



# E-NEWS

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## TECHNOLOGY



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### HAL's Light Utility Helicopter clears 6-km flight test

The multi-purpose Light Utility Helicopter (LUH) that is under development has achieved an important milestone of flying at 6 km altitude. "The helicopter exhibited satisfactory performance and handling qualities. With the completion of this milestone, the LUH can now undertake high altitude cold weather trials planned in January 2019," its creator, Hindustan Aeronautics Ltd, said on December 10 2018. The LUH has been undergoing tests to expand its envelop. The recent feat achieved in Bengaluru is a

critical requirement for certifying the 3-tonne helicopter for use. Built to fly over high altitude



areas, the LUH has a maximum permitted height limit of 6.5 km. HAL already has two in-principle orders for a total of 187 LUHs - 126 for the Army and 61 for the Air Force. Apart from military surveillance and

reconnaissance roles, it can also serve as a light civil transport helicopter. The LUH is being designed and developed by HAL's Rotary Wing Research and Design Centre to replace the aged Cheetah and Chetak helicopters of the Armed Forces. HAL's Chief Test Pilot Wg. Cdr. (Retd) Unni K. Pillai and Test Pilot Wg. Cdr. (Retd) Anil Bhambhani flew the copter. The LUH's first prototype, PT-1, first flew on September 6, 2016, and the second prototype flew on May 22, 2017

Source:

[https:// www.thehindu.com](https://www.thehindu.com)

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## CURRENT AFFAIRS

### **Aero India 2019: Top Pentagon officials and American aerospace companies to visit India**

Encouraged by the growing India-US relations especially in the defence and strategic areas, several top Pentagon officials along with US industry executives will be traveling to Bengaluru Feb 20 - 24 for Aero India 2019 event to showcase strong US government interest. The high level official as well business delegation having representatives of defence companies like BAE Systems, Textron Aviation, Raytheon, AECOM, Harris Corporation, Telephonics Corporation, Boeing, General Atomics, Northrop Grumman, and TCI, is being led by world-renowned aerospace scientist Dr Vivek Lall at US-based Lockheed Martin, who has also been appointed to the US Federal Aviation Advisory Committee. The two countries had this year the first ever US-India "2+2" dialogue in New Delhi where on the sidelines of the meeting the COMCASA, a landmark military communications and security pact was signed. Besides the Indo-Pacific region, the air force to air force relationships is another hallmark of strategic ties and trust between nations. The talks were between Minister of External Affairs Minister Mrs Sushma Swaraj and Minister of Defense Mrs Nirmala Sitharaman and both US Secretary of State Mike Pompeo and Defense Secretary James Mattis. The two countries have already inked the Logistics Exchange Memorandum of Agreement (LEMOA) in 2016 and the General Security of Military Information Agreement (GSOMIA) in 2002. The LEMOA agreement allows the use of each other's land, air and naval bases for repair and resupply, a step toward building defence relations. Sources have confirmed to FE that Lall who over the decades has been regarded as the leading US executive by both governments to help catalyze what now is almost \$18 billion dollars of defence trade between both countries will be leading the delegation. The US executives are coming under the umbrella of US India Business Council delegation that has all the top defence manufacturers as its members. Since both India and the US are aspiring to grow together as major defence partners, this visit of the top honchos of the American industry will give chance to companies on both sides to look for more ventures which would compliment each side. Sources also confirmed that several US defence platforms will be visible at the airshow. India has shown interest in several US platforms to be acquired in the years ahead notwithstanding its existing significant relationships with Russia, Israel, and Europe. As Chinese influence continues to grow in the Asian region countries are beefing up their partnerships and alliances to handle potential future threats. The US can play a critical role in the region if it offers its latest technologies to India for the long term. A lot of the US-based defence manufacturers are keen to participate in Prime Minister Narendra Modi's all the major initiatives including Made in India, Skill India, Digital India and others. Top aerospace companies including Boeing Company, Lockheed Martin, BAE Systems, Northrop Grumman, are already working with companies in India whether from Micro, Small & Medium Enterprises (MSMEs) throughout India. Defence minister Nirmala Sitharaman is also on her maiden visit to the US where besides having a meeting with the US Defence Secretary of state James Mattis, she also met with the top officials in the Pentagon, indicating that the defence ties between the two countries are growing. This is her fourth meeting with Mattis in one single year.

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

### **'The Big Bird', India's "Most Powerful" Satellite Launched Successfully**

The ISRO's GSAT-11 satellite also called the "Big Bird " was successfully launched into space today from the French space port of Kourou in South America. Launched at 2.07 am (IST), the satellite will help provide internet to remote places where cable-based internet cannot reach. It weighs around 5,854 kg and is the heaviest Indian-made equipment that the agency put into its orbit. After the first bid failed in May earlier this year, this was ISRO's second attempt. The satellite is healthy after the launch, according to ISRO. "GSAT-11 is the next generation high throughput communication satellite that will play a vital role in providing broadband services across the country. It will also provide a platform to demonstrate new generation applications," Dr K Sivan, ISRO chief said. Costing around Rs. 600 crore, the "Big Bird" has a life span of 15 years. The ariane-5 heavyweight rocket was hired from Arianespace by ISRO. The satellite internet, which the GSAT-11 will help to provide, will aid in giving internet connectivity in flights in India. The GSAT-11 is equivalent to the combined power of almost all communications satellites sent into orbit by India. The French Ariane-5 rocket has been hired by India, as it can heavy payload into orbit. India's own geosynchronous satellite launch vehicle MK iii or

GSLV MK iii can haul satellites that weighs upto 4 tons. The ISRO Chief added that along with its three siblings, GSAT-19, GSAT-29 and GSAT-20, the satellite will be a “game changer for providing internet access and data communications for India and will aid the digital India program.

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

## **Next, GSAT-11 awaits 1 200 crore ground system**

Now that GSAT-11, the third and latest Internet-boosting communication satellite, is up in space, the Indian Space Research Organisation (ISRO) says it is in the process of readying a 1 150-200-crore ground infrastructure across cities to use it. A Ka-band hub or gateway each is being set up in Delhi, Bengaluru, Ahmedabad and Ranchi to deliver high-speed broadband services via the giant satellite. Dr K.Sivan, Chairman, ISRO, said, “The activity of establishing the ground system is on and it may happen over some more months.” The nearly six-tonne heavyweight satellite was launched in December 5 on a European launcher. Along with its older HTS mates — GSAT-19 and GSAT-29 — it forms an Indian quartet of high-throughput satellites (HTSs). Each of them has a different space location over India and must have its own ground systems. The ground systems are being put up by external agencies chosen through competitive bidding. They will also be operated and maintained by them for five to seven years. Dr. Sivan admitted that there were “procedural delays” in completing the system with outside support. The use of the Ka band will be new in the country. In 2017, ISRO’s payload developing unit, the Space Applications Centre (SAC) in Ahmedabad, had put out a search or RFP (request for proposal) for companies that could set up GSAT-11’s Ka-band ground systems. About the HTSs, Dr. Sivan said, “Our target is to deliver close to [a Net data speed at the rate of] 100 Gbps through them. We have planned a fourth one, too — the GSAT-20. It will be a four-tonne-class HTS and will be launched towards the second half of 2019 on our GSLV MarkIII vehicle. With that, our current national requirement should be met.”

### **Remote areas**

The fleet is designed to mainly serve the remote and hilly northeastern States, and Jammu & Kashmir, which are starved of reliable Net services. “Our concentration is on those areas, where it is not possible to establish terrestrial cables as in cities,” Dr. Sivan said. Referring to the consecutive launches of GSAT-29 in November and GSAT-11 in December, Dr. Sivan said, “Within a matter of about 20 days, we have already beefed up the requirements of VSATs (very small aperture terminals) by putting up two satellites suited to them.”

