



# E-NEWS

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**Indian Start-Up Achieves Break-Through  
in Aero Engine Design with Digital Twin**

**Indian Army Launches "Him- Drone-a-  
Thon"**



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Bangalore 560 075  
Karnataka, INDIA  
Phone No : +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

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## Head Quarters

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

## Pioneers of Aeronautical and Aerospace Sciences and Technologies in India Series

### Dr. Vikram Ambalal Sarabhai (1963-1971)

#### His Contributions to Science in India

Vikram Ambalal Sarabhai is popularly known as Vikram Sarabhai. is a renowned Indian physicist and industrialist. Dr. Sarabhai's contributions in space research gave him recognition as the Father of the Indian space program. He was the innovator and creator of a number of institutions in the varied fields including but not limited to space, nuclear energy, arts, education, and management. His important contribution includes initiation of space research and development of nuclear power in India. He played an important role in convincing Government to initiate space research programs. He convinced the Government of India to form the Indian National Committee for Space Research (INCOSPAR) in 1962 and was the first chairperson of the committee. INCOSPAR was later renamed as Indian Space Research Organisation (ISRO) in 1969. He played an advisory role in the new setup.



#### Personal Life:

Vikram Sarabhai was born to Ambalal Sarabhai. The Sarabhais' were the major industrialist and the family members were committed to Indian Independence. He belonged to Shrimal Jain community and practiced Jainism throughout his life. He was married in 1942 to classical dancer Mrinalini. The couple was blessed with two children, daughter, Mallika and son, Kartikeya Sarabhai. His daughter and son were activist. His son was also an active person in science. He died on December 30, 1971, in Kovalam, India.

Continued.....

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for knowledge didn't end and he started research on cosmic rays. He was under the guidance of physicist Sir Chandrasekhara Venkata Raman at the Indian Institute of Science, Bangalore (Bengaluru). He did his doctorate from the University of Cambridge in 1945 and he wrote a thesis, "Cosmic Ray Investigations in Tropical Latitudes." Upon his return to India, he founded Physical Research Laboratory in Ahmadabad.

## **Professional life:**

The Physical Research Laboratory (PRL) which was established from his residence in 1947 did research in cosmic rays. The institute was later established as the M.G. Science Institute, Ahmedabad, on 11 November 1947. The institute was in collaboration with Karmkshetra Educational Foundation and the Ahmedabad Education Society. The institute started with research on cosmic rays and the properties of the upper atmosphere. Later the research was extended to theoretical physics and radio physics for which grants were received from the Atomic Energy Commission. He was a pioneer in establishing Operations Research Group (ORG), the first market research organization in India. Apart from being a physicist, his area of interest included industry and business. He founded the Ahmedabad Textile Industry's Research Association in 1947. His interest in professional management education in India, Sarabhai led to the formation of Indian Institute of Management in Ahmadabad in 1962. He was instrumental in establishing the Indian National Committee for Space Research in 1962, which is now called as Indian Space Research Organization (ISRO). Apart from ISRO, Sarabhai was also responsible for setting up of Thumba Equatorial Rocket Launching Station.

## **Indian Space Program:**

Indian Space Research Organization (ISRO) is his biggest contribution to the country. Dr. Homi Jehangir Bhabha, was the father of India's nuclear science program. He supported Dr. Sarabhai for setting the first rocket launching station in India. Dr. Sarabhai's discussion with NASA resulted in the launch of Satellite Instructional Television Experiment (SITE) (July 1975 – July 1976). Dr. Sarabhai overtook the position of Homi Bhabha in 1966, as chairman of the Atomic Energy Commission of India, after the latter's death. He continued the work of Homi Bhabha in the field of nuclear research. He was responsible for the establishment and development of nuclear power plants. He has worked for Defense Ministry for developing nuclear technology. Sarabhai initiated programs to take education to remote villages through Satellite communication programs. Sarabhai efforts led to the start of a project for the launch of an Indian satellite. The first Indian satellite launched was Aryabhata. It was put in orbit from a Russian cosmodrome. Dr. Sarabhai started a project for the fabrication and launch of an Indian Satellite. As a result, the first Indian satellite, Aryabhata, was put in orbit in 1975 from a Russian Cosmodrome. Dr. Sarabhai was instrumental in establishing institutions such as:

1. Physical Research Laboratory (PRL), Ahmedabad
2. Indian Institute of Management (IIM), Ahmedabad
3. Community Science Centre, Ahmedabad
4. Space Applications Centre, Ahmedabad
5. Electronics Corporation of India Limited (ECIL), Hyderabad
6. Uranium Corporation of India Limited (UCIL), Jaduguda, Bihar
7. Darpan Academy for Performing Arts, Ahmedabad
8. Vikram Sarabhai Space Centre, Thiruvananthapuram
9. Faster Breeder Test Reactor (FBTR), Kalpakkam

10. Variable Energy Cyclotron Project, Calcutta

### Important Positions Held:

- In 1962 he was the president of Physics section in Indian Science Congress
- In 1970 he was the president of the General Conference of the I.A.E.A., Vienna
- In 1971 he was the vice-president Fourth UN Conference on 'Peaceful Uses of Atomic Energy'

### Achievements and Awards:

- Awards: Sarabhai was awarded Shanti Swarup Bhatnagar Medal in 1962. He is the recipient of India's two highest honors the Padma Bhushan (1966) and the Padma Vibhushan. He was awarded Padma Vibhushan posthumously in 1972.
- The Indian Space Research Organization located in Thiruvananthapuram is named in memory of Sarabhai as Vikram Sarabhai Space Centre, (VSSC)
- On his first death anniversary (30 December 1972) Indian postal services released a postal stamp.

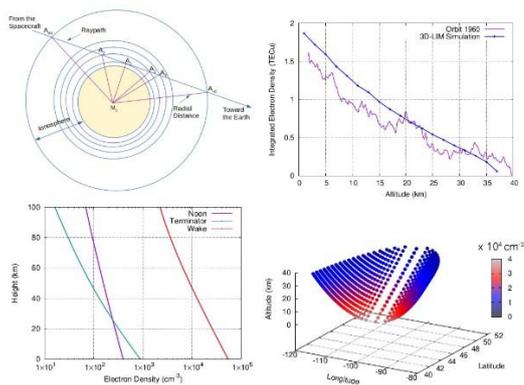
In 1973, the International Astronomical Union named a lunar crater as the Sarabhai crater.

