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Eminent Indian Aeronautical and Aerospace Personalities in India

No : 2

Satish Dhawan (1920-2002)

Prof. Satish Dhawan (25 September 1920–3 January 2002) was an Indian rocket scientist who was born in Srinagar, India and educated in India and the United States. He is considered by the Indian scientific community to be the father of experimental fluid dynamics research in India and one of the most eminent researchers in the field of turbulence and boundary layers.



He succeeded Vikram Sarabhai, the founder of the Indian space programme, as Chairman of the Indian Space Research Organisation (ISRO) in 1972. He was also the Chairman of the Space Commission and Secretary to the Government of India in the Department of Space. In the decade following his appointment he directed the Indian space programme through a period of extraordinary growth and spectacular achievement..

Even while he was the head of the Indian space programme, he devoted substantial efforts towards boundary layer research. His most important contributions are presented in the seminal book Boundary Layer Theory by Hermann Schlichting.

He was a popular professor at the Indian Institute of Science, (IISc) located in Bangalore. He is credited for setting up the first supersonic wind tunnel in India at IISc. He also pioneered research on relaminarization of separated boundary layer flows, three-dimensional boundary layers and trisonic flows.

Continued.....

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Prof. Satish Dhawan carried out pioneering experiments in rural education, remote sensing and satellite communications. His efforts led to operational systems like INSAT- a telecommunications satellite, IRS - the Indian Remote Sensing satellite and the Polar Satellite Launch Vehicle (PSLV) that placed India in the league of space faring nations.

Following his death in 2002, the Indian satellite launch centre at Sriharikota, Andhra Pradesh, located about 100 km north of Chennai in South India was renamed as the Prof. Satish Dhawan Space Centre.

Education

University of the Punjab in Lahore (undivided India at that time and now in Pakistan)

BA in Mathematics and Physics,

MA in English Literature

BE in Mechanical Engineering, 1945

University of Minnesota, Minneapolis

MS in Aeronautical Engineering, 1947

California Institute of Technology,

Aeronautical Engineer's Degree, 1949

PhD in Aeronautics and Mathematics, 1951, (with Prof Hans W. Liepmann as his advisor)

Date of birth

25 September 1920(1920-09-25) Srinagar, India

National Recognition:

Padma Vibhushan, Indira Gandhi Award

Fields

Mechanical and Aerospace Engineering

Institutions:

Indian Space Research Organization, Indian Institute of Science, California Institute of Technology, National Aerospace laboratories, Indian Academy of Sciences and Indian Space Commission.

Doctoral advisor:

Dr.Hans W. Liepmann.

Known for

Indian space program.

Career

Indian Institute of Science, Bangalore, India

- Senior Scientific Officer, 1951
- Professor and Head of the Department of Aeronautical Engineering, 1955
- Director, 1962-1981
California Insitute of Technology, USA

- Visiting Professor, 1971-72
National Aerospace Laboratories, Bangalore, India
- Chairman, Research Council, 1984-93
Indian Academy of Sciences
- President, 1977-1979
Indian Space Research Organisation
- Chairman, 1972-1984
Indian Space Commission
- Chairman, 1972-1984

Awards

- Padma Vibhushan, (India's second highest civilian honour), 1981
- Indira Gandhi Award for National Integration, 1999
- Distinguished Alumnus Award, Indian Institute of Science
- Distinguished Alumnus Award, California Institute of Technology, 1969

CURRENT AFFAIRS

Gaganyaan, India's manned space mission, to start soon

The first test-vehicle mission of Gaganyaan, India's manned space mission, will start in a couple of months, said R Umamaheswaran, Director of ISRO's Human Space Flight Centre. This to check whether the crew can escape if required, whether landing can be done safely by parachute and the crew retrieved, etc., he said. He was speaking at the Bengaluru Space Expo at BIEC in Bengaluru. The spacecraft would have a separate crew escape system that had been tested back in 2018. "But there are many things that can go wrong during ascent, so we have to test for different scenarios now. Since this is a manned mission, reliability is important, so we will have a series of test-vehicle missions," he said. "Though Prime Minister Modi had announced Gaganyaan in 2018, the foundation for it had started back in 2003-04," said Umamaheswaran. He said they have overcome the technical challenges with the launch vehicle already, but many components of the spacecraft are still being readied. For example, the design and development of the crew module is yet to be finalised. "We are planning for launch towards the end of 2023." He said the project was delayed due to Covid; its original deadline was August 2022. "This is not an ISRO project alone. Around 75 per cent of the development is done with the support of industries. Armed forces, research labs and academia are also involved. We also have strong collaborations with Europe, Russia, NASA, etc," he said. Indian and foreign organisations that are supporting the mission spoke at the session.