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

## **Light combat aircraft races to meet its target date**

With the recent Public Accounts Committee criticising the Hindustan Aeronautics Ltd (HAL) and the Aeronautical Development Agency (ADA) over failure in timely delivery of the Light Combat Aircraft (LCA) Tejas and with the deadline for the Final Operational Clearance (FOC) fast approaching, the agencies involved in the fighter jet’s development are working against time to meet the target date. December 2018-end has been fixed as the deadline for the FOC and though there is just 15 days left ADA, the nodal agency for the LCA program, is confident that it would meet the target date. ADA Officials had conveyed a meeting to discuss about the FOC and they expressed confidence that they would meet the December-end deadline. The FOC-compliant Tejas would incorporate Beyond Visual Range (BVR) missiles, improved and better stand-off weapons and air-to-air refuelling capability. If the agencies are able to meet the FOC target it would exactly five years after the aircraft got the Initial Operational Clearance (IOC) tag. Air Marshal B Suresh, Air Officer Commanding-in-Chief, Southern Air Command also had a firsthand experience of the aircraft as he took a sortie. The Air Marshal also reviewed the production facility of the LCA-Tejas He also visited the Aircraft and Systems Testing Establishment (ASTE), HAL Bangalore and Helicopter Complex, National Flight Test Centre (NFTC) and the ADA. At ADA, the Air Marshal was briefed on the future development plan of LCA and its advanced weapon integration. The Public Accounts Committee in its recent report stated that it “observed that the LCA project was sanctioned in 1983 to provide replacement aircraft for MiG-21 series which were to complete their technical life and were to be phased out in 1990s. As specified in ASR (Air Staff Requirement) specified in 1985, the LCA was to be inducted by 1994. “The Committee are aghast to

note that as July 31, 2018, IAF has only got nine out of the 200 fighter and 20 trainer aircraft envisaged in ASR. These six aircraft have been productionised after only Initial Operational Clearance (IOC) and are not combat ready, as yet. The committee are perturbed to note that the FOC has still not been achieved by the LCA even after more than 5 years of IOC. The ADA/HAL have also not been able to provide IAF with even a single production standard trainer aircraft till date," it stated.

*Source: <http://www.indiandefensenews.in>*

## **Busy year ahead for ISRO, Chandrayaan-2 mission launch likely by February-end**

From Chandrayaan-2 to the important demonstration flight of Small Satellite Launch Vehicle (SSLV), the Indian Space Research Organisation is looking forward to an exciting year ahead. As several global firms are investing heavily on reusable launch vehicles, ISRO is also expected to take a plunge into the sector and some key experiments are planned by the agency during the coming year. These projects will be apart from the ISRO's target of completing two launches in every month of the calendar year, a goal set by its chairman Dr K Sivan. Eleven years after Chandrayaan-1 was launched, ISRO will send another mission to the moon to perform several key experiments on the lunar surface. While the first mission had an orbiter and an impact probe, Chandrayaan-2 will be more advanced and will consist of an orbiter, rover and lander. Chandrayaan-2 is expected to perform multiple experiments to map major elements of moons' surface, prepare a three-dimensional map to assess its geology, and to check for the presence of water ice on the moon. While the first mission had lasted for a year before losing contact from the ground, ISRO has taken steps to improve the duration of the mission to collect more scientific data on the hostile surface of the moon. Dr K Sivan, in 2018, had said that Chandrayaan-2 will be launched aboard Geosynchronous Launch Vehicle (GSLV) Mk III in the first quarter of 2019, and the mission is expected to be launched by February end. While Chandrayaan-2 will be a scientific endeavour, ISRO will also improve its finances by developing SSLV to launch smaller satellites to lower earth orbits. SSLV, which is currently under development, will have an important demonstration flight by May or June 2019. The ultra portable launch vehicle will take only three to six persons to integrate and launch a satellite and will serve as an 'on-demand launcher'. Antrix, ISRO's commercial arm is also expected to play an important role in popularising the launch vehicle. Though international space firms such as SpaceX have already made some inroads into developing reusable launch vehicles, ISRO will be taking its first steps to develop it by conducting a landing experiment of a reusable vehicle. Apart from it, ISRO is also expected to contribute to the science education front by launching exclusive magazines and ISRO TV, which will broadcast science programmes to the general public.

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

## **India's heaviest communication satellite GSAT-11 launched successfully from French Guiana**

Indian Space Research Organisation's (ISRO) heaviest and most-advanced high throughput communication satellite GSAT-11 was successfully launched from the Spaceport in French Guiana during the early hours today. The launch vehicle Ariane 5 VA-246 lifted off from Kourou Launch Base, French Guiana at 02:07 am (IST) carrying India's GSAT-11 and South Korea's GEO-KOMPSAT-2A satellites, as scheduled. Ariane 5 is one of three launch vehicles operated by Arianespace along with Soyuz and Vega. After a 30-min flight, GSAT-11 separated from the Ariane 5 upper stage in an elliptical Geosynchronous Transfer Orbit. The achieved orbit was very close to the intended one. The 5854-kg GSAT-11 will provide high data rate connectivity to users of Indian mainland and islands through 32 user beams in Ku-band and 8 hub beams in Ka-band. "GSAT-11 will boost the broadband connectivity to rural and inaccessible Gram Panchayats in the country coming under the Bharat Net Project, which is part of Digital India Programme," ISRO Chairman Dr K Sivan said. The Bharat Net Project aims to enhance the public welfare schemes like e-banking, e-health, e-governance among others. He said GSAT-11 will act as a forerunner to all future high throughput communication satellites. "Today's successful mission has boosted the confidence of the entire team," Dr Sivan added. Post-separation, ISRO's Master Control Facility at Hassan in Karnataka took over the command and control

of GSAT-11 and found its health parameters normal. The scientists will undertake phase-wise orbit-raising manoeuvres in the days ahead to place the satellite in the Geostationary Orbit (36,000 km above the equator) using its on-board propulsion systems. GSAT-11 will be positioned at 74-degree east longitude in the geostationary orbit. Subsequently, the two solar arrays and four antenna reflectors of GSAT-11 will be deployed in orbit. The satellite will be operational after the successful completion of all in-orbit tests. In the last 21 days, ISRO successfully completed three satellite and two launch vehicle missions.

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

## **GSLV-F11 successfully launches GSAT-7A**

Indian Space Research Organisation's (ISRO) Geosynchronous Satellite Launch Vehicle (GSLV-F11) successfully launched the communication satellite GSAT-7A from the Satish Dhawan Space Centre (SDSC) in Sriharikota today. The GSLV-F11 lifted off from the Second Launch Pad at SDSC at 04:10 pm IST, carrying 2250 kg GSAT-7A and about 19 minutes later, injected GSAT-7A into a Geosynchronous Transfer Orbit (GTO) of 170.8 km x 39127 km which is very close to the intended orbit. An ISRO team led by Chairman Dr K Sivan, Vikram Sarabhai Space Centre (VSSC) S Somanath, U R Rao Satellite Centre (URSC) Director Dr P Kunhikrishnan, Space Applications Centre (SAC) Director D K Das, SDSC Director Mr S Pandian, Liquid Propulsion Systems Centre (LPSC) Dr V Narayanan and ISRO Propulsion Complex (IPRC) Director Mr T Mookiah witnessed the launch. Mission Director Mr Mohan M and Satellite Director Mr Killedar Pankaj Damodar oversaw the launch proceedings. Soon after the separation of the satellite, ISRO's Master Control Facility (MCF) at Hassan in Karnataka took over the command and control of GSAT-7A. The satellite's health parameters are normal. In the next few days, scientists at MCF will perform various orbit-raising manoeuvres, using GSAT-7A's onboard propulsion system, to place the satellite in its final geostationary orbit. In his post-launch televised address, Dr Sivan said the team has achieved another spectacular milestone by launching GSAT-7A. "In the last 35 days, ISRO has successfully launched three missions from SDSC starting with GSLV MkIII-D2 on November 14, PSLV-C43 on November 29 and finally GSLV-F11 today. GSLV has successfully injected GSAT-7A into a super synchronous transfer orbit," Dr Sivan said. He said GSAT-7A is the heaviest satellite being launched by GSLV with an indigenously developed cryogenic stage. "The cryogenic stage of this vehicle has been modified to increase the thrust rate. GSAT-7A is an advanced communication satellite with a Gregorian Antenna and many other new technologies. The testing and realisation of this satellite has been carried out meticulously by ISRO team. We have signed off year 2018 on a high and positive note," Dr Sivan added. GSLV is ISRO's fourth generation launch vehicle with three stages. The four liquid strap-ons and a solid rocket motor at the core form the first stage. The second stage is equipped with a high thrust engine using liquid fuel. The cryogenic upper stage forms the third and final stage of the vehicle. GSLV-F11 was the seventh flight carrying indigenously developed cryogenic upper stage. GSAT-7A is the 39th Indian communication satellite of ISRO to provide services to the users in Ku-band over the Indian region. Most of the functional requirements of the communication payloads and the other systems have been derived from ISRO's earlier geostationary INSAT/GSAT satellites. Today's launch was the 7<sup>th</sup> mission of ISRO from SDSC in the year 2018. This was the 13<sup>th</sup> flight of GSLV-MkII.