## CURRENT AFFAIRS

### DFRS payload onboard Chandrayaan-2 orbiter detects high density plasma in the Lunar wake region.

The Moon is believed to have a very tenuous atmosphere. Since the ionosphere derives its origin from the atmosphere the plasma density at the Moon is considered to be only a few hundred ions per cubic centimeter. Measurements made using the Dual Frequency Radio Science (DFRS) experiment onboard Chandrayaan-2 orbiter, however, have shown that Moon's ionosphere has a plasma density of the order of  $10^4 \text{ cm}^{-3}$ , in the wake region which is at least one order of magnitude more than that is present in the day side. Chandrayaan-2, the second Indian Lunar exploration mission launched by the Indian Space Research Organization (ISRO) on 22 July 2019, carried several payloads, among which the DFRS was designed to study the lunar ionosphere. It uses two coherent signals at the S-band (2240 MHz) and X-band (8496 MHz) of radio frequencies, transmitted from the Chandrayaan-2 orbiter and received at the ground station at Byalalu, Bangalore to explore the lunar plasma ambience using the radio occultation (RO) technique. Simultaneous measurements by two coherent radio signals help to mitigate the effect of the Earth's atmosphere and any uncertainties due to various sources during the experiments. The DFRS payload was conceptualized and jointly developed by Space Physics Laboratory (SPL) of Vikram Sarabhai Space Centre, Trivandrum; UR Rao Space Centre (URSC), Bangalore; and ISRO Telemetry, Tracking, and Command Network (ISTRAC), Bangalore. For the RO observations, an algorithm to estimate the integrated electron density profile was developed at SPL and used to study the Moon's ionosphere in the lunar wake region, a region of the Lunar ionosphere that does not directly interact with the solar wind. A total of 12 radio occultation experiments have been conducted in campaign mode on four different occasions based on carefully selected geometry suitable for the RO measurements. Detailed analysis shows that the total electron content along the ray path in the Lunar ionosphere can be as large as 1.5 TECU ( $1 \text{ TECU} = 10^{16} \text{ m}^{-2}$ ) with the uncertainty of 0.15 TECU, in the Lunar wake region. Large electron content is also seen near lunar polar regions during solar twilight conditions. These findings are unique and first of its kind as they show substantial post-sunset enhancement in plasma density compared to the dayside values reported so far by earlier missions. The observed large enhancements in electron density in the Lunar wake region open new dimensions in understanding the lunar dark side plasma environment. In the wake region, neither the solar radiation nor the solar wind interacts directly with the available neutral particles, but still, the plasma is getting generated. Numerical simulations of the dark side of plasma environment using a 3-dimensional Lunar Ionospheric Model (3D-LIM) developed at SPL suggest that the production of ions by charge exchange reactions may play a pivotal role in producing a significantly large plasma density in the Lunar wake region, which can sustain for a longer period. The model suggests that the dominant ions in the wake region are  $\text{Ar}^+$ , and  $\text{Ne}^+$  which have a comparatively longer lifetime than the molecular ions ( $\text{CO}_2^+$ , and  $\text{H}_2\text{O}^+$ ) that are dominant at other regions. On the other hand, fraction of the ions produced by solar radiation during the daytime is

swept by solar wind, leading to reduced daytime plasma density. *These path-breaking scientific results on the Moon's ionosphere using DFRS payload onboard the Chandrayaan-2 orbiter and modeling of the physical mechanism are published in the Monthly Notices of the Royal Astronomical Society- Letter; "A study on the characteristic features of the Lunar ionosphere using dual-frequency radio science (DFRS) experiment onboard Chandrayaan-2 orbiter", Keshav R. Tripathi, R. K. Choudhary, K. M. Ambili, K. R. Bindu, R. Manikantan and Umang Parikh, DOI: 10.1093/mnras/slac058 (<https://doi.org/10.1093/mnras/slac058>)*



**Figure 1: Top left panel:** Ray-tracing of radio signals in the lunar ionosphere.  $A_1$  is the point of impact factor on the given ray path, **Top right panel:** Comparison of observed and simulated ray-path integrated electron density for the Chandrayaan-2 orbit no. 1960 for the occultation experiment at a location inside the Lunar wake, **Bottom left panel:** Electron density profiles simulated using the 3D-LIM model for three different conditions (Lunar wake, Solar terminator, and local noon). The electron density is of an order of magnitude higher inside the lunar wake region, **Bottom right panel:** Altitude/latitude/longitude variations of electron density along the ray path as simulated by 3D-LIM. The color bar represents the electron density at different points along the radio path.

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

## SSLV-D1/EOS-02 Mission

ISRO developed a small satellite launch vehicle (SSLV) to cater the launch of up to 500 kg satellites to Low Earth Orbits on 'launch-on-demand' basis. The first developmental flight SSLV-D1/EOS-02 Mission is scheduled for August 7, 2022 at 09:18 am (IST) from the First Launch Pad of Satish Dhawan Space Centre, Sriharikota. SSLV-D1 mission would launch EOS-02, a 135 kg Satellite, into low earth orbit of about 350 km to the equator, at an inclination of about 37 degrees. The mission also carries AzaadiSAT satellite. SSLV is configured with three solid stages 87 t, 7.7 t and 4.5 t. The satellite insertion into the intended orbit is achieved through a liquid propulsion-based velocity trimming module. SSLV is capable of launching Mini, Micro, or Nanosatellites (10 to 500 kg mass) to a 500 km planar orbit. SSLV provides low-cost access to Space on demand basis. It offers low turn-around time, flexibility in accommodating multiple satellites, launch-on-demand feasibility, minimal launch infrastructure requirements, etc. SSLV-D1 is a 34 m tall, 2 m diameter vehicle having a lift-off mass of 120 t. EOS-02 is an earth observation satellite designed and realised by ISRO. This microsat series satellite offers advanced optical remote sensing operating in infra-red band with high spatial resolution. The bus configuration is derived from IMS-1 bus. AzaadiSAT is a 8U Cubesat weighing around 8 kg. It carries 75 different payloads each weighing around 50 grams and conducting femto-experiments. Girl students from rural regions across the country were provided guidance to build these payloads. The payloads are integrated by the student team of "Space Kidz India". The payloads include a UHF-VHF Transponder working in ham radio frequency to enable voice and data transmission for amateur radio operators, a solid state PIN diode-based Radiation counter to measure the ionising radiation in its orbit, a long-range transponder and a selfie camera. The ground system developed by 'Space Kidz India' will be utilised for receiving the data from this satellite.



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

## Launch of ISRO Technical Training Programme (ITTP)

Chairman, ISRO / Secretary, Department of Space launched ISRO Technical Training Programme (ITTP) on August 08, 2022 through virtual mode in the presence of Smt. Sandhya Salwan, DDG, Ministry of Skill Development and Entrepreneurship. Directors of various ISRO centres, Regional Director, RSSDE, Karnataka and Director, Capacity Building and Public Outreach, ISRO Headquarters were present in the event. The programmes aim to impart training for upgrading the skills and knowledge of Technicians and Technical / Scientific assistants of ISRO. In this regard, ISRO entered into an MOU with MSDE during April, 2022 to conduct short term customised training course at various NSTIs under MSDE. The first ITTP programme in the series of 12, during the calendar year is being organised from August 08-12, 2022 at NSTI, Bengaluru. Each training session covers 20 technical staff from all ISRO Centres. On this occasion, Chairman ISRO / Secretary DOS emphasised need to bring out skill development courses for ISRO employees and qualified youth to prepare them to cater to the requirements of transforming space Industries and start-ups.



