

**Source:** <https://defenceupdate.in>

## TECHNOLOGY

### HAL designs two-in-one plane to train in peace, fight during war

From cruise missiles to laser-guided bombs and antishipping missiles to smart weapons and modern radars and avionics systems, the new aircraft designed by Hindustan Aeronautics Limited (HAL) promises a lot. Design work for the plane that doubles as a new generation fighter trainer is complete.

The Supersonic Omni Role Trainer Aircraft (SpORT), a lead-in-fightertrainer (LIFT) built on the Light Combat Aircraft Tejas platform, is a fighter trainer that is capable of helping pilots of modern aircraft including the Rafale and SU-30 MKi. The IAF has not demanded for it. HAL CMDR R Madhavan recently said HAL no longer waits for IAF’s requirements. “We’re confident of doing R&D and offering a product. We’re even looking at markets outside,” he said. Group Captain HV Thakur, deputy chief test pilot, HAL, who conceived SpORT, says: “Work started last year when we wanted to participate in the US’ T-X programme for new-generation trainers. Our platform was a bit expensive as it was built on the Tejas platform and capable of combat. The United States wanted a pure trainer.” “There’s a quantum jump in training from advanced trainer to fighter jets which impedes the pilots learning pattern, causing an overload on type training aircraft and tends to impinge on safety during fighter training operations,” HAL said in an email. SpORT can train pilots on many operational capabilities. “All this in just six months, following which they only need to get used to their squadron aircraft,” he said.

**Source:** <https://www.newdelhitimes.com/>

### Israel’s first spacecraft to moon sends selfie to earth

An Israeli spacecraft on its maiden mission to the moon has sent its first selfie back to Earth, mission chiefs said. The image showing part of the Beresheet spacecraft with Earth in the background was beamed to mission control in Yehud, Israel — 37,600 km away, the project’s lead partners said. The partners, NGO SpacelL and state-owned Israel Aerospace Industries, launched the unmanned Beresheet — Hebrew for Genesis — from Cape Canaveral in Florida on February 22. The 585-kg craft took off atop a Falcon 9 rocket from the private US-based SpaceX company of entrepreneur Elon Musk. The trip is scheduled to last seven weeks, with the Beresheet due to touch down on April 11, 2019. So far, only Russia, the US and China have made the 384,000-km journey and landed on the moon. The Israeli mission comes amid renewed global interest in the moon, 50 years after US astronauts first walked on its surface. China’s

Chang'e-4 made the first-ever soft landing on the far side of the moon on January 3, 2019 after a probe sent by Beijing made a lunar landing elsewhere in 2013.

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

## ISRO to collaborate with academic institutes to bolster space tech

India's space research organisation (ISRO) recently made an Announcement of Opportunity (AO) to academic institutes around the country to collaborate on space technology. The AO will identify institutes with "proven credibility" in certain fields and the ISRO will recruit them as a Space-National Academic Partner (S-NAP). Through this, the academic provider will be involved in or facilitate research in space-related technology and applications. According to the AO notification, ISRO has the primary objective of developing space technology and application programmes to meet the developmental needs of the country. This involves creating technologies, realising new products, and signal processing. Collaborative working will enable Indian institutes to access ISRO facilities. These academic organisations will be involved in decision-making regarding the adoption of new technologies and applications. The S-NAP initiative will include development in the fields of satellite communication, satellite navigation applications development and ground segment, signal conditioning, and processing. Other S-NAP areas are VLSI (very-large-scale integration) and micro-electronics, metallurgy and material science, image processing, space sciences, composites and ceramics, and additive manufacturing techniques. Also, thermal science, tribology, chemical engineering sciences, structural engineering and analysis, computer science (high-speed computing) and big data analytics, robotics, AI, and RF (radio frequency) technology. ISRO noted the AO will not fund the organisations, but only identifies certain academic institutes as partners in particular fields. An academic provider will carry out work within ISRO departments or, with approval, with other collaborators. The S-NAP can submit project proposals suggesting advancements in existing space technology and applications, and the projects found appropriate will be funded by ISRO. S-NAPs will also be able to organise seminars and workshops in areas specific to space activities. For further progress in other space technology programmes, experts from ISRO are set to receive training for the **Gaganyaan** (Hindi for orbital vehicle) project at the Toulouse Space Centre in France from this month, according to the France space agency, CNES. **Gaganyaan** is an Indian crewed orbital spacecraft that will send three astronauts to space for seven days in 2022, as part of the Indian Human Spaceflight Programme. The ISRO-developed spacecraft consists of a service module and a crew module, collectively known as the Orbital Module. It will be India's first manned space flight. With this, India has the potential to become the fourth country to send a man to space, after Russia, the United States, and China. Denmark also has a manned space flight scheduled for 2022. Additionally, ISRO experts will be trained at CADMOS, the centre for development of microgravity applications and space operations, and the MEDES Space Clinic in France. ISRO and CNES have also signed an agreement to build a constellation of satellites for maritime surveillance to track ships. The agreement intends to supply an operational system for detecting, identifying, and tracking ships in the Indian ocean. It will also provide for a maritime surveillance centre to be set up in India.