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

## **India may cut US surveillance drone deal by half due to fund crunch**

India may prune by half a potential order to import hi-tech unmanned aerial vehicles (UAVs) from the United States due to financial constraints, two government officials familiar with the Navy's modernisation plans said. Instead of pursuing the navy's original requirement of 22 MQ-9B SeaGuardian UAVs to boost its intelligence, surveillance and reconnaissance capabilities, India now plans to buy only 10 such systems under the US government's foreign military sales (FMS) programme, one of the officials cited above said on condition of anonymity. The 22 UAVs, made by General Atomics, were estimated to cost \$2 billion. India began the FMS process in 2016 by issuing a Letter of Request (LOR) to the US. "Responding to the LOR, the US has supplied us with the price and availability (P&A) data for the SeaGuardian systems. The navy has studied it and rationalised its requirement from 22 to 10 UAVs

because of the cost and the requirement of the other services," said the second official, asking not to be named. The Indian Air Force (IAF) is also keen to buy Predator Avenger UAVs from the US. The downsizing of the order will mean that the navy will have to prioritise the areas it wants to keep under surveillance using the SeaGuardian UAVs, said a senior navy officer on condition of anonymity. "We had arrived at a figure of 22 on the basis of our requirements. But we have to manage with the resources we have. The navy has several aerial surveillance platforms such P-8I aircraft, IL-38s, Dornier planes and other UAVs," he said. A government-to-government deal does away with the need to float a tender. Such transactions may be complicated in their conception and execution but are more transparent to financial scrutiny. "If financial constraints are there, then there's no choice but to order fewer UAVs," said military affairs expert Rear Admiral (ret'd) Sudarshan Shrikhande. The MQ-9B SeaGuardian systems will provide unmatched intelligence and surveillance capabilities to the navy, he said. The navy currently operates a mix of Israeli-built Heron and Searcher UAVs for intelligence-gathering and surveillance. It has a vast area of responsibility in the Indian Ocean Region (IOR) spanning millions of square kilometres, with warships being deployed to as far as the Persian Gulf to the Strait of Malacca and northern Bay of Bengal to the southeast coast of Africa. With their range and endurance, SeaGuardian UAVs will provide India advanced capabilities for ocean surveillance, especially at a time when Chinese naval presence in the region has gone up. India's exclusive economic zone alone measures 2.4 million square kilometres, which is also the navy's responsibility. Navy chief Admiral Sunil Lanba had highlighted the significance of the Indian Ocean earlier this month, calling it the navy's only front. "As we surge ahead in the 21st century, the attention of the entire world is focused on the Indian Ocean Region, where our navy is increasingly seen as a 'net security provider'...Our security strategy is aimed at providing a maritime environment that is free from all forms of traditional and non-traditional threats to our national development," Lanba had said. The P-8I planes, the mainstay of the navy's long-range maritime surveillance fleet, have also been imported from the US. India currently operates eight Boeing P-8I planes and four more will join the fleet by 2021. General Atomics has also designed the electromagnetic aircraft launch and recovery system (EMALS), which is likely to be fitted on India's second Indigenous Aircraft Carrier (IAC-II). The navy is getting more American equipment. India issued an LOR to the US government in November for 24 MH-60R Seahawk multirole helicopters under the FMS programme. Since 2008, India has bought or ordered military equipment worth \$15 billion from the US. This includes C-130J special operations planes, C-17 transport aircraft and P-8I submarine hunter planes.

*Source: Source: - Hindustan Times*

## **DRDO on long range Pralay, K5 to stalemate China soon**

Defence Research and Development Organisation (DRDO) is set to throw up some pleasant surprises early next year. Along with the induction of 5,000-km range surface-to-surface ballistic missile Agni-V, the premier defence research agency is readying for the maiden test of its long range Submarine Launched Ballistic Missile (SLBM) K-5. K-5 missile developed under the secret 'K Series' project is the fastest missile in its class and can deliver nuclear warhead of more than one tonne 5,000 km away. The three-stage missile propelled by solid propellants can deceive enemy radar making it more lethal. While 750-km range K-15 (B-05) and 3,500 km range K-4 of the K-family have already been test fired successfully several times and are in the process of induction, the newly developed K-5 will add more teeth to the arsenal. Defence sources said the missile will be flight tested from a submersible pontoon launcher in Bay of Bengal off Visakhapatnam coast for a suppressed range to validate some new technology incorporated in the system before it is put under tests for full range in operational configuration."The K-5 missile was sanctioned in 2015. The weapon system is now being readied for initial phase trials. Though the test window has not been finalised, it is expected to fly in the sky soon. A successful trial would pave the way for the development of its longer range cousin K-6," said a senior defence official. With India perceiving China as a potential threat, the focus now seems to have been laid on development and deployment of long range missiles having underwater launch capabilities. The K-5 missile will undergo a series of developmental trials before its induction in armed forces. It will equip S4 nuclear powered submarine, currently under development. Indigenously developed INS Arihant submarine, which completed sea patrol recently, will be equipped with K-15 and K-4 missiles. Before the K-5 trial, the DRDO is also planning for first test of surface-to-surface tactical

Short Range Ballistic Missile (SRBM) Pralay from a defence base off Odisha coast on December 18. Earlier planned in September, the test was reportedly deferred for administrative reasons. The much faster and accurate Pralay has a strike range upto 500 km and weighs around five tonne. It can be compared with China's Dongfeng 12 and Russia's 9K720 Iskander, both short-range tactical ballistic missiles. "Preparation is also on for a user trial of 4,000 km range Agni-IV missile by the Strategic Forces Command. The missile will be fired in a lofted trajectory like the recent test of Agni-V. The trial is likely to be conducted on December 26," the official added.

### **Sky shield**

SLBM K-5 is the fastest missile in its class Can deliver nuclear warhead of more than one tonne 5,000 km away To be flight tested from a submersible pontoon launcher off Visakhapatnam coast SRBM Pralay to be test-fired from a defence base off Odisha coast Has a strike range upto 500 km Weighs around five tone

*Source: - Indian Express*

### **India Successfully Test-Fires Nuclear-Capable Agni-IV Missile**

India successfully test-fired its nuclear-capable long-range ballistic missile Agni-IV, with a strike range of 4,000 km, as part of a user trial by the Army. The strategic surface-to-surface Agni-IV missile was flight tested from launch complex-4 of the Integrated Test Range (ITR) at Dr Abdul Kalam Island, earlier known as Wheeler Island, at about 8.35 am, the defence sources said. Describing the trial as a "complete success", they said all mission objectives were met during the test-fire. All radars, tracking systems and range stations tracked and monitored the flight performance of the missile, which was launched with support of a mobile launcher. Radars and Electro-optical systems had been positioned along the coast of Odisha for tracking and monitoring all parameters of the missile, the sources said, adding two naval ships were anchored near the target area to witness the final event. This was the 7th trial of Agni-IV missile. The last trial conducted by the strategic force command (SFC) of the Indian Army from the same base on January 2, 2018 was successful. The indigenously developed sophisticated Agni-IV having 4,000 km strike range is a two-stage missile. It is 20 meter long with a weight of 17 tonnes, they said. "The state-of-the-art missile is equipped with modern and compact avionics to provide high level of reliability and precision," Defence Research and Development Organisation (DRDO) sources said. Agni-IV missile is equipped with advanced Avionics, 5th generation On Board Computer and distributed architecture. It has the latest features to correct and guide itself for in-flight disturbances, they said. The accurate Ring Laser Gyro-based Inertial Navigation System (RINS), supported by highly reliable redundant Micro Navigation System (MINGS), ensures the vehicle reaches the target with accuracy. The re-entry heat shield can withstand temperatures in the range of 4000 degrees centigrade and makes sure avionics function normally with inside temperature remaining less than 50 degrees centigrade. Ballistic missiles like Agni-I, II and III and Prithvi have been included in the arsenal of the armed forces, giving India an effective deterrence capability.

*Source: - NDTV*

### **Cabinet nod for 10,000-crore Gaganyaan human space mission**

The Union Cabinet approved the ambitious Gaganyaan programme, which will send three Indian astronauts to space for up to seven days by 2022 at a cost of 1 10,000 crore. The project was first announced by Prime Minister Narendra Modi in his Independence Day speech this year. As part of the programme, two unmanned flights and one manned flight will be undertaken. The first human space flight demonstration is targeted to be completed within 40 months of the sanction date. Prior to this, two unmanned flights in full complement will be carried out to gain confidence, the government said. The Indian Space Research Organisation (ISRO) has developed the launch vehicle GSLV MK-III, which has the necessary payload capability to launch a three-member crew module in low earth orbit.