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

## Aircraft Carrier INS Vikramaditya to Sail Out of Refit in Couple of Months

Aircraft carrier INS Vikramaditya is undergoing its first major refit since December 2020 and is expected to sail out in the next couple of months. "This is the first major refit of INS Vikramaditya and it should come out in couple of months," a defence source said. Once that happens and with Indigenous Aircraft Carrier (IAC) Vikrant set to be commissioned this month, the Navy will have two fully operational carriers for sometime, the official noted. Explaining the maintenance and refit process, the official said a ship or submarine, after two years of operation, goes for refit — called the assisted maintenance period. The duration ranges from two weeks to two months depending on the size of the vessel. Then there is the normal refit after six years, ranging anywhere from four months to one and half year, the official elaborated. Being very large and complex platforms, aircraft carriers are out of action for long periods of time for maintenance and upgrades, another officer noted, adding this is why the Navy has been pressing for a third aircraft carrier. The Navy envisages IAC-II to have a displacement of 65,000 crore and use a Catapult Assisted Take Off But Arrested Recovery (CARTOBAR) for launching aircraft. The 44,500-tonne INS Vikramaditya procured from Russia is the lone carrier currently in service. Like INS Vikramaditya, Vikrant too would employ the STOBAR (Short Take-Off But Arrested Recovery) mechanism with a ski-jump and arrestor cables to launch and recover aircraft. Fire during trials The schedule was delayed by couple of months due to the recent fire onboard during the trials at sea off Karwar on July 20. The fire was brought under control by the ship's crew using onboard firefighting systems and no casualties were reported. In June, China, which operates two carriers 3 Liaoning and Shandong, launched its third aircraft carrier, Fujian, into waters, also its largest. The Parliamentary Standing Committee on Defence, in its report last December, said in its recommendation to the government that having three aircraft carriers will considerably enhance combat

capabilities of the Navy. INS Vikramaditya anchored in Mumbai harbour Taking into account the long coastline and hostile adversities on both sides of Indian peninsula, an aircraft carrier on both sides of coast is “quintessential” to uphold operational requirements, the committee said, and noted that given the long time for repairs and to bridge operational deficiencies thus arising, three aircraft carriers are an “unavoidable requirement” to meet any eventualities. In its reply to the committee, the government had stated, “The requirement of third aircraft carrier will be worked out on the Indian Navy committed liabilities and future acquisition projects.”

**Source:** <https://www.thehindu.com/news/national/aircraft-carrier-ins-vikramaditya-to-sail-out-of-refitin-couple-of-months/article65722118.ece>

### **Chief of the Air Staff Flies Indigenous Aircraft at Bangalore**

Air Chief Marshal VR Chaudhari, Chief of the Air Staff (CAS) was on a two day visit to Bangalore. He flew three indigenous platforms, Light Combat Aircraft (LCA) Tejas, Light Combat Helicopter (LCH) and Hindustan Turbo Trainer-40 (HTT-40), which are being inducted into IAF as part of its drive towards Atmanirbharta. CAS was demonstrated the capabilities of the LCH and HTT-40 as well as updates on the Tejas. He also interacted with the designers and test crew to understand the current status and future plans. On 06 August 2022, CAS delivered the Air Chief Marshal LM Katre Memorial Lecture which was attended by serving & retired officers of IAF, HAL and other stakeholders from the aerospace industry. The CAS spoke on ‘Capability and Force Development Plans of IAF’ towards making it a future ready combat force.

**Source:** <https://pib.gov.in/PressReleasePage.aspx?PRID=1849057>

### **Indian Start-Up Achieves Break-Through in Aero Engine Design with Digital Twin**

This Indian DeepTech startup has recently achieved a breakthrough in the design of State-of-the-Art Aero-Engines for Cruise Missiles and Large UAVs recognized by DPIIT “Startup India” program. With a team of 35 engineers including Chief Engineers with Global OEM experience and expertise, PhDs and talented graduates from Global Universities including students from IITs, Paninian has embarked on this challenging journey of designing and developing state of the art Aero-Engines also known as Turbofan Engines to power our critical Defence needs. For the first time ever in the Indian private sector Paninian has successfully demonstrated the design and validation of a 4.5 KN Turbojet Engine which is further being developed into a family of engines in the range of 3-12 KN thrust, along with AI augmented digital twin companions. The other breakthrough is in terms of developing an Artificial Intelligence driven Digital Twin for Legacy engine performance modelling and prognostics for supporting Mission performance and life extension efforts for IAF aircrafts like Jaguar, Sukhoi and Mirage 2000. This can now serve as a tool to study the extension of engines and greatly assist the IAF and Centre for Military Airworthiness and Certification in their study of performance degradation. Such Digital Twin which are required for cutting-edge Prognostics, Engine Health and Performance Monitoring have been conceived entirely from scratch in India by Indian engineers. Now India can carry out life extension of engines locally and accurately without resorting to foreign assistance. Dr.Gouda , a former Senior Scientist and Program Director in DRDO, currently serving as a technology advisor for Paninian, brought out that such digital twin can also be 3D printed to develop future power requirements of cruise missiles and large UAVs for India as well as for exports. “With design / development centres in Hyderabad, Bangalore and Pune, I feel Paninian is quite well poised to attract the very best of the global Indian talent in Engineering and Manufacturing to join in this exciting journey”, he added. Paninian intends to develop and manufacture these complete families of engines ranging between 3-12 KN within India using state of the art 3D Printing technology. The founder Raghu Adla also said that he’s “immensely grateful to many senior Industry leaders from Lockheed Martin, GE, Rolls Royce including senior leaders from DRDO, IAF, IIT and IISc research faculty who have been supporting this journey.” He also emphasised on the need for the public sector to support such start up

efforts by providing grants, access to laboratories. This innovation could go a long way in the “Make in India” program to make the country “AtmaNirbhar” in the strategic field of aero engines. “I am glad to dedicate this innovation to the country on the eve of “AzadikaAmrutMahotsav”, Raghu added. Paninian is also participating in the upcoming Wargame conducted by Insighteon Consulting, a pioneer consulting firm in Aerospace and Defence, to identify barriers in the development of indigenous aero engines in India, being held in August 2022.

**Source:** <https://www.thehindu.com/brandhub/pr-release/indian-start-up-achieves-break-through-in-aeroengine-design-with-digital-twin/article65752878.ece>

## **India, Malaysia Begin Four-Day Air Exercise Udarashakti**

An Indian Air Force (IAF) contingent left for Malaysia to participate in a four-day bilateral exercise ‘Udarashakti’ with the Royal Malaysian Air Force (RMAF). This continues the recent trend of India’s expanding defence and security cooperation with South East Asian countries. “IAF is participating in the air exercise with Su-30 MKI and C-17 aircraft while the RMAF will be flying Su-30 MKM aircraft,” the IAF said in a statement. The exercise is being held in the RMAF base of Kuantan. The exercise will give an opportunity to the IAF contingent members to share and learn best practices with some of the best professionals from the RMAF, while also discussing mutual combat capabilities, the IAF added. The exercise will witness various aerial combat drills between the two Air Forces, the IAF said, adding that it would fortify the long-standing bond of friendship and enhance the avenues of defence cooperation between the two Air Forces, thereby augmenting security in the region. In recent years, India in addition to exercises and military exchanges has offered a range of major military hardware to countries in the region and there has been positive response from many. For instance, India has offered the Light Combat Aircraft (LCA) Tejas to Malaysia and to incentivise the offer has offered a Su-30 support package for the jets in the RMAF’s inventory