Source: <https://www.opengovasia.com/>

## NASA Discovers Water Molecules Moving on The Surface of Moon

NASA's Lunar Reconnaissance Orbiter (LRO) spacecraft has observed water molecules moving around the dayside of the Moon, a finding that may prove beneficial as the agency plans to put astronauts back on the lunar surface. Lyman Alpha Mapping Project (LAMP) — the instrument aboard LRO — measured sparse layer of molecules temporarily stuck to the Moon's surface, which helped characterize lunar hydration changes over the course of a day, revealed the paper published in Geophysical Research Letters. "The study is an important step in advancing the water story on the Moon and is a result of years of accumulated data from the LRO mission," said Mr John Keller, LRO deputy project scientist from NASA's Goddard Space Flight Centre in Maryland. Until the last decade, scientists thought that the Moon was arid, with any water existing mainly as pockets of ice in permanently shaded craters near the poles. More recently, they identified surface water in sparse populations of molecules bound to the lunar soil, or regolith. But, the amount and locations were found to vary based on the time of day. The lunar water is more common at higher latitudes and tends to hop around as the surface heats up. Scientists had hypothesised that hydrogen ions in the solar wind may be the source of most of the Moon's surface water. As a result, when the Moon passes behind the Earth and is shielded from the solar wind, the "water spigot" should essentially turn off. However, the water observed by LAMP does

not decrease when the Moon is shielded by the Earth and the region influenced by its magnetic field, suggesting water builds up over time, rather than “raining” down directly from the solar wind. “These results aid in understanding the lunar water cycle and will ultimately help us learn about accessibility of water that can be used by humans in future missions to the Moon,” said lead author Mr Amanda Hendrix, a senior scientist at the Planetary Science Institute. “Lunar water can potentially be used by humans to make fuel or to use for radiation shielding or thermal management; if these materials do not need to be launched from Earth, that makes these future missions more affordable,” Mr Hendrix added.