### **Escape system tested**

The ISRO has also tested the crew escape system, an essential technology for human space flight. Elements of the life support system and the space suit have also been realised and tested, the

government said. The Union Cabinet said the necessary infrastructure for crew training, realisation of flight systems and ground infrastructure will be established to support the Gaganyaan programme. Under the programme, ISRO will collaborate extensively with national agencies, laboratories, academia and industry. The ₹ 10,000 crore fund will cover cost of technology development, flight hardware realisation and essential infrastructure elements. The government believes that the programme will generate employment and train human resources in advanced technologies. "It will inspire a large number of young students to take up science and technology careers for national development," the government said.

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

## TECHNOLOGY

### **Boeing signs deal with British company to recycle aerospace waste materials**

SAN FRANCISCO, Dec. 5 (Xinhua) — U.S. aerospace giant Boeing Company (Boeing) signed a five-year agreement with Britain-based ELG Carbon Fibre (ELG) to recycle aerospace waste materials from Boeing factories in the United States. Under the deal that is the first of its kind in the aerospace industry signed by the two companies, Boeing said it will provide ELG with excess aerospace-grade composite materials from Boeing's 11 manufacturing sites for recycling. The cured and uncured carbon fiber waste will come from the Boeing composites manufacturing operations, including the 777X Composites Wing Center in Everett, Washington state, Boeing Charleston facility in South Carolina and eight other manufacturing locations. The recycled materials from cured and uncured carbon fiber used in airframes such as the Boeing 787 Dreamliner and the 777X will be repurposed for making secondary products like laptop cases, car parts and other items in manufacturing applications. The agreement will help Boeing reduce solid waste by more than 1 million pounds (about 453,592 kg) every year. Boeing is the largest producer of aerospace-grade composite materials. "Boeing has been working for several years to create an economically viable carbon fiber reuse industry. The company improved its production methods to minimize excess and developed a model for collecting scrap material," Boeing said. "Recycling cured carbon fiber was not possible just a few years ago," said Tia Benson Tolle, materials and fabrication director for Product Strategy and Future Airplane Development at Boeing. Boeing started a pilot project with ELG in March 2017 to recycle excess materials used to produce the massive wings of the 777X airplane at its plant in Everett, Washington state. The new partnership with ELG will support its goal to reduce by 20 percent solid waste going to landfills by 2025, Boeing said. It also noted that Boeing and ELG are considering expanding the agreement to include excess materials from three additional Boeing sites in Canada, China and Malaysia.

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

### **India's first military flight using a blended bio-fuel gets tested in city**

Experimental test pilots and test engineer from the Indian Air Force's (IAF) Bengaluru-based testing establishment ASTE flew India's first military flight using blended biojet fuel, an An-32 transport aircraft, on 27 July. The project is a combined effort of IAF, Defence Research and Development Organisation (DRDO), Directorate General Aeronautical Quality Assurance (DGAQA) and CSIR-Indian Institute of Petroleum. On 27 July, Air Chief Marshal Mr BS Dhanoa, Chief of Air Staff had announced IAF's intention to promote biojet fuels. Addressing the CII-SIDM seminar on promoting indigenised technologies, the CAS had stated that IAF intended to fly the An-32 with 10% biojet fuel for the Republic Day flypast in 2019. Indian Air Force carried out extensive engine tests on the ground. This is now being followed by flight trials using 10% biojet blended aviation turbine fuel. This fuel is made from Jatropa oil sourced from Chattisgarh Biodiesel Development Authority (CBDA) and then processed at CSIR-IIP, Dehradun.

Source: <https://bangaloremirror.indiatimes.com/>



## Open to helping India in production of Tejas aircraft: Lockheed

America's top fighter jet manufacturer Lockheed has said it is open to helping India in the production of the indigenously-designed light combat aircraft Tejas. Currently, the state-run Hindustan Aeronautics Ltd (HAL) is producing around eight Tejas annually and the defence ministry wants it to increase the number to 18 planes per year. Tejas is a single engine multi-role aircraft. It is the smallest and lightest Multi-Role Supersonic Fighter Aircraft of its class. Vivek Lall, vice-president of Strategy and Business Development for Lockheed Martin Aeronautics, told PTI that the company is open to helping India on Tejas. "Lockheed Martin has a strong record of successful international industrial partnerships, many of which happen to be directly related to the F-16," the Indian-American official said. "The F-16 is a proven force multiplier that would certainly complement the Tejas," Lall said. He said the production of F-16 in India, as being proposed by Lockheed, will not only put the country at the epicentre of a USD 165 billion fighter aircraft sustainment market but also the world's largest fighter aircraft ecosystem. Lockheed, which has proposed to shift its entire F-16 manufacturing base to India, subject to it getting a major order from the Indian armed forces, argued that currently there are production opportunities for more than 400 such fighter jets globally. "Exclusive F-16 production will put India at the epicentre of a USD 165 billion fighter aircraft sustainment market and the world's largest fighter aircraft ecosystem. The F-16 will also enables Indian industry to establish new relationships with Lockheed Martin and other global industry leaders," he said. "Those relationships and the technology sharing they facilitate can spawn new ideas and innovation in India for decades to come. This is about far more than an F-16 production line. It's about building trust, strategic partnerships and new ideas to unleash the potential of India's own innovators," he said in response to a question.

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

## Made in India F-16s – It's in India's interest to be part of Global Defence Supply Chains

Some in India have a negative reaction to being part of a "supply chain"—particularly when it involves defence production with foreigners. This reaction is often based on a visceral feeling that maintaining "strategic autonomy," or the atavistic "non-alignment," requires India to stand alone and never be a part of anyone else's "chain". Perhaps the very term "chain" conjures up restraint reminiscent of a colonial past. However, a dispassionate assessment of the benefits to India of participation with the United States in defence supply chains shows that the benefits far outweigh the constraints. Any contract for participation in a joint endeavour involves undertakings by each party. The question is not whether the undertakings involve constraints (all contracts involve constraints), but whether the benefits of the arrangement outweigh those constraints. Defence supply chains are now the way of the world. Unless India is willing to participate in such supply chains, many of its national interests and aspirations for great power status will remain unfulfilled. The challenge for India is not whether to participate in defence supply chains, but with whom to partner and on what terms. Cases in point are opportunities for India to partner with US defence giants Boeing and Lockheed in global supply chains. Thus far, Boeing has been the leader in integrating Indian manufacturers into defence supply chains. The deal between Boeing and Tata to build in Hyderabad fuselages for AH-6 Apache helicopters has received much publicity. However, Boeing was already involved in many Indian production efforts that have the potential of making Indian companies major players in global defence supply chains. The Apache project will only add significantly to the more than 3,500 Indians presently working on dedicated Boeing supply chain jobs. However, the Apache project is perhaps dwarfed by the possibility of Lockheed's teaming to build the entire F-16 fighter aircraft in India. This production would entail building in India 85% of the Indian Air Force's latest requirement for fighter jets. Lockheed is already slated to make in India wings for the F-16 Block 70. Partnering for the full aircraft would fully integrate Indian companies into a worldwide supply chain for virtually all components of an advanced F-16. The result would be a \$15 billion export potential in addition to the planes made for the IAF. Such an endeavour could employ thousands in high-end jobs. Thus, the first reason for India's partnering with the US on global defence supply chains matches directly with Prime Minister Narendra Modi's "Make in

India" initiative. The creation of sales and the resulting employment makes these partnerships highly desirable. But the importance of defence supply chain integration goes far beyond income and employment. India needs the skills development and knowhow transfer that come with being part of global defence supply chains. Decades ago, India tried the import substitution and border centric approach to development. The result was stagnation and a failure to keep pace in building the skills required for a modern economy. There is no better way to develop a highly-skilled workforce with the knowhow necessary to produce at the highest levels, than to meet the standards of a global supply chain. Interoperability of organisations and weapons systems is the gold standard for strategic partnership. Weapons systems that are jointly manufactured can be a fundamental driver of interoperability. Weapons systems that can be used by both the US and India enhance to the ability to collaborate in meeting common strategic challenges. No two nations have more commonality in the strategic challenges they face than do India and the United States. Chief among these is an increasingly belligerent and authoritarian China. Should China ever decide to make good its claims to an entire Indian state (Arunachal Pradesh) or choke off free access to the South China Sea, the US is the only major power likely to back India in defence of its national interests. In such situations, Indian participation with the US in global supply chains may well be a crucial component of meeting these challenges. To be sure, the US also benefits from having India as a partner in global defence supply chains. These benefits are largely mirror images of the benefits to India. Thus, the US and India need to redouble their efforts to include India in such supply chains as those for the F-16 and the Apache helicopter. These supply chains will greatly enhance the abilities of both countries to protect their national interests and build peace and stability throughout the world.