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

India to launch maiden human space-flight mission 'Gaganyaan' in 2024

India's maiden human space-flight mission 'Gaganyaan' is expected to be launched in 2024, Union Minister of State (Independent Charge) for Science and Technology, Jitendra Singh said. Earlier, the mission was scheduled to be launched in 2022 but that could not be achieved due to Covid-19. "The Covid-19 pandemic took a toll on the training of astronauts in Russia as well as India," Singh added as was quoted by an Indian news agency. The first test-flight will be followed by sending a female-looking spacefaring humanoid robot — VyomMitra — in outer space likely next year. The Indian Air Force had identified four fighter pilots as the potential crew for the human space flight mission. The potential crew had undergone basic training in Russia. The Indian Space Research Organisation (ISRO) will send at least two astronauts into a low earth orbit (LEO) in 2024 after assessing the outcome of the two orbital test flights. According to ISRO, the Gaganyaan programme envisages undertaking the demonstration of human spaceflight to LEO in the short-term and will lay the foundation for a sustained Indian human space exploration programme in the long run. The objective of this space programme is to demonstrate indigenous capability to undertake human space flight mission to LEO. As part of this programme, two unmanned missions and one manned mission are approved by the Indian government. The total cost of Gaganyaan programme would be to the tune of Rs 9,023 crore. The Human spaceflight programme has both tangible and intangible benefits for India, which includes progress towards a sustained and affordable human and robotic programme to explore the solar system and beyond; advanced technology capability for undertaking human space exploration, sample return missions and scientific exploration and future capability to actively collaborate in global space station development and to carry out scientific experiments of interest to the nation. It will also create a broad framework for wider academia — industry partnership in taking up development activities for national development. It will generate ample scope for employment generation and human resource development in advanced science and R&D activities. The mission will provide unique opportunity to inspire and excite Indian youth and steer many students toward careers in science and technology towards challenging jobs that encourage knowledge, innovation and creativity. The programme will strengthen international partnerships and global security through the sharing of challenging and peaceful goals. Having a vibrant human spaceflight programme can be leveraged as a potent foreign policy tool. According to ISRO, the uncrewed missions are for technology demonstration, safety and reliability verification and will be heavily instrumented to study the performance of systems before crewed flight. The major new technologies required for Gaganyaan programme are — human rated launch vehicle, crew escape systems, habitable orbital module, life support system and crew selection, and training and associated crew management activities. Officials said during the test mission, the spacecraft will be launched to an altitude of 15 km during which space scientists will simulate an abort scenario to ensure the return crew capsule to the Earth using parachutes. The second orbital test flight will take the Gaganyaan crew capsule to a higher altitude and undergo a similar abort scenario to perfect the system. The Gaganyaan programme is going to be a major national effort for India. The overall programme co-ordination, systems engineering and implementation will be carried out by ISRO. Further, the human rated launch vehicle, crew escape system, orbital module and essential infrastructure will be realised by ISRO utilising the in-house expertise and with participation of industry, academia and national agencies. The private players in the country have developed significant expertise in niche areas, and this will be effectively utilised in the programme. For the first crewed mission of Gaganyaan programme, astronaut trainees are selected from pool of test pilots, based on selection criterion jointly defined by ISRO and Indian Air Force which comprises of flying experience, fitness, psychological and aeromedical evaluation (including anthropometric parameters). After the successful completion of Gaganyaan programme, the next step will focus towards achieving capability for a sustained human presence in space. The ISRO also plans to launch the Chandrayaan-3 mission to the moon sometime in 2023. Officials said there were two launch windows for the moon mission in February and July 2023.

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

From animal ear tags to 'Gaganyaan' components, small Bengaluru firm makes its mark

From producing animal ear tags to supplying components to key ISRO projects like 'Gaganyaan', a small Bengaluru enterprise 'Pushpak Aerospace and Defence' is quietly making its mark. Remarkably, it was started 30 years ago with zero capital by founder C S Prakash. "I had less than Rs 100 when I started this venture. Now, this Rs 30 crore firm is part of the nation-building projects like 'Chandrayaan', 'Mangalyaan', 'Gaganyaan' (human spaceflight mission) and 'Astrosat' (all ISRO projects)," Prakash told PTI. In addition, the company is producing ear tags for cows and also supplying components to Defence Research and Development Organisation (DRDO), he said. Prakash is exhibiting the products of his company at the ongoing India Manufacturing Show-2022, the three-day event organised by the Laghu Udyog Bharati-Karnataka and the IMS Foundation at the Bangalore International Exhibition Centre (BIEC) off Tumakuru Road. According to him, the Bengaluru-based firm has emerged as one of the leading companies in designing, manufacturing and delivering aerospace components, services and solutions to its customers. The company with a team of nearly 100 people is offering products for multiple segments. "There are some more things which we are doing despite being a small company. The company has got the 'NADCAP', the highest certification in the aerospace industry worldwide, and 'AS9100D,'" Prakash said.

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

Women pilots to now run IAF's Chinook sorties

For the first time in India, women combat pilots have been assigned Indian Air Force's frontline Chinook helicopter unit. Pilots Parul Bharadwaj and Swati Rathore had been flying Russian-origin Mi-17V5 helicopters prior to their latest endeavour. These helicopters play a crucial role in supporting the Indian Army near the Line of Actual Control (LAC). The multi mission Chinook, costing Rs 650 crore apiece, is the latest addition to the air force fleet that has been imported from the US. Air Marshal Anil Chopra said, "Moving from M-17s to Chinooks is a noteworthy development. Women in the air force are moving to the next level in their careers." Before being assigned the responsibility of Chinook, Parul Bharadwaj captained the Mi-17V5's maiden all women flight in 2019 and Rathore was the first woman helicopter pilot to fly an Mi-17V5 in a four-helicopter formation over the Kartavya Path. Both Bharadwaj and Rathore have moved to CH-47F Chinook units based in Chandigarh and Assam's Mohanbari respectively. Not only in the air force, Women in all of India's armed forces have been witnessing several new opportunities in recent times. In another first, women candidates joined the National Defence Academy this year.



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

Bhubaneswar witnesses IAF aerobatic spectacle

Citizens of Bhubaneswar witnessed a dazzling exhibition of aerobatics in the sky by a team of the Indian Air Force. The exhibition by the Suryakiran Aerobatic Team was held at the Balijatra ground on the Kuakhai river bank near Jaripatana from 10 am. A fleet of nine aircraft made several manoeuvres during the air show, which was held to commemorate the 75 years of India's Independence. The aircraft made loops and also formed the shape of a diamond while flying past. Odisha Governor Ganeshi Lal witnessed the aerobatic display, which was organised by the Eastern Air Command. Air Marshal Dilip Patnaik thanked the Odisha government for "making such lovely arrangements" for all

the people to see. The Suryakiran (sunrays) will conduct another air show near the Raj Bhavan in Puri. The IAF had held an air show in Cuttack in 2016 to mark the birth centenary of former Chief minister Biju Patnaik.