**Source:** <https://www.news18.com/>

## **HAL RUAV:- India's First Unmanned Rotary-Wing Aerial Vehicle**

Indian aerospace and defence company Hindustan Aeronautics Limited (HAL) unveiled a full-scale prototype of a locally designed rotary-wing unmanned aerial vehicle (UAV) at the Aero India 2019 defence exhibition being held in Bangalore on 20-24 February. Specifically designed to perform intelligence, surveillance, and reconnaissance (ISR) operations, the UAV was developed by HAL in co-operation with the country's Aeronautical Development Establishment (ADE) and the Indian Institute of Technology (IIT), Kanpur, to meet specific requirements of the Indian Army and Indian Navy. The 200 kg UAV, which is equipped with a twin-blade main rotor and a locally developed petrol engine, is stated to have a range of 200 km, endurance of six hours, and a service ceiling of 6,000 m. The platform, the fuselage of which is 4.2 m long and 1.28 m wide, is reportedly capable of flying at a top speed of 200 km/h and can carry a 40 kg payload. To achieve self reliance in the aviation field and to enhance its R&D efforts, HAL is working closely with premier educational institutes and has established chairs at IITs in Madras, Roorkee, Kharagpur, Bombay and Kanpur and IISc Bengaluru. Advance Light Helicopter in its different variants (ALH-Dhruv, ALH-Rudra, ALH Wheeled version) is one of its star products and in service with the Indian defence forces. The Light Combat Helicopter is also designed and developed by this centre and is under production for the Indian Army and the Indian Air Force. The preliminary design of the platform was completed in January, with clearance for the preliminary design review (PDR) now pending. The UAV, which features a full authority digital engine control (FADEC) and SLR-DC datalink, can fly in fully autonomous mode, including auto take-off and landing with a return-to-home recovery option, according to HAL. It uses GPS for interactive command and control with completely programmable mission management computers. Real-time data and video links are available for line-of-sight operations. Indian navy has an interest in small unmanned aircraft that can be deployed from its fleet. The UAV can be used for humanitarian assistance and disaster relief (HADR) missions, coastal surveillance, radar and missile decoy operations, detecting improvised explosive devices and landmines, and tracking and designating targets.

## **IAI-HAL NRUAV**

Hindustan Aeronautics Limited (HAL) and Malat (a unit of Israel Aerospace Industries) had started co development of NRUAV. The IAI-HAL NRUAV project consisted of a Malatmade Helicopter Modification Suite (HeMoS) fitted on HAL's Chetan, an upgraded Chetak with turbomeca tM 333 2M2 engines. the helicopter is planned to be used for unmanned operations and advanced intelligence, surveillance and reconnaissance (Isr) missions from warship decks. The system got delayed due to many problems like the lack of a correct landing and take-off system for moving platforms as the NruAV was to feature with automatic vertical take-off and Landing (AVtoL) from aviation-capable ships and from unprepared landing sites. It was reported in february 2017 that hAL has cancelled its contract with Israel and taken India's Aeronautical Development establishment (ADE) on board to carry on with the project. other details are not known. As it is unmanned there will be no cost of life in its operational mode . As u know, a surveillance copter costs much more as compared to it , so it will be very cost effective. Once made it will be very easy to operate and hint the force in a very precise manner about the enemies presence. India shares border with many of its untrustable neighbours . So it is very much required for a country like India to keep its eye on every movement in its air and land. In a modern warfare generation large number of imports of these crafts may burden in the budget, so as our indigenouse firm HAL is developing ,it will comparably cost less and a huge opportunity of exporting these for friendly countries. And moreover, it's been said that HAL and IIT Kanpur have signed a pact to develop this RUAV will apparently whoop an experience for our technical institutions to build and develop further in this field.