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

## **Indigenous Aircraft Carrier-1 to be inducted into Indian Navy in 2020**

The first of the two Indigenous Aircraft Carriers (IAC) is expected to be inducted into the Indian Navy in 2020 and will be based with the Eastern Naval Command (ENC) here, Flag Officer Commanding-in-Chief of the ENC, Vice-Admiral Mr Karambir Singh said. Addressing a press conference onboard the INS Sahyadri on the eve of Navy Day here, Mr Singh said IAC-1 was currently being built in Kochi under the Maritime Capability Perspective Plan. A MiG-29 squadron would also be positioned at the ENC once the IAC-1 was inducted, he said. "In keeping with the country's maritime interests, the Navy has a requirement of two operational aircraft carriers. The Maritime Capability Perspective Plan envisages a force level of three aircraft carriers to ensure availability of at least two Carrier Battle Groups at any given time," the Vice-Admiral said. While INS Vikramaditya has already been inducted in line with this plan, IAC-1 was under construction, he said. "The case for IAC-2 is being progressed to meet all future requirements without any degradation in force levels," he added. The Navy was building required infrastructure like berthing facilities and associated services at the ENC for IAC-1. Plans were also afoot to build a 10,000-ton ship-lift facility at the Naval Dockyard here. Once commissioned, this would be the second such facility in the country after the one at Karwar, he said. Mr Singh said orders were issued for building 27 warships and submarines under the Make in India initiative that would aid the capability building programme of the Navy. "On an average, four to five warships, including submarines, are normally inducted in a year. So, the new ones are expected to be inducted in the next five or six years," he said, in reply to a question. On the increasing positioning of rival warships in the Indian Ocean region, the ENC chief said they too enhanced deployment of ships, submarines and aircrafts. "We have transitioned to mission-based deployments, aimed at maximising our time at sea with defined outcomes. We also have automatic identification systems in place, specially in 'choke points' like the Malabar Straits," he said. "Having designated our role in the Indian Ocean Region as the net security provider, the aim of these deployments is to have presence in relevant areas so as to secure our maritime interests and also assure our friends in the region that we are available to assist in the event of a developing situation," the Vice Admiral said.

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

## All Issues Pertaining to Serviceability of MiG-29K Sorted Out – Indian Navy

MiG-29K, being the choice of aircraft for both the aircraft carriers, viz. INS Vikramaditya and an under-construction domestically-produced aircraft carrier, as well as two naval air stations on the East and West coast, is the mainstay of the Indian Navy's air defence fleet. Indian Navy Chief Admiral Sunil Lanba announced that the issues related to maintenance and availability of spare parts for the MiG-29K fleet have been sorted out. Admiral Lanba also stated that the defence ministry is working on how to resolve payment issues due to the US sanctions. The announcement holds significance as these issues were believed to have been posing major impediments to improving the serviceability of the aircraft. "There is no issue on supplies of spare parts from Russia at the moment... The MiG-29K fleet has been performing well now," Admiral Sunil Lanba said while addressing the press on the eve of Navy Day. According to a report by the Comptroller and Auditor General of India, in 2016, serviceability of the MiG-29K was unsatisfactory (37.63%) until 2015. However, recent efforts made by the two countries have improved serviceability to around 70%. Serviceability implies that the aircraft is technically available and is not undergoing a scheduled repair or overhaul at any level. In the initial years of service, the MiG-29K was riddled with problems relating to the airframe, RD MK-33 engine, and fly-by-wire systems. Fly-by-wire (FBW) is a system that replaces the conventional manual flight controls of an aircraft with an electronic interface and allows automatic signals sent by the aircraft computers to perform functions without the pilot's input, as in systems that automatically stabilise the aircraft. The Indian government concluded a contract in January 2004 with the Russian Aircraft Corporation MiG for the acquisition of 16 MiG-29K/KUB aircraft and associated equipment at a cost of \$740.35 million, which included 13 aircraft for Admiral Gorshkov (i.e., INS Vikramaditya). Thereafter in 2010, an option clause contract for the acquisition of an additional 29 MiG 29K/KUB aircraft was concluded at a cost of \$1.46 billion. The Indian Navy had placed a total order for 113 engines along with 45 aircraft (90 installed on aircraft and 23 spare engines) under the main and option clause contract.

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

## India's own Attack Helicopter: HAL Light Combat Helicopter

During the 1999 Kargil War, Indian Air Force High-Altitude Operations were hampered as the only combat helicopter, the Mi-35, couldn't operate at extremely high altitudes. Due to the fact that Mi-25/35 or even armed Mi-17 could not be utilized to its full potential, India regarded the need for a proper designated High-Altitude Warfare Capable Attack Helicopter which can climb to humongous heights and still carry the mettle and firepower to give the punch of an attack helicopter. In this post, I will discuss some facts about India's first indigenous Attack Helicopter: HAL Light Combat Helicopter.

A. The aircraft was originally conceived as Light Attack Helicopter in 1989 based upon early IAF requirements. The early model has a far aft tail wheel and a stepped canopy. After a design revision in 2002, HAL moved to a fixed cannon design and a nosewheel configuration. In August 2013, IAF issued a new Air Staff requirement, and it was designated LCH and the design was approved by Defence Acquisition Council in 2006 and a mockup was displayed at Aero India 2007 with final design frozen in March 2008. LCH is derived from the existing Dhruv Helicopter. The flight controls and hydraulics of Dhruv have been redesigned for the LCH. It will be again a wonder that the LCH was designed from Dhruv, a utility helicopter and HAL's most successful plan which is used in other nations too, knowing the fact that both are totally different in their design as well as their role. But it is the very reality. Initially, HAL had done some major changes on Dhruv to develop LAH (light attack helicopter) in Jun 2001. Later this Light Attack Helicopter's (LAH) model was discarded and was restyled to Light Combat Helicopter (LCH) signifying light combat roles. Original slimmed-down 'gunship' fuselage was discarded and basic Dhruv airframe was curtailed except the forward fuselage which was modified to tandem crew seating. B. It supports some stealth features like Canted flat panels for low Radar Cross Section. Composites Manufacturing Division of HAL has carried out Monolithic & sandwich construction structural parts for LCH. Composites have been used in Rotor systems (Main Rotor Blades, Tail Rotor Blades, Hub Plates and Torque plates etc.). The excessive use of composite materials makes the