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

Scientist Who Heads ATAGS Project to Head DRDO's Armament Cluster

Shailendra V Gade, Outstanding Scientist (OS) and the Project Director of the Advanced Towed Artillery Gun System (ATAGS) appointed as the Director General (DG) of the crucial Armament and Combat Engineering systems, DG(ACE) with effect from September 1 here in Pune. The DG (ACE) heads nine important laboratories of DRDO, including the Armament Research and Development Establishment (ARDE), High Energy Materials Research Laboratory (HEMRL), and Research and Development Establishment (Engineers) R & D E(E) in Pune. Under his leadership, ATAGS has been designed, developed and realized successfully. The gun has cleared the high altitude and desert trials in Sikkim and Rajasthan respectively said the DRDO officials. Apart from this, Gade has played a pivotal role in various projects taken up by the DRDO in the last three decades. Speaking to TOI, Gade, said, "The laboratories under the ACE cluster have been working on major DRDO projects. We endeavor to complete them in the stipulated time frame. We have prepared a roadmap to achieve this objective in the coming years." "Gade has worked in the past on the design and development of India's fully indigenous Multi Barrel Rocket Launcher System (Pinaka) and played a pivotal role towards fructifying this system and its induction into Army. Subsequently, he took over the Small Arms Group (SAG) at ARDE and led the team successfully towards realizing, Joint Venture Protective Carbine (JVPC), Under Barrel Grenade Launcher (UBGL), Multi-caliber Individual Weapon System (MCIWS), Air Bursting Grenade (ABG) apart from improvements in the INSAS small arms," said a senior DRDO official on condition of anonymity. DRDO News 2 He carried out extensive research and formulated a project proposal on 'Future Infantry Soldier as a System (F-INSAS)' towards enhancing the capabilities of the soldiers in the areas of lethality, surveillance, survivability, protection and communication. Gade has led the team in developing the armament system for Infantry Combat Vehicle (ICV) for DRDO's project Abhay. Abhay was equipped with the main gun system and a very innovative two-column feed and ejection system to handle two different Ammunitions. He has been instrumental in leading the team in developing tank ammunitions for Main Battle Tank Arjun and other main battle tanks. He was appointed as Director of Vehicles Research and Development Establishment (VRDE) Ahmednagar and has been associated with several critical projects such as WhAP, IPMV, CBRN- Tracked, CBRN- WhAP, 180 HP Engine, Unmanned Ground Vehicle (UGV) and so on. He is a recipient of the DRDO's Performance Excellent award for Pinaka(2002), Scientist of the Year award (2013), team leader award for ATAGS in 2017, DRDO's Agni award for excellence in self-reliance in 2017' for ATAGS and Best innovation/Futuristic dev. award (2020). Under his leadership, VRDE has announced the Silicon trophy for 2020. Gade is an alumnus of IIT Delhi and IIT Bombay. He has guided B Tech and M Tech students in their projects. He has more than 40 papers to his credit in National and International journals. He has been delivering technical lectures at the Infantry, Artillery, and many International conferences. He is also spearheading several strategic systems projects.

Source: <https://timesofindia.indiatimes.com/india/scientist-who-heads-atags-project-to-head-drdosarmament-cluster/articleshow/93988496.cms>

India is Transforming itself as a Technology-Exporting Nation

Eminent defence scientist Satheesh Reddy, who is now Scientific Advisor to the Defence Minister after working as chairman of the Defence Research and Development Organisation (DRDO), has said that the winds of change for the better blowing across all sectors and the country are transforming the nation from an entity importing technology to one exporting technology. Delivering the fourth convocation address of Sharnbasva University online, Dr Reddy said that within five years, the country has seen 73,000 startups setting shop. These startups have come up in all spheres of the industrial sector right from the defence to the ancillary units to the IT industry. Dr Reddy said that the Ministry of

Defence has given the green signal to many new initiatives by startups in select areas of defence production. The Defence Research and Development Organisation is in the forefront of providing liberal assistance to meritorious students with innovative ideas. A sum of ₹ 10 crore is provided to students submitting bright proposals to the DRDO in defence-related R&D activities and at the industry level, DRDO extends assistance to an extent of ₹ 50 crore for design and development of innovative technology, he added. Dr. Reddy said that at the university and centres of higher education level, DRDO provides an assistance of up to ₹ 50 crore to students to take up research activities in incubation centres in their respective universities for any good project. "The government has come out with many schemes and projects for the support of research for achieving advanced technology," he said. The dedication to the country of its first indigenous aircraft carrier Vikrant by Prime Minister Narendra Modi a couple of days ago is the first major step towards achieving self-sufficiency in defence matters, he added.

Source:<https://www.thehindu.com/news/national/karnataka/india-is-transforming-itself-as-a-technologyexporting-nation/article65862197.ece/amp/>

Army Looking to Create Separate Cadre of UAV Operators

The Army is looking to create a separate cadre for operating its Unmanned Aerial Vehicles (UAVs), said Lt. Gen. A.K. Suri, Director General of Army Aviation while a senior Indian Air Force (IAF) officer said that a proposal to develop an indigenous Unmanned Combat Aerial Vehicle (UCAV) has been taken up. "This cadre will be of operators in terms of piloting and will reduce the load on helicopter pilots," Lt. Gen. Suri said speaking at a seminar on UAVs organised by the Centre for Air Power Studies. Stating that Indian Army has been using UAVs for the last two decades, he said they have primarily used them in the northern and western borders. A major part of the surveillance is carried out by them, he added. The proposal is currently with the Army headquarters and once cleared, will be sent to the Defence Ministry for approval, officials said on its status. A similar proposal for a separate UAV cadre by the IAF has been long pending with the Defence Ministry for approval. In August 2021, Army Aviation got control of the UAVs of the Army which were earlier under Artillery. The Army operates over 30 Heron UAVs procured from Israel. Speaking at the seminar, Air Marshal Radhakrishnan Radhish, Senior Air Staff Officer (SASO) at Western Air Command, said the IAF has a road map for induction of more capable medium-altitude long-endurance UAVs as well as high-altitude long-endurance UAVs. IAF is joining an indigenous effort to develop a UCAV and Aeronautical Development Establishment (ADE) has been sanctioned to develop the niche technologies, he stated. The Bengaluru-based ADE is under the Defence Research and Development Organisation (DRDO). Stating that the "unmanned market" is expected to see a significant growth in India, Air Marshal Radhish added that by 2026 it is anticipated to be the world's third largest market.