**Source:** <https://defenceupdate.in>

## India to launch electronic intelligence satellite Emisat for DRDO on April 1

India on April 1 will launch an electronic intelligence satellite Emisat for the Defence Research Development Organisation (DRDO) along with 28 third-party satellites and also demonstrate its new technologies like three different orbits with a new variant of PSLV rocket, ISRO said. According to Indian Space Research Organisation (ISRO), a new variant of its Polar Satellite Launch Vehicle (PSLV) rocket will first put the 436 kg Emisat into a 749 km orbit. After that, the rocket will be brought down to put into orbit the 28 satellites at an altitude of 504 km. This will be followed by bringing the rocket down further to 485 km when the fourth stage/engine will turn into a payload platform carrying three experimental payloads: (a) Automatic Identification System (AIS) from ISRO for Maritime satellite applications capturing messages transmitted from ships (b) Automatic Packet Repeating System (APRS) from AMSAT (Radio Amateur Satellite Corporation), India – to assist amateur radio operators in tracking and monitoring position data and (c) Advanced Retarding Potential Analyser for Ionospheric Studies (ARIS) from Indian Institute of Space Science and Technology (IIST) – for the structural and compositional studies of ionosphere, the space agency said. The whole flight sequence will take about 180 minutes from the rocket's lift off slated at 9.30 a.m. on April 1. The 28 international customer satellites (24 from US, 2 from Lithuania and one each from Spain and Switzerland)- will weigh about 220 kg. "It is a special mission for us. We will be using a PSLV rocket with four strap-on motors. Further, for the first time we will be trying to orbit the rocket at three different altitudes," ISRO Chairman Dr K. Sivan had earlier told IANS. The PSLV is a four-stage engine expendable rocket with alternating solid and liquid fuel. In its normal configuration, the rocket will have six strap-on motors hugging the rocket's first stage. On January 24, the ISRO flew a PSLV with two strap-on motors while in March, it had four strap-on motors. The Indian space agency also has two more PSLV variants, viz Core Alone (without any strap-on motors) and the larger PSLV-XL. The ISRO selects the kind of rocket to be used based on the weight of satellites it carries. The ISRO will also be launching two more defence satellites sometime in July or August with its new rocket Small Satellite Launch Vehicle (SSLV). In January, the space agency launched a defence imaging satellite Microsat R for the DRDO.

Source: <https://defenceupdate.in>

## BUSINESS

## New Private Firm to Aid Commercial Transfer of ISRO Technology

A private entity, Bengaluru-based Newspace India Limited, has been set up under the Department of Space to aid the transfer of ISRO technologies for commercial purposes. The company was incorporated on March 6 with Mr Radhakrishnan Durairaj and Ms. Suma Devaki Ram as directors and a paid-up capital of Rs 10 crore. This has come after the Union cabinet last month cleared the establishment of such a company to commercially exploit the research and development work of the space agency. This includes the small satellite programme, the small satellite launch vehicle (SSLV) programme and the polar satellite launch vehicle (PSLV). Dr. K. Sivan, the chairperson of the Indian Space Research Organisation (ISRO), told Times of India that the said entity will be a link between ISRO and the industry and help transfer its technologies to private firms for a fee. While the space agency currently has a commercial arm - Antrix Corporation Limited - according to Sivan, Newspace India will play a different role since Antrix is solely involved in commercial launches of foreign satellites. The Major Indian and International Space Missions to Look Out for in 2019 As per Antrix's website, the company 'promotes and commercially markets the products and services emanating from the Indian Space Programme.' Other than commercially exploiting the tech transfer of SSLV, PSLV programmes and lithium-ion cells etc, Newspace India is also meant to market space-based products - in India and abroad. 'Once companies start mass production of small satellites and launchers, ISRO will be charging them for using its launch services,' Dr Sivan explained. Writing for Times of India, Surendra Singh noted that setting up this company will encourage the private sector to play a greater role in the production of small launchers as well as satellites. According to Dr Sivan, till now, ISRO has been directing engaging with private companies as well as overseeing the process of transfer of technology - for example of Vikram Sarabhai Space Centre-developed lithium-ion (Li-ion) cell technology. According to a January 2019 release on ISRO's website, ten industries were selected for the transfer of Li-ion cell technology.