**Source:**<https://www.thehindu.com/news/national/india-malaysia-begin-four-day-air-exerciseudarashakti/article65762024.ece>

## **Vikrant to Take a Finite Time to be Fully Ready for Deployment**

It’s going to take a ‘finite time’ for the maiden indigenous aircraft carrier, set to be inducted into the Navy as Vikrant on September 2, to be fully ready for deployment, according to the ship’s commanding officer (designate) Commodore Vidhyadhar Harke. Talking to The Hindu on the flight deck of the spanking new vessel, which carries the crest and the pennant number (R11) of India’s first aircraft carrier Vikrant inducted in 1961, Cmde Harke said that the vessel had done exceedingly well in the series of sea trials that were undertaken from August, 2021. “Its progress has been very encouraging. We achieved full power on the first sortie itself which is a record of sorts for any ship constructed in India or abroad. We followed it up with four more sorties, altogether for over 35 days at sea, to prove the ship’s systems, maneuvering capabilities, engine performance, various machines, sensors, and the like. The ship has been put through the paces to prove herself at sea. And nearly all the systems have matured to such a level that we can confidently operate at sea. So, it’s ready for commissioning and to be put to the sea,” he said. While helicopter operations were carried out from the deck of the carrier during the trials, integration of the fighter aircraft —MiG 29K, for now — and the carrier’s integration with the fleet, the Carrier Battle Group (CBG), would be undertaken soon after its induction. “So far, we have been proving our internal machineries. Now, we will see how this behemoth, a potent fighting platform, integrates with the fleet as we do our training, hone our warfighting skills, do drills and conduct aircraft operations. Deployment follows all that,” said Cmde Harke. “It does take a finite time for the complete realisation of the potential of a carrier. If you take the example of HMS Queen Elizabeth, after commissioning, it was only last year that it undertook a deployment of about six months to the South China Sea,” he added. Asked about the survivability of carriers in times of carrier killer missiles, Cmde Harke said several countries, China, Japan, South Korea and many others, were building carriers which indicated that “carriers have a future and that’s why countries are investing in it”. The IAC-1, Vikrant, has self-defence capabilities, with its escorts part of the CBG providing a layered defence and the

integral fighter fleet providing the long vector offensive. The ship, he said, would have a large 'surveillance bubble' around it and shouldn't ideally face any trouble from missiles. Meanwhile, Madhu S. Nair, chairman and managing director of the Cochin Shipyard, said that the long-range surface to air missile (LR-SAM) — Barak 8, jointly developed 16 by IAI and DRDO—and the track and guidance radar MFSTAR, would be fitted on the carrier as per a schedule drawn up for the same. The close-in weapon system (CIWS) is already up and operational.

**Source:** <https://www.thehindu.com/news/national/kerala/vikrant-to-take-a-finite-time-to-be-fully-ready-for-deployment/article65818801.ece>

## **IAF to Raise First LCH Squadron at Jodhpur in October**

The Indian Air Force (IAF) is set to formally raise its first unit of indigenous Light Combat Helicopters (LCHs) in Jodhpur in the first week of October coinciding with Air Force Day on October 8. Ten LCHs will be inducted in the first batch completing one unit, a defence official said. The IAF is still working out the total number of LCHs to be acquired, the official stated. The IAF operates the older Russian Mi-25 and Mi-35 attack helicopters, of which one squadron has been phased out following the induction of 22 Boeing AH-64E Apache attack helicopters. The existing Mi-35 squadron is in the process of being sent for overhaul which will extend its life by many years, the official stated. The Army had already raised its first LCH squadron on June 1, 2022 in Bengaluru. As reported by The Hindu earlier, the unit will move to Eastern Command along the Line of Actual Control (LAC) on completion of the raising next year. The Army plans to acquire 95 LCHs of which seven units, each having 10 helicopters, are planned to be deployed for combat role in the mountains. In March 2022, the Cabinet Committee on Security (CCS) had approved procurement of 15 Limited Series Production (LSP) variants of the LCH at the cost of ₹ 3,887 crore along with infrastructure sanctions worth ₹ 377 crore. Of the 15 helicopters, 10 are for the IAF and five for the Army. The LCH is designed and developed by Hindustan Aeronautics Limited (HAL). The Defence Ministry had stated earlier that the LCH LSP is an indigenously designed, developed and manufactured state-of-the-art modern combat helicopter containing approximately 45% indigenous content by value which will progressively increase to more than 55% for Series Production Version. The LCH is the first dedicated attack helicopter of the Army, which otherwise operates 75 Rudra helicopters, the weaponised variant of the indigenous Advanced Light Helicopter. It will start receiving Apache attack helicopters from early 2024 onwards, six of which have been contracted under an estimated \$800 million deal from the U.S. in February 2020. It is also in talks with Boeing for the procurement of 11 additional Apache helicopters.

**Source:** <https://www.thehindu.com/news/national/iaf-to-raise-first-lch-squadron-at-jodhpur-in-october/article65826771.ece>

## **TECHNOLOGY**

### **Launch of ISRO Technical Training Programme (ITTP)**

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

## Launching of ISRO's Virtual Space Museum "SPARK"

While the country is celebrating Azadi Ka Amrit Mahotsav – the 75<sup>th</sup> year of Independence, ISRO has come up with an innovative idea of showcasing digital content pertaining to various ISRO missions in an interactive manner. The Virtual Space Museum "SPARK" was launched by Secretary, DOS / Chairman, ISRO on 10.08.2022 for the public use. The platform hosts several documents, images & videos related to ISRO launch vehicles, satellites and scientific missions. Chairman, ISRO & Directors of the various ISRO centres appreciated the initiative taken and suggested more non-sensitive digital content to be brought on this platform for use by different stakeholders. The beta version of the application can be accessed through ISRO website or at <https://spacepark.isro.gov.in>

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

## Gaganyaan Low Altitude Escape Motor (LEM) Static Test

Another important milestone in the Gaganyaan project is completed, by successfully test-firing the Low Altitude Escape Motor (LEM) of Crew Escape System, from Sriharikota on August 10, 2022. The Crew Escape System (CES) takes away the Crew module of Gaganyaan mission in case of any eventuality and rescues the astronauts. In case of mission-abort during the initial phase of flight, LEM provides required thrust to CES, to take away Crew Module from the launch vehicle. LEM is a distinctive special purpose solid rocket motor with four reverse flow nozzles and generates maximum sea level thrust of 842 kN (nominal) with burn time of 5.98 s (nominal). The nozzle end of LEM is mounted at the fore end of the launch vehicle unlike at aft end in conventional rocket motors to avoid exhaust plume impingement on crew module. This necessitates the use of a reverse flow multiple nozzle in this solid rocket motor. The reverse flow nozzle implies the reversal of the exhaust gas flow direction in the nozzle region.