Source:<https://www.thehindu.com/news/national/army-looking-to-create-separate-cadre-of-uavoperators/article65887077.ece>

Now, Cochin Shipyard to Install Missile Systems on INS Vikrant

With the indigenous aircraft carrier INS Vikrant now joining the Navy, its builder, the Cochin Shipyard Limited (CSL) has to complete the installation of the Long Range Surface to Air Missile (LR-SAM) system, and the MF-STAR (multi-functional digital active electronically scanned array) radar, according to senior shipyard officials. The Navy has stated that aviation trials are likely to begin by November. "For us, the most important is the LR-SAM and MF-STAR installation and commissioning," Madhu S. Nair, Chairman and Managing Director, CSL, told The Hindu. "As the Navy would now take over and start operationalising the aviation complex, we would be backing it up." Essentially, most of the installation has been completed. "When the flights start coming in, various tuning happen. Whatever is needed the shipyard would be backing it up," he explained. "Certain other integrations would also be happening and that would also be done by the shipyard." "We need 45-60 days to complete their installation and the ship needs to be brought into the dry dock," Mr. Nair elaborated on the timelines. The ship also has a guarantee period which is typically one year but can go back

or forth depending on the operational requirements of the Navy, Mr. Nair added. Large parts of the aviation complex have been procured from Russia, another shipyard official said. LR-SAM is a joint development by Defence Research and Development Organisation (DRDO) and Israel Aerospace Industries (IAI) of Israel, and is manufactured by Bharat Dynamics Limited. MF-STAR is manufactured by the IAI and is also in service on other frontline warships of the Indian Navy. INS Vikrant, which was commissioned into the Navy on September 2, has undergone five sets of sea trials since August 2021, which both the shipyard and Navy officials said were extremely successful. However, the aviation trials are to be carried out post-commissioning. Explaining this, the Vice Chief of Naval Staff, Vice Admiral S.N. Ghormade said that since the full crew was not there before commissioning, all trials could be done. "After commissioning, when the complete crew is there, all systems are in place, only then aircraft landing trials happen, which is also a practice in advanced nations which build carriers," he stated.

Source:<https://www.thehindu.com/news/national/cochin-shipyard-to-install-surface-to-air-missile-systems-main-radar-on-ins-vikrant-next/article65903193.ece>

ISRO Tests Hybrid Propulsion System

The Indian Space Research Organisation (ISRO) said, September 21, 2022, that it has successfully demonstrated a hybrid propulsion system that uses a solid fuel and liquid oxidiser. The hybrid motor was tested at the ISRO Propulsion Complex (IPRC), Mahendragiri. The hybrid system is more efficient, "greener" and safer to handle and paves the way for new propulsion technologies for future missions, the Vikram Sarabhai Space Centre (VSSC) which tested it with support from the Liquid Propulsion Systems Centre (LPSC), said. In the ground-based test, the flight equivalent 30 kN hybrid motor used Hydroxylterminated polybutadiene (HTPB)-based aluminised solid fuel and liquid oxygen (LOX) as the oxidiser. The test was performed for 15 seconds on a 300-mm sounding rocket motor. Conventional HTPB-based solid propellant motors used in rockets use ammonium perchlorate as oxidiser. In rocket engines, oxidisers supply the oxygen needed for combustion. While both HTPB and LOX are green, the cryogenic LOX is safer to handle. And unlike conventional solid motors, the hybrid technology permits restarting and throttling capabilities on the motor. The use of liquids facilitates throttling and control over the flow rate of LOX, the VSSC said. The technology demonstration paves the way for hybrid propulsion-based sounding rockets and an exciting platform for vertical landing experiments for spent-stage recovery, the VSSC said. As part of perfecting the technology, ISRO will try it out on a sounding rocket launch in future.

Source:<https://www.thehindu.com/news/national/isro-tests-hybrid-propulsion-system/article65917332.ece>

At DefExpo 2022, India-Africa Defence Dialogue on the Anvil

The forthcoming DefExpo 2022, scheduled to be held in Gandhinagar from October 18 to 22, will host the second edition of the India-Africa Defence Dialogue with invites extended to 53 African countries. A separate Indian Ocean Region plus (IOR+) conclave with participation of approximately 40 countries is also on the anvil, the Defence Ministry said Tuesday. Defence Secretary Ajay Kumar reviewed the preparations of the Expo at a meeting Tuesday with Gujarat Chief Secretary Mr Pankaj Kumar and other senior officers of the State government and the Defence Ministry. This edition will see the participation of only Indian companies. The theme of DefExpo 2022 is 'Path to Pride' and the aim is to showcase the might of the domestic defence industry which is now powering 'Make in India, Make for the World' resolve of the Government and the nation at large, the statement said. This edition of the expo is being planned in a total area of 1+ Lakh sqm which would make it the largest so far. The inaugural ceremony and seminars will be held at Mahatma Mandir Convention and Exhibition Centre, the exhibition at Helipad Exhibition Centre, live demonstrations on all five days at Sabarmati river front and ship visits for public by the Indian Coast Guard at Porbandar. The biggest drone show by the indigenous IIT-Delhi start-up, Botlabs, has also been organised, which will be another highlight of the mega-event, the statement added.