Source: <https://m.dailyhunt.in/>

## **Tamil Nadu govt wooing HAL to set up manufacturing facility at Salem**

The Tamil Nadu government is impressing upon Hindustan Aeronautics Limited to set up a manufacturing unit at Salem as the state has been chosen for establishing the Centre's ambitious defence corridor, a senior official has said. The move is a part of the 'Make in India' programme to catalyse indigenous production in defence manufacturing. "(In) Salem, we are looking at a big chunk of land. To do that we are talking to HAL if it comes forward to set up a manufacturing facility," Mr D P Yadav, Secretary (MSME) to the Tamil Nadu government told PTI. He was speaking on the sidelines of International Engineering Sourcing Show (IESS) which concluded here yesterday. "Aerospace is also one area where we are looking so that there is a specialised aerospace park established in Oragadam near Chennai," Mr Yadav said. Asked about the timeline, Mr Yadav said defence is a Central subject and the Ministry of Defence is working on the issue and has deployed an agency to work on the corridor. Outlining the focus areas, he said "one was technology transfer and the other indigenisation of defence products". Defence Minister Mrs Nirmala Sitharaman inaugurated the Tamil Nadu Defence Industrial Corridor in January this year, and investment worth over Rs 3,038 crore was announced. A majority of the investments would come from PSUs like Ordnance Factory Board, Bharat Electronics Ltd and Bharat Dynamics Ltd which committed to invest Rs 2,305 crore, Rs 140.5 crore and Rs 150 crore, respectively. Lockheed Martin, one of the global security giants, also announced its intention to invest in the corridor. The Tamil Nadu Defence Industrial Corridor is also called the Tamil Nadu Defence Production Quad as the nodal cities form a quadrilateral with one of them at the centre. The corridor will include Chennai, Hosur, Salem, Coimbatore and Tiruchirappalli as nodes. Besides Tamil Nadu, the Centre had announced another Defence Corridor in Uttar Pradesh to propel indigenous manufacturing in the country's most strategic area. An outlay of Rs 3.05 lakh crore was set aside for the defence budget for 2019-20, which was a hike of around Rs 20,000 crore compared to allocation of Rs 2.85 lakh crore in the previous fiscal. India is amongst the largest importers of defence equipment globally.

**Source:** <https://www.business-standard.com/>

## **TataChem signs MoU with ISRO for lithium-ion cell technology**

Tata Chemicals has signed a non-exclusive agreement with the Indian Space Research Organisation for the latter's lithium-ion cell technology. Under this agreement, ISRO will transfer the technology to Tata Chemicals which will utilise the knowhow to manufacture lithium-ion cells, Tata Chemicals said in a statement. The Vikram Sarabhai Space Centre, a part of ISRO, has developed the technology to produce space grade lithium ion cells of various kinds, to power its rockets and satellites. Arvind launches water components and O&M business. Arvind has launched a new business division 'Kaigo' specialising in waste-water management, which will have two verticals including components and spares and operations and maintenance services. Through the new vertical and its sister concern Envisol, Arvind will focus on creating end-to-end solutions across projects, components and services for water treatment, industrial waste water treatment, sewage treatment, desalination and zero liquid discharge at minimal cost, the company said in a statement. Waaree Energies has launched customized solar modules for electric vehicles. These indigenous modules, specially designed for the transport industry, are portable, flexible, lighter, durable and more efficient, and expected to increase the efficiency of EVs by 10-25 percent, the company said in a statement. Waaree will manufacture these modules in their facility in Surat in Gujarat. Siemens installs RDS for Gail India Siemens will install state-of-the-art remote diagnostic services (RDS) for state-run gas major Gail India covering gas turbines installed across the Hazira-Vijaipur-Jagdishpur (HVJ) pipeline and Vijaipur C2/C3 plant. The scope includes supply of RDS hardware, site installation and commissioning including three years' remote operational service desk and help-desk services, the company said in a statement. IRB partially commissions Yedeshi-A'bad project. IRB Infrastructure has partially commissioned the Yedeshi Aurangabad Tollway project, which is part of the Rs 3,370-crore four laning highway project from Yedeshi to Aurangabad in Maharashtra. The newly-widened highway will now have direct and quicker connectivity between the cities, including Solapur and Aurangabad," the company said in a statement.