The main objectives of the static test are:

- a) To evaluate motor ballistic parameters.
- b) To validate motor subsystem performance and to confirm the design margins.
- c) To evaluate the thermal performance of nozzle liners; especially to confirm the erosion / ablative characteristics.
- d) To validate integrity of all interfaces.
- e) To evaluate the head-end mounted safe arm (HMSA) based ignition system performance.
- f) To evaluate side thrust due to misalignment and variation in flow and other functional parameters including flow reversal.

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

## Wind Tunnel Model Of India's 5th Gen, Twin-Engine AMCA Stealth Fighter Jet Reveals Exciting Details

Images of a miniature scale model of India's under development Advanced Medium Combat Aircraft (AMCA) on social media have sparked speculation about the features and configuration of India's fifth-gen fighter aircraft. Called the Integrated Wind Tunnel Model (IWTM), the results of the wind tunnel test could possibly inform the prototype of the AMCA Mark.1 (Mk1), after which the plane is expected to go into serial production. The Mk1 itself will influence the Mk2, expected to be a full stealth aircraft, with the Mk2 having Low Observability (LO) features. Indian AMCA is envisioned as a twin-engine stealth aircraft with an internal weapons bay and diverter-less supersonic intake, which has been produced for the first time and for which the design is now complete. It will be a 25-tonne aircraft with an internal payload of 1,500 kg and an exterior payload of 5,500 kg in addition to 6,500 kg of internal fuel. Being developed by the Aeronautical Development Agency (ADA), a laboratory of the Defence Research and

Development Organization (DRDO), the first prototype is scheduled to roll out by 2023-24, with deliveries to begin by 2030. The Indian Air Force is said to have committed to 40 AMCA Mk1 fighters and at least 100 Mk.2 variants, which is expected to begin reaching IAF units by 2035.

## **What Does The Wind Tunnel Model Reveal?**

The prime features are the Diverterless Supersonic Inlet (DSI) and a 3D 'bump' that prevent radar waves from bouncing off the engine blades/turbines, becoming a major stealth feature. It then sports in what appears to be an Infrared Search and Track (IRST) above the nose cone on the left outside the cockpit canopy. Cued with an Active Electronically Scanned Array (AESA) radar, it is used to enhance medium and long-range detection of targets. However, the model shows it to be mounted on a cylindrical stand, which is odd, considering that such protrusions compromise stealth as it gives a greater surface for radar waves to bounce off from and return to their source. Thus, its frontal Radar Cross Section (RCS) would be higher, meaning when scanned from the front, the likelihood of it being detected is greater. The IRST seen on India's MiG-29s, Dassault Rafale, and Su-30 fighters is inserted into a socket-like section. The AMCA scale model displayed at last AeroIndia did not show the IRST. Then the top left-hand side of the front fuselage behind the cockpit is what seems like an internal cannon, mostly a 23 mm gun for close engagements, which again juts out quite prominently. Cannons for dogfights are internal, embedded into the body, and covered by an automatically opening hatch. On stealth jets like the F-35 Lightning II, the cannon is concealed just on top of the left engine with a retractable door. On the top fuselage in the middle of the spine is another protrusion whose design is unclear but could be one of either two things – A Missile Approach Warning System (MAWS) or a concealed mid-air refueling inlet. In case it is the former, it could be part of a larger Distributed Aperture System (DAS) like on the F-35, which synthesizes data from various sensors spread around the aircraft, allowing the pilot a better 360-degree situational awareness. Other rounded sections seen outside the cockpit could be Front Sector Optronics like on the Dassault Rafale or the F-35, which would also form a part of its DAS. The absence of a chin-mounted Electro-Optical Targeting System (EOTS) like the F-35 or the J-20 means the AMCA will have to use an external targeting pod that compromises stealth and takes up space that could carry other ordnance. An EOTS can also double up as an IRST, making it more versatile. And on the top fuselage towards the nozzles and between the two vertical stabilizers (tail) is an Auxiliary Power Unit (APU) air intake system. It is a pre-cooler and heat exchanger that cools the electronics on board. The tails themselves seem to be fixed and not all moving from the root, like on the J-20 or the Su-57.

## **Not Fully Stealth?**

These observations are merely speculative as there has been no official confirmation on the design features and may very well exist only on the prototype but altered in the final production variants. There had been talks about the Mk.1 possibly not being a full stealth aircraft anyway, with only some very Low Observability (LO) characteristics. But the Mk.1 would still fall in the Gen 4.5++ category, which is still a major air warfare platform. Being able to command wingmen drones and possessing advanced radars, avionics, and electronic warfare (EW) can still allow the aircraft to undertake highly complex, frontline missions. And that it will be followed by the Mk.2 means even these design flaws would be corrected.

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

## **Indian Army Launches "Him- Drone-a-Thon"**

The Indian Army in collaboration with the Drone Federation of India has launched the 'Him Drone-a-thon' programme on 08 August 22. This initiative in line with Atmanirbharta in defence manufacturing is aimed to catalyse and provide focused opportunities to the Indian drone ecosystem to develop path-breaking drone capabilities for meeting requirements of frontline troops. The Indian Army's support to the indigenous drone ecosystem is based on the principle that 'good available indigenously' is better than the 'best available globally'. However, gradual enhancement in technology demanded by defence forces is likely to incentivise manufacture of better and more capable drone products. The 'Him Drone-a-thon' programme is pan India sustained connect between all stake holders including industry, academia, software

developers and drone product manufacturers. It will be conducted in stages with quantifiable parameters (like altitude, weight, range, endurance etc) being progressively enhanced based on demonstrated capabilities. Broad activities planned include interactions & ideation between users, development agencies, academia etc, seeking of industry responses, visits by development agencies to operational locations to understand the ground perspective & requirements, handholding of development agencies for internal development & on-ground trials and actual conduct & evaluation of drone products. As a start point, development in the following categories are included:- → Logistics/ Load carrying Drone in High Altitude Areas. → Autonomous Surveillance/ Search & Rescue Drone. → Micro/ Nano Drones for Fighting in Built Up Areas.

**Source:** <https://pib.gov.in/PressReleasePage.aspx?PRID=1849961>

## BUSINESS

### **Everyone wants a Tejas: Why USA, Australia, Malaysia and other countries are vying to procure India's Tejas aircraft?**