airframe both light and sturdy the basic philosophy LCH wanted to achieve as a light attack helicopter. Its design is Stealthier than Apache and Mi-28 and is superior to another modern attack chopper like Chinese ZW 19. The LCH's four-axis auto-hover and digital automatic flight control system have been developed in-house, while the DRDO's Bangalore-based Defence Avionics Research Establishment (DARE) is developing the defensive aids suite, which includes a combined radar/laser warning system (this being SaabTech's MILDS AR-60V2) and Bharat Dynamics Ltd-developed countermeasures dispensers. HAL LCH sports an Electronic Warfare Suite and a state-of-the-art sensor suite which includes electronic warfare suite with a radar warning receiver, laser warning receiver and missile approach warning system. The LCH's four-axis auto-hover and digital automatic flight control system have been developed in-house, while the DRDO's Bangalore-based Defence Avionics Research Establishment (DARE) is developing the defensive aids suite, which includes a combined radar/laser warning system (this being SaabTech's MILDS AR-60V2) and Bharat Dynamics Ltd-developed countermeasures dispensers. E. It has 'JedEyes' helmet-mounted targeting system co-developed by HAL and Israel's Elbit Systems. JedEyes is designed for the day, night and brownout flight environments. JedEyes TM has a 70 x 40-degree FOV and 2250x1200 pixels resolution. JedEyes addresses the special needs of helicopter pilots and offers dramatic improvements over existing HMDs, not only through its ultra-wide Field of View (FOV), but also by providing razor-sharp, high-resolution imagery and allowing pilots to take in wider than ever areas of ground and sky, with everything in sharp focus. Exciting features and unique technologies combine to provide dual vision 3D imagery on the See-Through Visor as well as processing and manipulation of a variety of visual cues and video sources such as UAVs, digital maps and on and off-board sensors. C. It sports some advanced features like Anti Resonance Isolation System ( ARIS ) which helps in Vibration Damping. This feature is already present in ALH Dhruv comprising of four isolator elements between the fuselage and the main gearbox. The dynamic systems of the Dhruv have been adapted to it, making it both formidable and dependable. It is equipped with four-axis auto-stabilization system and anti-resonance isolation system (ARIS) for a comfortable and easy flight. D. HAL LCH sports an Electronic Warfare Suite and a state-of-the-art sensor suite which includes electronic warfare suite with a radar warning receiver, laser warning receiver and missile approach warning system. F. HAL LCH though light in its configuration is pretty well armoured to protect itself against 12.7 mm and 7.62 mm rounds. Lightweight Ceramic Faced Composite Armour Panels for Advanced Light Helicopter and Mi-17-IV helicopter have successfully undergone integration and flight-trials. This provides protection to aircrews and critical parts of helicopter against hits of bullets of 12.7 mm AP. Composite laminates were made using kevlar fabric as reinforcement and modified epoxy resin for the matrix. Kevlar-epoxy composite laminates of different thicknesses were prepared by the compression moulding process. Kevlar-epoxy composite laminates were bonded with alumina ceramic cylindrical pellets with the help of the epoxy structural adhesive. Gaps between the ceramic pellets were filled with modified epoxy resin. G. HAL LCH carries many aerodynamic changes to reduce drag and flight performances which were highlighted during the prototypes stage. The LCH can fly to extreme angles of 70 degree-80 degree nose down, demonstrating high manoeuvrability. Dr.Prasad Sampath general manager of RWDC, claimed the LCH, "probably the most agile design in the world because of its rotor". Its main rotor with swept blade tips gives it good manoeuvrability. At higher altitudes which is LCH-dominated LCH will turn out to be more agile and have higher performance than legacy attack helicopters in general because it is custom-designed to fight at higher altitudes.

Source: <https://defenceupdate.in>

## **Made in India Light Utility Helicopters by HAL to replace Cheetah and Chetak**

The indigenously built Light Utility Helicopter (LUH) which will replace the ageing Cheetah and Chetak helicopters being used by the armed forces is set to undertake high altitude cold weather trials in January 2019. The LU recently achieved a major milestone of flying at 6 km altitude during a trial test in Bengaluru which was carried out under the envelope expansion tests, which is a critical requirement towards the certification of LUH. The LUH is a 3-ton class new generation helicopter being indigenously developed by state owned Hindustan Aeronautics Ltd (HAL) to meet the requirements of both military and civil operators. The machine which has been developed by Rotary Wing Research and Design Center (RWR&DC) of HAL will be manufactured at a green field helicopter manufacturing facility at

Tumakuru which is under progress. The helicopter with Glass Cockpit will be deployed for Reconnaissance, Surveillance roles and as a light transport helicopter. The helicopter will be capable of flying at 235 Kmph, with a service ceiling of 6.5 Km and a range of 350 Km with 400 kg payload and is powered by TM/HAL Aridden 1U/Shakti 1U single turbo shaft engine with sufficient power margins to cater to demanding high altitude missions. The design and development was launched in February 2009. The initial Ground Test Vehicle (GTV) run was carried out on Dec 6, 2014. HAL successfully conducted technical flight of first prototype Light Utility Helicopter (LUH) in Bengaluru on September 6, 2016. Two prototypes are currently under flight testing. As has been reported earlier, HAL has an "in principle" order for 187 LUH, including 126 for Indian Army and 61 for Indian Air Force (IAF).

*Source: - Financial Express*

### **Indigenous EW system ignored for Tejas Mark 1A fighter**

In a path breaking achievement, the Defence R&D Organisation (DRDO) has indigenously developed an "electronic warfare" (EW) system for the Indian Air Force's (IAF's) fleet of 60 MiG-29 fighters. Yet, when buying EW systems for the Tejas Mark 1A fighter that Hindustan Aeronautics Ltd (HAL) is developing, the aerospace firm signed a contract on October 26 with Israeli firm, Elta – a subsidiary of Israel Aerospace Industries (IAI). The indigenous EW system was developed under "Project D-29" by the Defence Avionics Research Establishment (DARE), a DRDO laboratory, in partnership with Israeli firm, Elisra and Italian firm Elettronica. The IAF, delighted with the outcome of Project D-29, is about to accord it final acceptance. Bharat Electronics Ltd (BEL) will manufacture the indigenous EW systems for upgrading the MiG-29 fleet. Under the Defence Procurement Procedure of 2016 (DPP-2016), the D-29 EW system falls squarely in the category of "Indian designed, developed and manufactured" (IDDM) equipment, the highest priority for procurement. DPP-2016 mandates that, if equipment is available under the IDDM category, it cannot be procured under other categories – such as "Buy Global" or "Buy and Make (India)". This is to sponsor Indian design and development of equipment. Yet, the Ministry of Defence (MoD) and the IAF, disregarding the success of Project 29 and its IDDM status, permitted HAL to buy the Israeli Elta EW system. The Israeli government scuttled the Project D-29 EW system, say highly placed industry sources. The Israeli MoD did not allow Elisra – a key player in the D-29 system – to participate in HAL's tender for an EW system for Tejas Mark 1A. Instead, the Israeli MoD nominated state owned firm, Elta. The Israeli government has not responded to Business Standard queries. Given the volume of business the IAF provides Israeli firms, it is unclear why the IAF could not persuade the Israeli MoD to allow Elisra to participate, so as to standardise the indigenous D-29 EW system across the upgraded Tejas fleet, as well as the MiG-29UPG. The indigenous system could also have been retrofitted on the 120-aircraft Jaguar fleet, which is currently being upgraded. On January 10, 2017, Elisra wrote to the IAF boss, Air Chief Marshal BS Dhanoa, pointing out that the D-29 system is "an indigenous system jointly developed with DRDO... [and] shall be produced in India by BEL and qualifies for IDDM categorization." Stating that the equipment commonality with the MiG-29 would allow "considerable savings in maintenance and operational support", Elisra requested that the D-29 EW system be nominated for the Tejas Mark 1A. which the IAF did not respond to. Contacted for comments, the MoD and IAF have not responded. The Elta EW system is now going to be fitted in 83 Tejas Mark 1 fighters, which the MoD sanctioned for Rs 33,000 crore (Rs 330 billion) last December. The Tejas Mark 1A is being developed because the IAF is dissatisfied with the current Mark 1 version, of which 40 are being built. To overcome their operational shortcomings, the IAF, HAL and the MoD agreed in September 2015 on specifications for a new improved version (Tejas Mark 1A), which would have five specific improvements – including an upgraded EW system, AESA radar and the Meteor long-range air-to-air missile. An EW system, which uses the electromagnetic spectrum to obtain combat advantage, will be crucial for the Tejas Mark 1A's combat edge. In the Rafale fighter, many of the expensive "India specific enhancements" consisted of EW systems. An integrated EW system includes several elements: First, a "radar warning receiver" (RWR), which detects when an enemy aircraft's radar picks up one's own aircraft. A "radar lock" would indicate the enemy is firing an air-to-air missile, warning the pilot to start evasive measures. A second EW system component is the "missile approach and warning system" (MAWS), which picks up electromagnetic radiations from an incoming missile, cueing the pilot to initiate defensive manoeuvres, or to deploy countermeasures to confuse the incoming missile. A third EW measure is "radar warning and jamming" (RWJ). This involves detecting enemy radar and then confusing and blinding it with

concentrated electromagnetic pulses. Fighter aircraft can carry a jammer in an external pod under its wing. Alternatively, the function could be carried out by “escort jammers” (EJ), mounted on a single aircraft within a group of fighters on a strike mission. Finally, EW systems include “countermeasure dispensing systems” (CMDS), to defeat incoming missiles detected by the RWR or MAWS, or even infrared seeking missiles that home in on heat sources rather than rely on radar. The CMDS releases a cloud of metal strips, called chaff, which create a false signature of a fighter aircraft, towards which the incoming missile gets diverted. Alternatively, the CMDS fires flares in rapid succession, their heat signatures confusing IR-seeking air-to-air missiles. DRDO sources point out that the D-29 based system integrates all these functions, while legacy systems operate the functions individually.