**Source:** <https://www.newsnation.in>

## **BrahMos in demand! Chile eyes Indo-Russian missile; big interest for ship and shore-based platforms**

India's BrahMos missile for Chile! The armed forces of Chile have reached out to India and expressed their interest in buying the BrahMos missile a joint venture of India-Russia. BrahMos Company is already registered with

Chilean Armed Forces, which is mandatory requirement for any company to export system to Chile. However, as per the law of that country for any negotiations, the company has to register itself with all the three services. President Mr Ramnath Kovind is going to visit the country soon and during discussions with his counterpart President Sebastián Piñera, defence cooperation, will be one of the topics of discussions between the two sides. Sources told Financial Express Online that “There has been lot of interest for ship and shore-based platforms. With its reduced size BrahMos NG (Next Generation) can be accommodated in a number of sea and air platforms.” The South American nation has expressed interest in the coastal, naval as well as air version of the missile. It has expressed interest in mobile autonomous launchers for coastal defence batteries, ship-based weapons complex for submarines and frigates. The Chilean Air Force had reached out soon after the successful trials of the BrahMos missile aboard the SU-30. Developed at a low budget of \$300 million, the missile system has caught the attention of a number of countries in the Latin America including Argentina, Venezuela, Chile and Brazil. According to diplomatic sources, besides the missile system, there is a huge opportunity for Indian defence companies to participate in modernisation of the Chilean armed forces. Chiefs of the armed forces from both sides talked about exploiting the potential in shipbuilding, radar systems, submarines and joint training. The agreement between India and Russia for development of the advanced BrahMos system allows the use of the missile in both countries’ armed forces and export to other friendly countries. In an earlier interaction, Mr Anantoly Punchuk, Deputy Director FSMTC, said that the joint Indo-Russian venture was established back in 1998 BrahMos and has been successfully producing and testing missiles. According to him the venture is a real “precious gem” in the defence cooperation between the two countries. BrahMos missile complexes are supplied to the Indian Army and manufactured in series. The Joint Venture (JV) is also testing new types of missiles, namely airborne-based, underwater deployment, missiles with increase range, hypersonic experimental as well as supersonic all-purpose missile. And this success is equally shared by both India and Russia. The BrahMos missile, indeed, has a good export capacity. “Under the Inter-governmental Agreement (IGA) signed in 1998 the issue of exporting to a third country is decided jointly by Russia and India when there is a request from a specific country and after passing the necessary intergovernmental procedures in both countries,” Punchuk said. Also, as reported earlier there is a great opportunity for Indian defence companies to participate in the modernisation of Chilean armed forces, especially in the ship building, submarines and joint training. BrahMos Missile is a short-range ramjet supersonic cruise missile that can be launched from submarines, ships, aircraft or land. It is a joint venture between Russia’s NPO Mashinostroyeniya and the Defence Research and Development Organisation (DRDO) of India leading to the formation of BrahMos Aerospace Private Limited. On the other hand, weighing 1.4-1.6 tonne and length of 6 metre, the BrahMos-NG (next generation) is a breakthrough, meeting requirements of both the Indian Navy and the Indian Air Force. The Brahmos NG – will also be integrated with the Su 30 MKI fighter aircraft.

**Source:- Financial Express**

### **India-US looking to co-develop small air launch UAVs, says Pentagon**

India and the US have identified small air launch unmanned aerial vehicles and a lightweight small arms technology project along with aircraft maintenance for defence collaboration, a top Pentagon official has said. The US statement came as defence officials from the two countries held their latest round of Defence Technology and Trade Initiative (DTTI) talks here. The India-US DTTI meeting focused on encouraging the US and Indian industry to work together and develop next-generation technologies. “One project we’re looking at is small air launch UAVs,” US Undersecretary of Defence for Acquisition and Sustainment Ellen Lord told a media roundtable at the Pentagon. Lord, who co-chaired the meeting along with Secretary of Defence Production Mr Ajay Kumar, said the teams are looking at very specific deliverables on the specific dates with key individuals having responsibility. “Overall, we look at this as a cost-efficient, cost-effective way to provide additional capability to the warfighter. There are three proposed mission scenarios, humanitarian assistance/disaster relief, cross border operations and cave tunnel inspection,” Mr Lord said. On the drones, the discussions are mainly between the US Air Force Research Laboratory and India’s Defence Research and Development Organisation. In April, the two sides will write the technical planning document. “We plan to sign that sometimes in September timeframe,” she said, adding that the potential exists to involve the Indian industry in its co-development. The two sides also talked about virtual, augmented mixed reality for aircraft maintenance, which she stressed can deliver very significant potential to the two countries. “What we want to do is take both the US and Indian technology and translate that into a warfighting capability that both the US and the Indians can use. This is very much a collaboration in terms of our governments, our industries and our overall know-how. The beneficiaries will be both the US as well as the Indians,” Mr Lord said. The next meeting will be held in India in September. With some of these systems, whether it be launching UAVs or virtual, augmented mixed reality, they