Tejas — India's light combat aircraft (LCA) has caught the fancy of many countries for its unique features. It is a single-engine multi-role fighter aircraft, capable of operating in high-risk air environments. Thanks to its features, Tejas has competed with, surpassed and overshadowed the developed aircraft of China, Russia and South Korea. Demand for India's Tejas fighter jets seems to be soaring in the global market. According to the government's statement in the Lok Sabha, six countries — the USA, Australia, Argentina, Egypt, Indonesia and the Philippines — have expressed interest in procuring light combat aircraft (LCA), whereas Malaysia has already placed an order for procuring 18 India's indigenously-made fighter jets. Manufactured by state-owned Hindustan Aeronautics Limited (HAL), Tejas is a single-engine multi-role fighter aircraft, which is capable of operating in high-risk air environments. HAL developed its first supersonic fighter — HAL HF-24 Marut — in the 1960s and phased them out in 1990. After that, it developed its supersonic fighter — Tejas — which is by far the smallest and lightest in its class of contemporary supersonic combat aircraft. The light combat aircraft made its maiden flight in January 2001 and was inducted into the squadron of the Indian Air Force in 2016. Tejas — meaning 'radiant' — has many USPs. For starters, it has active electronically-scanned radar for critical operation capability. Second, it can refuel in the air and be ready for war again. Third, it can target enemy aircraft from a distance, and also has the ability to dodge the enemy's radar. Thanks to its features, Tejas has competed with, surpassed and overshadowed the developed aircraft of China, Russia and South Korea. What's more, is that Tejas is as indigenous as it could get for an Indian-made aircraft. According to a statement by Defence Minister Rajnath Singh last year, "LCA-Tejas incorporates a large number of new technologies, many of which were never attempted in India. The indigenous content of LCA-Tejas is 50 per cent in the Mk1A variant which will be enhanced to 60 per cent." Since then, Tejas has caught the fancy of leading air forces in the world. Malaysia, for instance, has expressed its interest in procuring the aircraft for many years now. The Royal Malaysian Air Force (RMAF) intends to procure Tejas to supplement its MiG-29 fleet. Tejas marked its international debut at the Langkawi International Maritime and Aerospace Exhibition (LIMA) in March 2019 amidst great fanfare amongst the RMAF and then-Malaysian Prime Minister Mahathir bin Mohamad. HAL announced last month that Malaysia has opted for the Tejas to potentially replace its MiG-29s. An IANS report quotes defence expert Qamar Agha saying that if compared to Sukhoi, Tejas is much lighter. "Tejas is fully capable of carrying a load of eight to nine tonnes. It can fly with as many weapons and missiles as Sukhoi, which weighs more. Its biggest advantage is its speed. Despite being light, its speed is unmatched. These aircraft can fly as fast as the speed of sound, i.e., Mach 1.6 to 1.8, up at an altitude of 52,000 feet," he said. He goes on to add that "The Tejas Mark-1A is also costlier than the Sukhoi-30MKI fighter aircraft because many latest types of equipment have been added to it. For example, it has radar developed in Israel. Apart from this, the aircraft also has an indigenously developed radar. It is very light and its fighter power is also better. It is a multifunctional fighter aircraft." Not just from outside, there is a huge demand for Tejas by the Indian forces as well. According to reports, just last year, the Indian government awarded a contract worth Rs 48,000 crore to Hindustan Aeronautics Limited for manufacturing 83 Tejas jets to be delivered by 2023. HAL has already doubled the production

capacity of Tejas from eight to 16 aircraft per year. The contract is a massive boost to the government's push for Aatmanirbhar Bharat. "About 500 Indian companies including MSMEs in the design and manufacturing sectors will be working with HAL in this procurement. The programme would act as a catalyst for transforming the Indian aerospace manufacturing ecosystem into a vibrant Aatmanirbhar-self-sustaining ecosystem," Defence Ministry had said while approving the much-awaited deal last year.

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

## **HAL to Supply 12 Light Utility Helicopters to Armed Forces**

Hindustan Aeronautics Ltd. (HAL) has received the Letter of Intent from the Services for the manufacture of 12 Light Utility Helicopters (LUH), which have been designed and developed indigenously. At the same time, nine Light Combat Helicopters (LCH) have been manufactured against the sanction of 15 limited series production (LSP) variants and are in the process of being handed over to the Services. In another development, the Army is in negotiations for acquiring 11 more Apache AH-64E attack helicopters from the U.S. "Production work has begun. Two LUH are in an advanced stage of completion," a HAL source confirmed to The Hindu. In addition, the Request For Quotation (RFQ) for the larger order for LUH RFQ has also been issued, one source stated. HAL is in the process of responding to the RFQ and expects to conclude the related issues in one or two years, the source stated. Last November, the Defence Acquisition Council approved the procurement of an initial lot of 12 LUH, six each for the Army and the Air Force. In June, the Army raised its first LCH squadron in Bengaluru which will move to the Line of Actual Control (LAC) in Eastern Command once complete next year. "Of the 15 LSP on order, nine LCH have been produced. They are in acceptance stage," HAL sources said. As of now the Army is looking at acquiring around 111 LUH and 95 LCH, officials stated. Army sources had said that seven LCH units are planned for combat role in the mountains, with each having 10 helicopters. The IAF is also scheduled to raise its first LCH squadron in the next few months. More Apache attack helicopters The Cabinet Committee on Security had earlier given sanction for the procurement of 39 AH-64 Apache attack helicopters from the U.S.. Following this, IAF had inducted 22 Apaches procured under a deal signed in September 2015. The government had ruled that any further Apache procurements would go to the Army. In line with this, India signed a deal for six more Apaches at a cost of around \$800 million in February 2020. Deliveries which were to begin in the first half of 2023 have been delayed by around 10 months due to the COVID-19 pandemic, a defence official said. They are now scheduled to arrive in early 2024, an Army source said. In addition, the Army is pushing the case for the remaining 11 Apaches of the 39 sanctioned, the official added. A senior official of aircraft manufacturer Boeing had recently confirmed that they were in talks with the Indian Army for additional Apaches. The Army has three Aviation Brigades at Leh, Missamari and Jodhpur. It operates around 145 indigenous Advanced Light Helicopters (ALH), 75 of which are the Rudra-weaponised variants. Another 25 ALH Mk-III are on order and scheduled to be inducted within two years. The Army operates around 190 Cheetah, Chetak and Cheetal helicopters and are in dire need of their replacement, while the IAF operates close to 140 of them. In all, the IAF operates a wide mix of around 500 rotary platforms which includes around 90 Mi-17s, over 130 Mi-17V5s, over 70 ALH, including the weaponised variants, 22 Apaches, one squadron of Mi-35 attack helicopters and 15 CH-47F Chinook heavy lift helicopters. In the utility helicopter category, the Army and the IAF together have a requirement of more than 400 helicopters and are meant to replace the vintage Cheetah and Chetak helicopters in 16 service. This requirement was to be met jointly by the LUH and the 200 Ka-226T utility helicopters to be built with technology transfer from Russia. However, the Ka-226T deal has been delayed by several years over indigenisation issues and with the LUH now ready and the geopolitical situation due to the war in Ukraine, the deal is all set to be dropped, officials had stated. The LUH has come up well, but will take time for sufficient numbers to come in, Army sources had stated.