*Source: - Ajai Shukla/Business Standard*

## **Uttam AESA radar: Everything you need to know**

The Uttam is an advanced active phased array radar (APAR) system being developed by Electronics and Radar Development Establishment (LRDE) for the HAL Tejas and other combat aircraft of Indian Air Force. Development of Uttam started in 2008 and it was first unveiled at Aero India 2009. Uttam is slated to be a successor to hybrid passive electronically scanned array radar EL/M-2032 currently equipping LCA Tejas. Radar is currently being integrated with an LCA.

### **Difference between AESA and PESA radar:**

Conventional passive phased array radars have a single high power RF source (usually Travelling Wave Tube) at ‘back-end’ and RF signals are fed into slotted array antenna via a waveguide or coaxial tube. Introduction of the phase difference between each transceiver element allows the radiation pattern to be steered electronically. In the reception cycle, a PESA antenna cannot transmit. PESA radar has a light antenna which can be mounted on a mechanical steering mechanism thereby giving it a wide frontal coverage area or FOV. Active phased array antennas have transmitter-receiver modules or transceiver module (TRM) built right into the antenna. A single array may feature hundreds or thousands of TRMs depending upon antenna size and operational requirement. Each TRM can either operate independently or under a hierarchy. Each TRM can generate and radiate its own signal of different phase and frequency as required, thus the transmitted signal is wideband in nature. Unlike PESA radar, signals can be transmitted and received simultaneously in an AESA radar. Active phased array antennas are usually heavier than slotted planar array antenna so it is difficult to mount them on a steering mechanism, which limits their field of view (FOV). Electronic steering is faster compared to mechanical steering but at high steering angle (90-120 degree) it may also increase side lobe power which is undesirable. FOV limitation can be mitigated by using a swash-plate repositioner.

### **Various aspects of Uttam AESA radar:**

UTTAM has capabilities like, Identification friend or foe (IFF), electronic and communication support measures, C-band line-of-sight and Ku-band SATCOM datalinks, etc., similar to those on the AWACS and Conformal Airborne Early Warning & Control Systems (CAEW) systems. The important modes of operation of the UTTAM radar system are the surface surveillance and the air surveillance. The sensor has the abilities to search, track-while-scan, priority tracking, high performance tracking, etc. In priority tracking, the targets will be placed in full track mode even if these cross the primary surveillance area. In high performance tracking, additional measurements are made to improve the tracking accuracy. Utilizing active aperture technology, the radar provides a fast-beam agile system that can operate in several modes concurrently. Uttam features an active phased array (APAR) which gives it superior scanning performance over legacy passive phased array radar. Unlike most contemporary radars, Uttam features Quad TRM i.e. a single plank consists of 4 TRMs. It allows the array to be more densely packed. Each TRM is equipped with low noise power amplifier, built-in test facility, digital phase-gain, and side lobe control elements. The inert model displayed at Aero India 2015 had ~184 QTRMs i.e. 736 TRMs. The array temperature is controlled by a liquid coolant circulation system. The QTRM configuration makes Uttam maintenance friendly. The radar can be scaled up or down depending on antenna size requirement.

### **Uttam’s QTRM configuration**

The radar is capable of tracking 100 targets simultaneously and engage 6 of them by SARH/ARH missiles in high priority tracking mode. For comparison, Elta EL/M-2052 is capable of tracking 64

targets in TWS mode. In 2015 Uttam was stated to be capable of tracking a target having RCS of 2m<sup>2</sup> at a distance of 92 kilometers. According to the new reports, the range has been increased to 150 kilometers for the target of the same RCS. In GMTT mode 2 targets can be tracked. Uttam has over 16 different types of operational modes and the radar can operate in multiple modes simultaneously by changing modes pulse-to-pulse which gives the pilot exceptional situational awareness and mission flexibility. DRDO published a brochure of the Uttam AESAR Fire control System which features the first image of UTTAM Aesa Radar undergoing installation process on LCA Tejas LSP-2 which has been deputed to carry out flight trials and integration of India's indigenous Uttam AESA radar. LRDE already has built Three Developmental Prototypes of UTTAM Aesa Radar which were intensively used and tested from Rooftop and Helicopters in different modes to evaluate the performance of the Radar in the past. LRDE now has developed Three more Radars which will be used for Integration and flight testing program which is likely to commence soon and will take 2-3 years to complete. Defense Analysts predict it might take even 5-6 years from the date of commencement of flight trials to clear all modes and all weapons integration into the new indigenous FCR before it can be cleared for production. HAL already has selected ELTA's EL/M-2052 AESA Radar for the upcoming upgraded LCA-Tejas MK-1A Variant since it was more or less confirmed that indigenous fire control radar was unlikely to be ready in time for MK-1A. LRDE is hopeful that if all trials are completed in the decided time frame it might still be selected to be used on last batches of MK-1A if desired by the customer. UTTAM Aesa Radar is most likely will be refined and re-tuned to be used on Indigenous developed Medium Combat Fighter (MCW) which was previously known as Tejas MK-2. LRDE reportedly also has been tasked to develop a more powerful variant for India's 5th Generation AMCA Fighter jet in near future.

## **FOCUS ON AIRBORNE RADAR FOR TEJAS**

Hardware has already been realized for this radar which has a range of 100 km against small fighter sized targets and rooftop testing has been completed. Though the Uttam AESA currently weighs 120 kg which is some 40 kg more than the current MMR, there will be no problem in integrating it with the LCA Mk-II which can easily carry a radar of this weight. It is a 3D radar for fighters, a MMR follow on, the Active Phased Array Radar (APAR) project aims to field a fully fledged operational AESA fire control radar for the expected Mark-2 version of the Tejas. This will be the second airborne AESA program after the AEW&C project and intends to transfer the success DRDO has achieved in the Ground based radar segment to airborne systems. The overall airborne program aims to prevent this technology gap from developing, with a broad based program to bring DRDO up to par with international developers in airborne systems: both fire control and surveillance. The earlier versions of radars has mechanically moving parts, whose output was painfully slow when compared to the new generation electronic technology. LCA also has a sophisticated fly by wire system and glass cockpit. AESA in the LCAs will obviously have a lower range, but it will be well integrated within the IAF network, and give a quantum technology jump to IAF's combat capabilities. Notably, the 36 Rafales being acquired by IAF in the Government-to-Government deal will also have the AESA radar, developed by Thales.

## **FUTURISTIC 360°-CAPABLE ANTENNA**

Preliminary studies have been carried out at Center for Airborne Studies (CABS) for a possible optimal design of a futuristic antenna with the desirable 360°-vision for roles identified under various war situations. The unique aerodynamically-shaped delta radome will blend with the aerodynamics of the platform-aircraft to provide the required radar performance together with better operational economy by virtue of its better aerodynamics, reduced weight, and better or similar electro-magnetics. This radar may be dorsal or conformal fuselage mounted doubts still remain as not much is known about its specifications or configuration. The foregoing summarises the efforts made by DRDO towards development of the AESA radar for its current and future AEW&C applications as well as for realising essential allied technologies. The necessary core competence to evolve futuristic applications in AESA radar has thus been adequately established.