Source:<https://www.thehindu.com/news/national/india-africa-defence-dialogue-and-ior-plus-at-defexpo2022/article65931237.ece>

ISRO Eyeing 200th Successful Launch of RH-200 Sounding Rocket in a Row

In a few weeks' time, the Indian Space Research Organisation (ISRO) hopes to achieve a remarkable feat — the 200th successful launch of the Rohini RH-200 sounding rocket in a row. The 3.5-metre-tall RH-200, a trusted member of the Rohini sounding rocket family used by the ISRO for atmospheric studies, has completed 198 consecutive successful flights, according to the Vikram Sarabhai Space Centre (VSSC), Thumba. The 199th launch, from Thumba, will happen on October 7 during the World Space Week celebrations. The 200th will take place either towards the end of October or the beginning of November, VSSC Director Dr S. Unnikrishnan Nair told. "When RH-200 was first introduced, we were taking our baby steps in rocketry. So there was focus on aspects such as spin-stabilisation and solid motors, in addition to atmospheric studies. Sounding rockets have since been used for a variety of experiments, including those on phenomena related to eclipses," Dr. Unnikrishnan Nair said. RH-200 is a two-stage rocket capable of climbing to a height of 70 km bearing scientific payloads. The first and second stages 36 of RH-200 are powered by solid motors. The '200' in the name denotes the diameter of the rocket in mm. Other operational Rohini variants are RH-300 Mk-II and RH-560 Mk-III. Sounding rockets have an important place in the ISRO story. The first sounding rocket to be launched from Thumba was the American Nike-Apache - on November 21, 1963. After that, two-stage rockets imported from Russia (M-100) and France (Centaure) were flown. The ISRO launched its own version - Rohini RH-75 - in 1967. The sounding rocket programme "was indeed the bedrock on which the edifice of launch vehicle technology was built", the space agency has noted. Today, these small rockets are launched both from the Thumba Equatorial Rocket Launching Station (TERLS) and the Satish Dhawan Space Centre, Sriharikota. The ISRO has launched more than 1,600 RH-200 rockets so far. The rocket celebrated its 100th consecutive successful mission on July 15, 2015. Over the years, the rocket has served as a flexible platform for experiments and testing out new technologies. For years, the RH-200 rocket had used a polyvinyl chloride (PVC)-based propellant. The first RH-200 to use a new propellant based on hydroxyl-terminated Polybutadiene (HTPB) was successfully flown from the TERLS in September 2020.

Source:<https://www.thehindu.com/news/national/kerala/isro-eyeing-200th-successful-launch-of-rh-200-sounding-rocket-in-a-row/article65931221.ece>

TECHNOLOGY

ISRO successfully demonstrates new technology with Inflatable Aerodynamic Decelerator (IAD) – a game changer with multiple applications for future missions.

An IAD, designed and developed by VSSC, has been successfully test flown in a Rohini sounding rocket from TERLS, Thumba at 12.20 pm today. The IAD was initially folded and kept inside the payload bay of the rocket. At around 84 km altitude, the IAD was inflated and it descended through atmosphere with the payload part of sounding rocket. The pneumatic system for inflation was developed by LPSC. The IAD has systematically reduced the velocity of the payload through aerodynamic drag and followed the predicted trajectory. This is first time that an IAD is designed specifically for spent stage recovery. All the objectives of the mission were successfully demonstrated. The IAD has huge potential in variety of space applications like recovery of spent stages of rocket, for landing payloads on to Mars or Venus and in making space habitat for human space flight missions. Rohini sounding rockets are routinely used for flight demonstration of new technologies being developed by ISRO as well as by scientists from India and abroad. In today's flight, along with IAD new elements like micro video imaging system which captured the bloom and flight of IAD, a miniature software defined radio telemetry transmitter, MEMS based acoustic sensor and a host of new methodologies were flight tested successfully. These will be inducted later to the major missions. Sounding rockets offers an exciting platform for experimentation in upper atmosphere. "This demonstration opens a gateway for cost effective

spent stage recovery using the Inflatable Aerodynamics Decelerator technology and this IAD technology can also be used in ISRO's future missions to Venus and Mars" said Shri S Somanath, Chairman ISRO, Secretary DOS who witnessed the launch. The launch was also witnessed by senior dignitaries of ISRO including Dr S Unnikrishnan Nair, Director, VSSC and Dr V Narayanan, Director, LPSC.



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

ISRO develops microprocessor-controlled smart limbs

As a spin-off of Space technology, ISRO develops an intelligent artificial limb likely to be commercialised soon, expectedly cheaper by about ten times, benefitting above-knee amputees to walk with a comfortable gait. These 'microprocessor-controlled knees (MPKs)' offer extended capabilities for the amputee than those offered by the passive limbs that do not use the microprocessors. Thus far, a 1.6 kg MPK has enabled an amputee to walk about 100 m in the corridor with minimum support. Efforts to improve the performance are underway. These smart MPKs are being developed by Vikram Sarabhai Space Centre (VSSC), ISRO under an MoU with National Institute for Locomotor disabilities (NILD), Pt. Deendayal Upadhyaya National Institute for Persons with Physical Disabilities (Divyangjan) (PDUNIPPD (D)), and Artificial Limb Manufacturing Corporation of India (ALIMCO).

Configuration and working

An MPK consists of a microprocessor, hydraulic damper, load & knee angle sensors, composite knee-case, Li-ion battery, electrical harness, and interface elements. The microprocessor detects the state of gait based on the sensor data. The control software estimates the real-time damping needed to attain the desired gait by changing the stiffness of the system that is achieved by a hydraulic damper operated by a DC motor. Walking parameters specific to amputees can be set using PC-based software to improve one's comfort. The interface plots the parameters in real time during walking.