**Source:** <https://www.thehindu.com/news/national/hal-receives-letter-of-intent-for-12-indigenous-utilityhelicopters-nine-lch-ready/article65707237.ece>

## **Coimbatore-Based Private Firm Working with DRDO on an Indigenous Engine for Tapas**

Drone DRDO scientists are working with a Coimbatore-based private firm (reportedly Tech Mahindra) on an indigenous engine for TAPAS. The drone is currently powered by the Austria-made Austro engine, which comes with twin turbochargers. As of now, close to 75 per cent of the drone is India-made. DRDO scientists claim that, once inducted, TAPAS would be almost eight times cheaper than imported drones. TAPAS-BH-201 (formerly referred to as RUSTOM-II), developed by the Bangalore-based Aeronautical Development Establishment (ADE), recently achieved an altitude of 28,000ft and 18 hours of endurance. The agency, under the DRDO, began developing the medium-altitude long-endurance (MALE) unmanned aerial vehicle a decade ago at a cost of Rs1,786 crore. TAPAS BH-201 is currently flying with an imported AUSTRO AE300 Diesel-Kerosene Engine TAPAS has a good structural design, It is pre-designed to carry certain weapons and can be converted into an armed platform. TAPAS has a range of sensors that make it capable for day and night missions, and it also has autonomous take-off and landing capabilities. TAPAS is equipped with enhanced aerodynamic configuration, digital flight control, navigation system, communication intelligence, medium and long-range electro-optic payloads and synthetic aperture radar that will enable it to see through the clouds. It is capable of carrying different combinations of payloads depending on the mission objectives including electronic intelligence systems and situational awareness systems. It has a satellite communication link to relay situation in the battle theatre on real time basis. DRDO News 1 The drone can loiter autonomously at high altitudes performing real-time, high-resolution intelligence, surveillance and reconnaissance (ISR) with its SAR and EO sensors. When a target is identified, it will either illuminate the target with a laser designator for other strike aircraft, or descend to lower altitude and attack the target with its own air-to-surface missiles. In November 2021 the DRDO demonstrated TAPAS's ability to take off and land autonomously as well as its ability to utilise India's satellite-based navigation system – GPS-aided GEO augmented navigation (GAGAN) – that has been jointly built by the Indian Space Research Organisation (ISRO) and Airports Authority of India. TAPAS has a cruising speed of 135 kt carrying 350 kg of payload. The armed forces were especially impressed by the drone's advanced ground control system. During a recent test, two major requirements of India's armed forces—altitude at which the bird can fly and endurance (hours spent in sky). When it landed, TAPAS still had about eight hours of fuel left reported The Week. Hindustan Aeronautics Limited will produce the first five TAPAS drones. Bharat Electronics Limited is the primary partner for electronic systems, like on-board avionics. A total of 76 TAPAS drones will be inducted into the armed forces—the Army, 60; the Air Force, 12; and the Navy, four.

**Source:** <http://www.indiandefensenews.in/2022/08/coimbatore-based-private-firm-working.html>

## **Armed Forces Need to Prepare for 'Long Forms' of War Say Defence Experts**

Indian Armed forces need to focus on the long form' of wars rather than preparing for 'short term' conflicts to counter future security and strategic challenges, said defence experts. The ongoing Russian and crisis is a testimony to prove that the forces need to prepare for a long war. The world leadership had thought the Russia- Ukraine war would finish in a few days. But it went on for months. And it is still going on, they said. The experts were talking at a symposium on 'The Ukraine crisis: Challenges to India's foreign policy.' The Pune International Center (PIC) in association with Takshashula Institution had organised a day-long event. Air Marshal BhushanGokhale (retd), former vice chief of air staff, said, "The present Russia and Ukraine crisis has shown varied aspects of modern warfare and military tactics. The Indian Armed forces need to take lessons from it to face the future security challenges." Rear Admiral SY Shrikhande (retd), former assistant chief of naval staff, said, "The highest standard of strategic planning is the most essential part of modern warfare today. The US armed forces' failure in Afghanistan was a classic example of strategic failure. All these years, the US could project its supremacy in Afghanistan. However, eventually, they lost the war and left the country. Hence the armed forces need to focus on this front. And it can be achieved by fine-tuning their military doctrines at prominent military establishments." He said that the 6 Ukraine armed forces had learned hard lessons from the 2014 conflict with Russia. "This time they had shown more resilience than the last time. On other hand, the

Russian military leadership failed to forecast it. “As a result, they (Russians) could not achieve the objectives that they had thought to get within a short period. But it was again a strategic failure,” Shrikhande added. Lt General Shokin Chauhan (retired), former director general of Assam Rifles, said a strong ground force with the highest order of military ethos is needed to fight the war. “Technology alone will not help any military to win the war. Thus, any force needs professional soldiers, not conscripted soldiers. This is what the Russian military leadership is facing the problem today. The military leadership should draw lessons from it,” Chauhan pointed out. Former ambassador Gautam Bambawale talked about the lessons for India’s foreign policy choices. Representatives from private companies, who are working in defence productions, said, “They have got the necessary support from the government under its ‘Atmanirbhar Bharat’ initiative in the last few years. And hence they are working on various niche military technologies and systems positively.” Some of them pointed out that the armed forces need to give clarity on the systems that they are planning to acquire. “It will help them to work on it extensively to meet their operational requirements,” they said. Senior retired armed forces personnel, defence and strategic analysts, security experts, serving army officers and academicians attended the event.

**Source:** <https://timesofindia.indiatimes.com/india/armed-forces-need-to-prepare-for-long-forms-of-warsay-defence-experts/articleshow/93297041.cms>

## **HAL Offered Light Combat Aircraft Tejas Twin Seater for Malaysia Tender**

Hindustan Aeronautics Limited (HAL) has responded to the Request for Proposal (RFP) issued by Royal Malaysian Air Force (RMAF), Malaysia for 18 Fighter Lead in Trainer – Light Combat Aircraft (FLIT – LCA) offering the Light Combat Aircraft Tejas twin-seater variant, the Defence Ministry informed Parliament. Several other countries too have evinced interest in the indigenous fighter, it stated. “Other countries which have evinced interest in LCA aircraft are: Argentina, Australia, Egypt, the U.S., Indonesia, and Philippines,” Minister of State for Defence Ajay Bhatt said in a written reply to Shrimati Queen Oja and others in Lok Sabha. Stating that HAL had responded to a Request for Information (RFI) received from RMAF received in 8 February, 2019 for LCA class aircraft, the reply said that subsequently, it responded in October, 2021 to the RFP.

**Source:** <https://www.thehindu.com/news/national/hal-offered-light-combat-aircraft-tejas-twin-seater-formalaysia-tender/article65731560.ece>

## **Indian Army Signs a MoU with Drone Federation of India**

The Army Design Bureau on behalf of the Indian Army has signed a MoU with the Drone Federation of India to collaboratively work towards promoting research, development, testing and manufacturing of drones, counter-drone and associated technologies that can assist the Indian Army in its operations. This MoU also signifies the unwavering commitment of the Indian Army in supporting our industry and the complete eco system to develop indigenous equipment and weapon systems in line with Atmanirbharta in defence manufacturing. The Army Design Bureau is the nodal agency of the Indian Army to be the facilitator for the R&D efforts with the Industry, Academia, DRDO and DPSUs to enable them to understand and appreciate user requirements in depth. The Drone Federation of India promotes the drone industry by bringing about policy change, creating business opportunities, developing a robust skilling infrastructure, facilitating technology and knowledge transfers, developing standards, and promoting R&D efforts with industry-academia collaboration. This MoU between the Indian Army and the Drone Federation of India will promote efforts to handhold the industry and academia in order to assist them to develop niche technology and products for procurement by Indian Army. As per the new MoU, both parties have agreed to collaboratively work on the following:-

- To create a road map for drone, counter-drone and allied technologies in the Indian Army.
- To promote research, development, testing and indigenous manufacturing of drones and associated technologies by provision of testing sites to enable the designing, prototyping, testing and manufacturing of drones and associated components.