*Source: - Futureuniverse, Maxima Vigilantia Blog*

## **Akash NG : A Look at What India's Next Generation SAM Could Be**

Confident with the success of Akash-1 missile system DRDO is now moving full steam ahead with the development of the highly advanced Akash-NG i.e. Akash-Next Generation. In May 2018, L&T's 'milestone ceremony' gave us a glimpse of new Akash missile. Using that poster we created 3D images of Akash-

NG SAM. Since we had to extrapolate the upper section of the missile, proportions might be slightly mismatched, but I think 3D-rendering gives us an idea of how the actual thing would look like. The Akash-NG missile has a cylindrical body with four cropped delta fins at mid-body and four tail fins. Second stage air-breathing solid ramjet engine has been ditched in favor of lighter dual-pulse solid rocket motor. The new propulsion system will increase the range of the missile to 50km+. Akash-NG has six major components- radome, indigenous active RF seeker, RF/Laser proximity fuse, pre-fragmented warhead, electromechanical actuation, and dual-pulse rocket motor. The new model has substantial improvement in missile performance. The Akash-NG will not only have greater range but also the advanced signal processing and guidance system which will improve missile's reliability and performance at extremes of engagement envelope and in a dense electronic jamming environment. Another plus point is that Akash-NG will utilize a canister-based launch system. Since the new model appears to be considerably lighter and less bulky than its predecessor, a single launcher unit is expected to carry six hermetically sealed missile canisters. Canister-based launch system would provide much longer shelf life and reliability. It also reduces overall deployment time. Akash-1 missiles are also stored in sealed canisters but they have to be mounted on launcher rails without the canister, which makes reloading a time-consuming task. According to unconfirmed reports, Akash-NG will feature an AESA Multi-Function Radar(MFR). The Addition of MFR will afford the Akash missile system capabilities it never had before. MFR will combine functions (search, track and fire control) of three different radars in one single unit. The use of AESA radar versus older PESA Rajendra radar allows for a much higher sensitivity and reliability. MFR combined with enhanced command and control system will improve overall processing and target handling capability which means that Akash-NG will have a faster reaction time and a higher level of protection against saturation attacks. It has increased the number and types of target Akash can engage. In addition to intercepting incoming PGMs, cruise missiles, and aircraft, the new SAM will also be able to destroy short-range rockets and ballistic missiles. In networked air-defence environment, Akash-NG will work with Integrated Air Command and Control System (IACCS). Akash-NG will bridge the gap between 25km Akash-1 / Akash-1S and 70 km MR-SAM and will be slotted in between this two Air Defence system to provide two-layer air defense protection to various high valued military and civilian installations against aerial targets like fighter jets, cruise missiles, and air-to-surface missiles" as well as ballistic missiles.

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

## **ALSR – An Advanced feature which will transform Tejas into Deadlier Dogfighter**

One of many modern features India's Tejas Mk-1 fighter's FOC variant will share with other Excellent Dogfighters like Eurofighter Typhoon is **ALSR** or '**Automatic Low Speed Recovery**' System. Auto low-speed recovery (ALSR) flight tests are part of the last leg of activities towards the Final Operational Clearance (FOC), likely to be accorded to the Tejas program, this December. Unlike in many 4th and older Generation fighter aircraft, where the pilot has to continuously monitor all the parameters while doing combat, Tejas with this feature becomes completely carefree. ALSR is a state-of-the-art-feature that guarantees complete carefree maneuvering of the aircraft. In a conventional dogfight situation, the fighter jets need to perform Extreme maneuvers. To enable the pilot to concentrate on his combat task, Tejas's Advanced 4-Axis Fly-by-Wire system automatically limits the aircraft parameters to ensure no departure from controlled flight and also ensures that none of the structural limits of the aircraft are exceeded. In this mode, the flight control system (FCS) continuously monitors the pilot's maneuvers and once it detects that the current manoeuvre if continued for some more seconds could lead to a low-speed departure, it gives a warning to the pilot to take corrective action. However, in case the pilot ignores this warning the auto-low speed recover function takes over control of the aircraft and recovers it to a safe condition in the shortest possible time. The advantage of this feature is that it allows the pilot to fly at the limits of the aircraft capabilities by toggling on the low-speed warning during combat. However, it weaves around a safety net, if the pilot makes any error of judgement.

## **Disorientation Recovery Function (DRF)**

Another related feature in the FOC version of the control laws which is also being tested simultaneously is the Disorientation Recovery Function (DRF). Pilots may get disoriented at times while flying into clouds or while flying over the sea. In such situations, a switch (panic button) is provided in the



cockpit. If pressed by the pilot, the FCS takes over the controls and recovers the aircraft to level flight optimally (with minimum loss of speed or altitude). Here again IIT Bombay is said to have done some cutting edge work in creating the optimal algorithms. Thus while the auto low speed recovery mode cuts in automatically, the DRF mode is engaged by the pilot when he needs it. With the FOC now at a striking distance, the Tejas programme has been surely heading with a clear flightpath in sight. The software fine-tuning will continue even as the FOC fighters start rolling out from HAL hangars.

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

## BUSINESS

### **NY based Aviation Startup BLADE Starting India Operation to Create Your Own Crowdsourced Flights**

New York, U.S.-based Blade, an aviation startup co-founded by former Sony and Warner Music Group executive *Rob Wiesenthal* and GroupMe co-founder Mr Steve Martocci, is starting its operations in India in March 2019, with its maiden flight taking off between Mumbai and Pune. Touted as “Uber-for-Helicopters”, BLADE is a digitally-powered aviation startup that allows users to create their own crowdsourced flights or purchase seats on pre-existing flights that are usually short distance. BLADE is said to be setting up its India subsidiary called “Blade India” in a joint venture with a Delhi-based equity investment firm, Hunch Ventures. The joint venture has not yet settled on prices for its India service, but promises to price the flights significantly lower than private chartered jets. Rob Wiesenthal, CEO of BLADE, that charter flights between Mahalaxmi and Shirdi currently costs around \$8,000 but by using BLADE’s application, one can share the helicopter ride by booking a single seat. This will lead to cutting down the price and thus making these charter flights available for a cheaper rate. BLADE will work on the asset-light model and thus, the company will not purchase flights but will tie-up with charter flight operators on a “contractual basis”. In India, BLADE will essentially be the service aggregator which will provide services to those who wish to book a seat for the route. BLADE will use integrated technology in three formats — *The app*, which will be available on Android and iOS, and *An accounting dashboard*, which will monitor the back-end work and a cockpit software. BLADE is in the midst of getting permission from the Airports Authority of India and the Civil Aviation Ministry to set up BLADE lounges at all the start points of the routes. While BLADE is headquartered in Delhi, the company will start its operations in Mumbai due “security issues at Delhi” said Karanpal Singh, Founder of Hunch Ventures. BLADE has roped in Mr Amar Abrol, a former CEO and MD of AirAisa, to head the India operations and will be CEO of BALDE India unit. “Initially, BLADE will operate three times a week or four times a week. The goal however after a couple of quarters is to cater to a larger audience and in multiple cities,” Mr Abrol said. Backed by prestigious American investors including Colony Northstar, Raine Ventures and David Zaslav, President & CEO of the TV channel Discovery, BLADE has raised a total of \$44 million in funding over three rounds. To take the services offered by BLADE, passengers have to download its app (available for both iOS or Android) , sign up for an account, and enter additional information such as a valid phone number and credit card details. When a passenger wants to fly, he or she opens the app and selects an existing flight to join at a time that works for them. If no times work for the passenger, he or she can crowdsource their own flight at a more convenient time; any remaining seats on a crowdsourced flight may then go on to be sold to other flyers through the digital community BLADE provides in-app. In India BLADE would compete with Delhi-based JetSetGO, an India’s first marketplace for private jets and helicopters backed by cricketer Mr Yuvraj Singh’s startup fund YouWeCan Ventures. Touted as “Uber of Indian skies”, JetSEtGO was founded in 2014 by Kanika Tekriwal and has recently acquired Indo Pacific Aviation Limited , the country’s oldest non-scheduled aircraft operator (NSOP).

Source: <https://www.inventiva.co.in/>

## India to buy 2 Mirage 2000 aircraft from France virtually free

As controversies over the Rafale refuse to die down, a delegation from the Indian Air Force is scheduled to head to France early next month to inspect two Dassault-made Mirage-2000 aircraft which will be France's gift to India. While India has signed a deal with France for 36 Rafale jets which will be manufactured by Dassault Aviation, France has presented two Mirage-2000 fighter aircrafts which also be manufactured by Dassault aviation for a very minimal price. The Mirage-2000 is a millennial aircraft which emerged as an important weapon in the Indian weaponry and was enormously used in the Kargil war as India thwarted her enemies. The defence ministry has cleared off the deal which comes across as virtually free, the Indian Air Force is set to send a team for inspecting the quality of the aircrafts. A squadron leader rank officer would be heading the Air Force delegation. The Air Force team would be headed to Chateaudun French airforce base, which is near the French capital of Paris to have a first look at the aircraft. Although India has accepted the deal on papers and the team of airforce officers would inspect the planes. If everything executes as per plan, the Indian Air Force will have two more aircrafts in its fleet of 50-odd mirage aircrafts. The airforce would use the two commissioned aircrafts for in-air combats for a brief while which will depend on their serviceability. This is precisely what the inspection team would inspect. After that, the planes could be broken up and used as spare parts. Since Dassault is closing on the manufacture of Mirage-2000 aircrafts, these planes would come in handy when the IAF needs spare parts for its other Mirage-2000 crafts.

Source: <https://defenceupdate.in>

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