Development of the system

The development of MPK was a multi-disciplinary, multi-stage activity. After arriving at a configuration based on the literature, validating it through kinematics analysis for estimating the sub-system requirements, multiple models of the system were developed. The feasibility of the design was verified using an engineering model. The system consisted of an aluminium knee case, a solenoid valve-based damper, and a six-axis load cell. While the next engineering model included a stepper motor-based damper and composite knee case, the subsequent model utilised DC motor-based damper with a spool position sensor, pylon integrated load cell, miniaturised control electronics, and a Graphical user interface for parameter tuning.

Testing and walking trials at VSSC

The sub-systems of the limb, viz. hydraulic damper, control electronics, and load cell, were tested and characterised in stand-alone mode, using customised setups. An ingenious method was conceived for conducting the walking trials

with non-amputee involving a custom-designed exo-socket realised for the purpose. Multiple walking trials conducted with non-amputee enabled the updating of the control software and fine-tuning of the parameters.

Walking trails with amputees at NILD

With the clearance of the Joint Project Monitoring Committee (JPMC), the device was tested with an amputee, identified by NILD for conducting walking trials. The trials were conducted at NILD lab jointly by NILD and VSSC. The socket and fitment of MPK to amputee were realised NILD. VSSC tuned amputee-specific parameters. Initial walking trials were conducted with the support of parallel bars. Subsequently, the amputee could walk about 100 m in the corridor with minimum support. All the sub-systems of the knee performed satisfactorily.

Further plans

MPKs currently available commercially in India are imported and range from Rs. 10 Lakh to Rs. 60 Lakhs, depending on the complexity and functionality. MPKs being developed, once commercialised, are expected to cost around Rs. 4 Lakh to Rs. 5 Lakh. Optimisation of MPKs in terms of mass and envelope size is underway. More intelligence is being incorporated into the system to help the amputee walk through uneven terrains with advanced features for more comfort.



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

BUSINESS

IAF TO INDUCT LIGHT COMBAT HELICOPTER ON OCT 3: OFFICIALS

The Indian Air Force (IAF) is set to formally induct the indigenous light combat helicopter (LCH) at the Jodhpur air force station on October 3, with the new platform capable of targeting enemy air defences, slow moving aircraft, high-altitude bunkers as well as carrying out counter-insurgency operations, officials familiar with the matter said. Defence minister Rajnath Singh and IAF chief Air Chief Marshal VR Chaudhari are expected to attend the function. India's Cabinet Committee on Security, headed by Prime Minister Narendra Modi, had in March cleared the purchase of 15 such helicopters for the air force and the army from Hindustan Aeronautics Limited (HAL) at a cost of ₹ 3,887 crore. Of the initial 15 limited series production helicopters approved, 10 are for the IAF and five for the army. It can land and take-off from an altitude of 5,000 metres with weapons and fuel, the officials said. LCH has an indigenous content of 45% by value and it will progressively increase to more than 55% for the series production version, according to the defence

ministry. HAL expects follow-on orders as IAF and army have a combined projected requirement of 160 LCHs. Production of LCH will reduce India's dependence on imported combat helicopters, the ministry earlier said.

Source: <https://epaper.hindustantimes.com/>

India to design, build reusable rocket for global market: ISRO

India has plans to design and build a new reusable rocket for the global market that would significantly cut the cost of launching satellites, a top government official said. "...all of us want launches to be much cheaper than what we do today," Secretary in the Department of Space and Chairman of Indian Space Research Organisation (ISRO) S Somanath said. Addressing the seventh 'Bengaluru Space Expo 2022' and later talking to reporters, he noted that at present it takes about \$10,000 to \$15,000 to put a one-kg payload into orbit. "We have to bring it down to \$5,000 or even \$1,000 per kg. Only way to do that is to make the rocket reusable. Today in India we don't have reusable technology yet in launch vehicles," Somanath said. "So, the idea is the next rocket that we are going to build after GSLV Mk III should be a reusable rocket," he added at the inaugural session of the international conference and exhibition. ISRO, Somanath said, has been working on various technologies, including the one demonstrated with Inflatable Aerodynamic Decelerator (IAD), last week. "We will have to have a retro-propulsion to land it (rocket back on earth)". Combining these technologies, ISRO would like to design and build a new rocket which will be reusable, in partnership with industry, startups and its commercial arm NewSpace India Limited (NSIL). "This is the idea and we are working on that idea. That idea cannot be ISRO's alone. It has to be an industry's idea. So, we will have to work with them in designing a new rocket, not only designing it, engineering it, manufacturing it and launching it as a commercial product and operating it in a commercial manner," he said. "So, it's a big shift from what we do today," he pointed out. "I would like to see this (proposal) taking shape in the next few months." "We would like to see such a rocket, a rocket that will be cost-conscious, production-friendly which will be built in India but operated globally for the services of the space sector. This should happen in the next few years so that we can retire all those operating launch vehicles (in India) at appropriate time," he said.

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

ISRO enables pvt companies for small satellite launch

At the Bengaluru Space Expo, VSSC Director Dr S Unnikrishnan said they were trying to enable private space companies with the technology to launch small satellites. "In the next 10 years, around 17,000 satellites are expected to be launched globally. In 2021, 94 per cent of the satellites launched were small satellites." As satellites now have applications in many areas like communications and agriculture, the private space sector has been producing smaller, cheaper satellites for these purposes. These satellites are unlike conventional satellites that are heavy and costly. So, the technology needed to launch them needs to be developed too. "Space companies should be able to launch satellites in a fast, cost-effective manner as per their clients' requirements," Nair said. VSSC has been handholding startups like Space Machines Company, Skyroot Aerospace and Bellatrix to finetune launch technologies. Skyroot Aerospace, for example, is developing a launch vehicle that is lightweight but can carry upto 100 kg of payload. Naga Bharath Daka, co-founder of the company, said, "Launch vehicles that allow low-cost access to space is important because it's the key enabler for all other parts of the industry. There is a lot of latent demand for space-based solutions, but this is invisible now as accessing space is prohibitively expensive." Bellatrix, meanwhile, is trying to build propulsion systems powered by electricity instead of conventional fuel, to bring down costs. Rajat Kulshrestha, co-founder of Spaces Machines, said, "For a long time, space transport was all about launch. But now we think about last-mile access for different customers." Though ISRO had developed its SSLV (Small Satellite Launch Vehicle) for the use of private companies, its launch this August wasn't fully successful. S S Vinod, Project Director of SSLV, said,