- Develop goal-based technology research programs in groups with members from industry, academia and the armed forces.
- Enabling outreach for Field Trials in collaboration with industry and user groups of the Armed Forces.
- 5 • Facilitate visit of Army Representatives to factory premises of industry members to understand industry capabilities and development progress along with visit of Industry Representatives and other Experts to army base and other operational posts for bringing awareness about field scenarios within Indian industry.

**Source: <https://pib.gov.in/PressReleasePage.aspx?PRID=1849959>**

### **This maritime partnership is still a work in progress**

The docking of the USNS Charles Drew, a United States Navy dry cargo ship, for repairs at an Indian facility in Chennai last week, marks an important first in the India-U.S. military relationship. Although bilateral strategic ties have advanced considerably over the past decade, reciprocal repair of military vessels was still a milestone that had not been crossed. With the arrival of Charles Drew at the Larsen and Toubro (L&T) facility at the Kattupalli dockyard, India and the U.S. seem to have moved past a self-imposed restriction. Signs of a broader template As some see it, a renewed sense of optimism now drives India-U.S. relations. During the bilateral 2+2 dialogue held in April this year, the two countries agreed to explore the possibilities of using Indian shipyards for the repair and maintenance of ships of the U.S. Military Sealift 17 Command (MSC). In the weeks following that meeting, the MSC carried out an exhaustive audit of Indian yards, and cleared the facility at Kattupalli for the repair of U.S. military vessels. The docking of a U.S. military vessel at an Indian facility has both functional and geopolitical implications. Functionally, it signals a more efficient leveraging of the Logistics Exchange Memorandum of Agreement (LEMOA) — the military logistics agreement India signed with the U.S. in 2017. Thus far, India-U.S. cooperation under the pact had largely been confined to the exchange of fuel and stores during joint exercises and relief operations. With the arrival of a U.S. military vessel at an Indian dockyard, the template of logistics cooperation seems to have broadened. There is a good possibility now that India would seek reciprocal access to repair facilities at U.S. bases in Asia and beyond. Many in India, meanwhile, are seeing the U.S. ship's docking as a global endorsement of Indian shipbuilding and ship-repair capabilities. In recent years, New Delhi has sought to showcase its private shipyards, in particular the L&T, which has developed significant ship design and construction capability at its yards in Hazira (Gujarat) and Kattupalli. At a time when the Indian Navy has taken delivery of the INS Vikrant, the country's first indigenously constructed aircraft carrier, the spirits of Indian shipbuilders are already riding high. As Indian observers see it, the presence of the USNS Charles Drew in an Indian dockyard is a boost for 'Atmanirbhar Bharat' and 'Make-in-India'. The political signal Politically, too, the development is noteworthy, as it signals a consolidation of the India-U.S. partnership, and the Quadrilateral (India, Japan, Australia and the United States) Security Dialogue. Despite its intention to strengthen logistics exchanges among Quad members, New Delhi has desisted from offering foreign warships access to Indian facilities. Notwithstanding the odd refuelling of foreign warships and aircraft in Indian facilities, India's military establishment has been wary of any moves that would create the impression of an anti-China alliance. Yet, Indian decision makers evidently are willing to be more ambitious with the India-U.S. strategic relationship. New Delhi's decision to open up repair facilities for the U.S. military suggests greater Indian readiness to accommodate the maritime interests of India's Quad partners. For Washington, the strategic implications of the docking in India are no less tangible. This is an incremental step forward in the U.S. moving to bolster its military presence in the Eastern Indian Ocean. Recent assessments of the evolving security picture in the Indian Ocean point to the possibility of China's military expansion in the Asian littorals, holding at risk U.S. and European assets. Reportedly, the North Atlantic Treaty Organization (NATO) has been readying to play a more active security role in the region. New Delhi's offer of repair services for U.S. military vessels could kickstart a process that would culminate in India opening up its naval bases for friendly foreign warships. At a time when New Delhi has shied away from backing the U.S. position in the Russia-Ukraine war, greater India-U.S. synergy in the Indian Ocean littorals could galvanise the supporters of closer bilateral ties. It would revive talk about the bilateral as a defining partnership in the Indian Ocean, and of India's potential to counter China in the Indian Ocean. Coming on the heels of the delivery of the first two U.S. manufactured MH-60R (Multi Role Helicopters) to India (with a third craft due to arrive later this month)

the visit of the USNS Charles Drew has given Indian and U.S. observers much to be optimistic about. CMF cooperation 18 Meanwhile, the Indian Navy has formally commenced its cooperation with the Bahrain-based multilateral partnership, Combined Maritime Forces (CMF), as an 'associate member'. This comes months after India had announced its intention to join the grouping in furtherance of its regional security goals. India's political and military leadership is seeing this as a demonstration of Indian commitment towards the collective responsibility of ensuring security in the shared commons. Indian analysts, however, ought not to overread developments, as extrapolating from perceived trends can often be misleading. The reality is that the India-U.S. relationship is still some way from crossing a critical threshold. For all the hype in the media surrounding India's membership of the CMF, the modalities of the engagement are still being worked out. The Indian Navy, it seems, has stopped short of formally joining the group, of which the Pakistan Navy is a key member. According to the CMF website, "associate members provide the assistance that they can offer, if they have the time and capacity to do so, whilst undertaking national tasking". This is not unlike India's earlier model of cooperation, whereby the Indian Navy worked alongside CMF and other security forces in the Western Indian Ocean on a need-to basis — all while operating independently, and under the broader banner of the United Nations. Despite increased engagement with the U.S. Navy, India's liaison officer at the U.S. Navy component (NAVCENT, or the U.S. Naval Forces Central Command) in the U.S. Central Command (CENTCOM) is still the military attaché at the Indian Embassy in Bahrain. Limited in scope now Even with the docking of the U.S. vessel at Kattupalli, Indian analysts ought to recognise that the U.S. military sealift command has no warships. The MSC is charged with delivering supplies to U.S. bases, and deals only with transport vessels of the U.S. Navy. The agreement with India for the repair of U.S. military vessels is limited to cargo ships. U.S. decision makers are unlikely to seek Indian facilities for repair and replenishment of U.S. destroyers and frigates in the near future until New Delhi is clear about the need for strategic cooperation with the U.S. Navy. By many accounts, then, the India-U.S. maritime relationship remains a work in progress. There has doubtless been some movement ahead, but it is far from clear whether navy-to-navy ties are headed towards a wide-ranging and comprehensive partnership in the Indian Ocean littorals.

**Source:** <https://www.thehindu.com/opinion/op-ed/this-maritime-partnership-is-still-a-work-inprogress/article65780441.ece>

## APPOINTMENTS

### **HAL's Director Finance Gets Additional Charge of CMD, HAL**

Mr. C. B. Ananthakrishnan, Director (Finance) of HAL has taken over the additional charge of the post of Chairman and Managing Director today following the superannuation of Mr R. Madhavan as CMD HAL on July 31, 2022. Mr Ananthakrishnan will hold this post for a period of three months from today or till the post of CMD, HAL is vacant, whichever is earlier

**Source:** <https://hal-india.co.in/>

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