are trying to focus on bolstering capabilities of platforms the two countries can share, she said. "There is lightweight, small arms technology project," Lord said. The key is the combined weapons and ammunition offer a 40 per cent weight reduction and improved accuracy. The ammunition uses full polymer casings that significantly reduced weight and give less heat transfer and recoil. "This is an area where there's co-development as well as co-production opportunity. What we're interested in technologies, where the US has brought them to a certain level and there's an appetite for more investment and for whatever reason we're not able to get to that in the US right now," the top Pentagon official said. Under the DTTI, the two countries have a number of joint working groups to identify areas for co-development and co-production. These are a joint working group in aircraft carrier technology, land systems, naval systems, air systems, and other systems. It all started in 2012 when then Defence Secretary Leon Panetta directed Deputy Secretary of Defence Ashton Carter to undertake an initiative to provide increased US senior level oversight and engagement to get beyond these obstacles. The DTTI's aim is to transform the bilateral defence relationship into one that is limited only by independent strategic decisions, rather than bureaucratic obstacles or inefficient procedures; and strengthen India's defence industrial base by moving away from the traditional "buyer-seller" dynamic toward a more collaborative approach. It also aims at exploring new areas of technological collaboration from science and technology cooperation through co-development and co-production and expands US-Indian business ties. "These interactions really form the basis of a very, very strong industry interaction as well," Mr Lord said. The DTTI meeting included updates on ongoing projects and collaborative opportunities in land, naval, air, and aircraft carrier technologies; a meeting with the US and Indian industry representatives; a visit to Norfolk Naval Station to tour the aircraft carrier USS Abraham Lincoln and destroyer USS Bainbridge; and a visit to a US defence company. "The DTTI is really delivering some opportunities, for both of our industrial bases to both better interact, as well as to bring the best of technology and innovation," Lord added

**Source:- PTI**

## **Hangars for Air Force Jets far from ready for soon to arrive Rafale and Su-30 MKIs**

Indian Air Force fighter bases are facing serious issues related to shortage of hangars and blast pens for the soon-to-arrive Rafale and Sukhoi fighter jets. Fund crunch in the Defence Ministry has almost brought work on new blast pens and hangars to a stop. The hangars being constructed to house the Rafale, besides the maintenance work of hangars to house Sukhois at the Gwalior Air base has also slowed down since January this year with just one to 2 per cent of the contracted work for this year completed. Overall, just 40% of the work on Rafale hangars and 30% of Sukhoi related pens have been completed. Sources said, MoD was due to pay about '2,000 crore to the Military Engineering Services (MES) contracted builders by January this year but only '230 crore was released, that too after association members met Defence Minister Mrs Nirmala Sitharaman to apprise her on the situation. President of the MES Builders Association of India (BAI), Mr Praveen Mahana, said, "Till January only 40% work for the Rafale related hangar, approach route and associated work for two new squadrons being done at Ambala in Punjab and Hashimara in West Bengal, were completed. "The Sukhoi hangars are stuck with just 30-35% work completed," Mahana said. MES contractors have stopped work as the bill raised against work has not been paid yet. The MES BAI, a registered body, has been raising the issue of non-payment for various Armed Forces related projects across the country since January 2018. At the beginning of this year, the association had warned the MoD that it was getting difficult to carry on work due to paucity of funds. The liability till December 2018 was '1,600 crore.