“ISRO already has launch capability, but we need to have launches that are low-cost, with low turnaround time, and reliability. SSLV costs only one-sixth that of PSLV (Polar Satellite Launch Vehicle, which is used for ISRO’s conventional launches).”

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

Centre Gives Nod to Tejas Mark-2 Development Project - Details

The Centre has given its nod to the development of the next generation variant and a more potent version of the indigenous light combat aircraft (LCA) Tejas – Tejas Mark 2. The Prime Minister Narendra Modi-led Cabinet Committee on Security (CCS) approved the project to develop LCA Mark 2 multirole fighter jet, a more capable and powerful version of the indigenous aircraft. The fighter jet will be developed at a cost of over Rs 6,500 crore, in addition to the Rs 2,500 crore previously sanctioned for it. “LCA Mark 2 fighter aircraft development project was cleared by the government. This would pave way for designers to develop an advanced 17.5-tonne single-engine aircraft,” Aeronautical Development Agency chief Girish Deodhare said, ANI reported. The development of new aircraft will be completed by 2027, he said. Tejas is a single-engine and highly agile multi-role supersonic fighter manufactured by the state-run Hindustan Aeronautics Ltd (HAL). Last year, Chairman and Managing Director of HAL R Madhavan had said that the upgraded version of the jet will have a bigger fuselage, longer range, better maintainability, greater load carrying capability, much stronger engine power and superior net-centric warfare systems. He had also said that the first high-speed trial of the jet will start in 2023 and the production is expected to begin somewhere around 2025. Tejas is a potent platform for air combat and offensive air support with reconnaissance and antiship operations as its secondary roles. The Tejas project will be followed by another mega project for fifth-generation medium weight deep penetration fighter, which is estimated to cost around USD 5 billion.

Source: <https://www.timesnownews.com/india/centre-gives-its-nod-to-tejas-mark-2-project-detailsarticle-93921205>

DRDO Targets 2027 to Complete Development and Flight Testing of LCA-MK2

With the Cabinet Committee on Security (CCS) sanctioning the development of Light Combat Aircraft (LCA)-Mk2, a bigger and more capable fighter than the present one, the Defence Research and Development Organisation (DRDO) is setting a target of 2027 to complete the flight testing, according to Defence officials. “The CCS sanctioned the project early this week at a total development cost of ₹ 9000 crore including the ₹ 2500 crore that has already been spent. The roll out of LCA-Mk2 is planned by 2024 and the target is to complete flight testing by 2027,” one official said. Indian Air Force (IAF) has given commitment to procure six squadrons of LCA-MK2, another official said. The proposal on the indigenous fifth generation fighter, the Advanced Medium Combat Aircraft (AMCA), is currently with the CCS and the approval is expected very soon, officials stated. The LCA-Mk2 will be a heavier and much more capable aircraft than the current LCA variants and the LCA-Mk1A that is scheduled to be delivered to the IAF by early 2024, 83 of which have been contracted under a ₹ 48,000 crore deal with Hindustan Aeronautics Limited (HAL). As per schedule, HAL is expected to deliver first three Mk1A aircraft in 2024 and 16 aircraft per year for subsequent five years. Enhanced range and endurance The Mk2 features enhanced range and endurance, including an Onboard Oxygen Generation System, which is being integrated for the first time, and the ability to carry heavy stand-off weapons of the class of Scalp, Crystal Maze and Spice-2000. The Mk2 is 1350 mm longer, featuring canards and can carry a payload of 6,500 kg compared with the 3,500 kg the LCA can carry. The Mk2 will be powered by the General Electric GE-414 engine, which will also power the AMCA. A GE-414 produces 98kN thrust compared to 84kN thrust of the GE-404 engine powers the LCA Mk1 and MK1A. The Indian Air Force (IAF) has one squadron of LCA in Initial Operational Clearance (IOC) and one squadron in the Final Operational Clearance (FOC) configuration. Induction of all IOC standard aircraft is complete, while induction of FOC standard is nearing completion. Manufacturing of the LCA trainer is also underway

with deliveries expected to begin this year. The IAF had earlier placed orders for 20 IOC standard aircraft and 20 FOC standard aircraft, including eight twin seater trainers. Till date, 31 LCA — IOC and FOC combined — have been produced and 26 have been delivered, and few aircraft in the process of being delivered to the customer, HAL sources said. HAL has already set-up a second assembly line to ramp up production from eight aircraft per year to 16 aircraft per year. The order for 83 Mk-1A is expected to be completed by 2028-29.