**Source: <https://defenceupdate.in/>**

## **Why is India developing its maiden deep-sea port in Indonesia**

### **Highlights**

- The port will give India better access to the South East Asian markets
- It will also give India a strategic hedge at a time China is increasing its presence in the Strait of Malacca
- The port will be key to India's Indo-Pacific strategy

India is developing its maiden deep-sea port in Indonesia's Sabang, not far from the Andaman and Nicobar Islands, amid China's attempts to have a greater say in the region through the Belt and Road Initiative (BRI). The port will be key to India's Indo-Pacific strategy. The port will give India better access to the South East Asian markets and provide a strategic hedge at a time China is increasing its presence in the Strait of Malacca (as also the larger Indian Ocean). Despite the Look East Policy, tracing back to the days of then PM Mr Narasimha Rao, India's relationship with ASEAN nations have largely been trade-oriented. But the rise of China in the waters of Indo-Pacific (and its economic

clout) calls for a new approach to the region. Hence, the reason the Mr Narendra Modi government has upgraded its policy to Act East. But countering China in the region is easier said than done. For one, China is the largest trade partner to ASEAN, increasing from \$192 billion in 2008 to \$515 billion by 2018. Then there is the BRI, through which China has spent about \$400 billion. Also, China's focus on Indo-Pacific region is aimed at displacing the US from the region — American military bases in Guam, Diego Garcia (Indian Ocean) as well as in Darwin (Australia), and its economic ties with the region ensure its primacy. But that mission threatens India as well, considering the nature of the relationship between Beijing and New Delhi. Hence, strategic partnerships with Indo-Pacific nations help. During PM Modi's visit to Indonesia last year, the two nations had agreed on a "Shared vision of maritime cooperation in the Indo-Pacific". Connectivity with Sabang port was identified as a key priority area within that vision. Following this, an Indian naval ship, INS Sumitra, visited Sabang for the first time last July. Now an Indian Coast Guard ship, Vijit, has visited the port (from March 17-20). India is also strengthening its forces in the Andamans. The Indian Navy recently commissioned its third (and India's fourth) air base in the islands.

**Source:- TNN**

## AWARD

### **DRDO Chief Satheesh Reddy conferred Missile Systems Award by AIAA**

India's aerospace scientist and Chief of the Defence Research Development Organisation (DRDO), Dr G Satheesh Reddy, has been conferred the Missile Systems Award 2019 by the American Institute of Aeronautics and Astronautics. Dr Satheesh is the first Indian to win the award, which recognises his leadership role in the Indian missile programme. AIAA is the world's largest and reputed aerospace technical society. He will share the prize with Rondell J. Wilson, a former Principal Engineering Fellow of Raytheon Missile Systems. Dr Satheesh Reddy, who is Scientific Adviser to the Defence Minister, is considered the architect of advanced missile technologies and smart guided weapons technologies in India. As Project Director, he led the design and development of the country's first 1,000 kg class guided bomb which has enhanced precision strike capabilities. Earlier, he was the first scientist from India to receive the Silver Medal from the Royal Aeronautical Society, London. The AIAA said in a press release the award recognises excellence in developing or implementing missile systems technology, including significant technological accomplishments or for inspired leadership of missile systems programmes. Dr Reddy has contributed significantly to the indigenous design, development and deployment of diversified strategic and tactical missile systems, guided weapons, advanced avionics, and navigation technologies. He has played a major role in the development of some key systems, including tactical missile systems such as the quick reaction surface-to-air missile, the portable anti-tank guided missile and the HELINA and NAG anti-tank weapons, the DRDO said.

**Source: <https://www.thehindubusinessline.com/>**

## ADVERTISEMENTS

E-news is bringing out an exclusive slot for individuals to advertise for career opportunities. Industries and Institutions can promote advertise at very nominal charges product ranges as well as airline operators to present route and tariff