Source:<https://www.thehindu.com/news/national/defence-research-and-development-organisationtargets-2027-to-complete-development-and-flight-testing-of-lca-mk2/article65845106.ece>

Defence Ministry Signs ₹ 1,700-Crore Deal for 35 BrahMos Missiles

Officials of Ministry of Defence (MOD) and M/s BrahMos Aerospace Pvt. Ltd. (BAPL) sign a contract for the acquisition of additional dual-role capable Surface to Surface BrahMos missiles. The Defence Ministry signed a ₹ 1,700-crore contract with BrahMos Aerospace Pvt Ltd for 35 combat and three practice BrahMos supersonic surface-to-surface cruise missiles for two P-15B class of stealth guided missile destroyers of the Indian Navy. “Induction of these dual-role capable missiles will significantly enhance the operational capability of the Navy fleet assets,” the Defence Ministry said in a statement. Four stealth guided missile destroyers being constructed under Project-15B at a project cost of about ₹ 29,643.74 crore are a follow-on to the Kolkata class (Project 15A) destroyers. They are christened after major cities from all four corners of the country — Visakhapatnam, Mormugao, Imphal and Surat. While INS Visakhapatnam was commissioned end 2021, the remaining three have been launched into waters. They are designed by the Navy’s Directorate of Naval Design and constructed by the Mazagon Dock Shipbuilders Limited, Mumbai. With a displacement of 7,400 tonnes, they feature enhanced stealth features resulting in a reduced Radar Cross Section and are packed with sophisticated state-of-the-art weapons and sensors, including BrahMos and Barak-8 Surface-to-Air missiles. Joint venture 5 BrahMos is a joint venture between the DRDO and Russia’s NPO Mashinostroyeniya and the missile derives its name from Brahmaputra and Moskva rivers. The missile is capable of being launched from land, sea, sub-sea and air against surface and sea-based targets and has been long inducted by the Indian armed forces. The range of the missile was originally capped at 290 km as per obligations of the Missile Technology Control Regime (MTCR). Following India’s entry into the club in June 2016, DRDO officials had stated that the range would be extended to 450 km and to 600 km at a later stage. The ER version has been tested several times from warships, including from INS Visakhapatnam.

Source:<https://www.thehindu.com/news/national/defence-ministry-signs-deal-for-35-brahmos-missiles-for-two-p-15b-destroyers-of-indian-navy/article65922724.ece>

How do the Dual-role BrahMos Missiles add more Firepower to the Indian Navy?

India has signed a ₹ 1,700-crore deal with BrahMos Aerospace Private Limited (BAPL) for dual role BrahMos missiles. The deal gives a boost to the Indian Navy’s firepower as well as India’s Make in India programme. The dual-role capable surface-to-surface BrahMos missiles will be deployed on the warships of the Indian Navy. The Ministry of Defence said in a statement: “Providing further impetus to atmanirbharta (self-reliance) in defence production, the Ministry of Defence (MOD) signed a contract with BAPL for acquisition of additional dual-role capable surface-to-surface BrahMos missiles at an overall approximate cost of Rs 1,700 crore under the ‘buy-Indian’ category. Induction of these dual-role capable missiles is going to significantly enhance the operational capability of Indian Navy fleet assets.” The new generation surface-surface missiles come with an advanced range and capability to take out targets on land as well as anti-ship attacks. The MoD further noted: “This contract is going to give further boost to indigenous production of critical weapon system and ammunition with active participation of indigenous industry.” India has put a thrust on indigenous weapon system and ammunition production. The contract was signed under the ‘Buy (Indian)’ category. According to the MOD’s acquisition procedure, the ‘Buy (Indian)’ category refers to the procurement of

products from an Indian vendor meeting one of the two conditions: products that have been indigenously designed, developed and manufactured with a minimum of 50% Indigenous Content (IC) on cost basis of the total contract value; Or products, which may not have been designed and developed indigenously, having 60% IC on cost basis of the total contract value. What is the BrahMos system? BAPL is a joint venture between India's Defence Research and Development Organisation (DRDO) and Mashinostroyeniya of Russia. The name BrahMos is a combination of the names of Brahmaputra and Moskva rivers. The first test launch of the initial version of Brahmos took place in 2001 and it became the main weapon system of Indian Navy warships. A variety of BrahMos have been developed since then that can be fired from land, warships, submarines and the Sukhoi-30 fighter jets. In May this year, India successfully fired an extended range variant of BrahMos missile from a Sukhoi-30 fighter aircraft. Before that, in February, India successfully test-fired a naval variant of the advanced supersonic BrahMos cruise missile from INS Vishakhapatnam – Indian Navy's stealth guided-missile destroyer. Reports say that an underwater version is also being developed that will not only be inducted into the Indian arsenal but also sold to friendly countries. Last year, Philippines accepted BAPL's Shore-Based AntiShip Missile System Acquisition Project for its navy. Advanced range BrahMos missiles The BrahMos missile is one of the fastest supersonic cruise missiles in the world, according to the company. It has a maximum range of more 290 kilometers and travels at a speed of Mach 2.8 (which is nearly three times the speed of sound). In May, the extended version of the missile that 3 was successfully test fired had a range of 450-500 km. The BrahMos missiles were earlier restricted to 290 km to adhere to rules laid down by the Missile Technology Control Regime (MTCR), which restricted missile sales involving a non-MTCR country to a maximum range of 300 km. After India got admitted to the MTCR in June 2016, the Indo-Russian JV is permitted to develop these advanced range missiles. India is also in the initial stages of preparing to develop an even longer range BrahMos missile. Reports earlier this year said that the air-launched missile would have a range of 800 km. The development comes as India has been upgrading its navy muscle power in the backdrop of Chinese threats in the Indian Ocean. Prime Minister Narendra Modi had on September 2 inducted India's first indigenous aircraft carrier – INS Vikrant - into the naval force. With its rising profile in the neighbourhood and amid the choppy waters of the Indo Pacific, India needs to ensure it has a strong navy to project power over the important maritime area.

Source: <https://www.timesnownews.com/exclusive/how-do-the-dual-role-brahmos-missiles-add-more-firepower-to-the-indian-navy-article-94414772>

India Can Scale Up Production of Tejas Fighters for Operational Needs and Exports

India can scale up production of the indigenous Tejas light combat aircraft to meet operational requirements and export orders, defence ministry officials say, claiming that delays in deliveries are now a thing of the past. The single-engine Tejas fighter is already the frontrunner to bag a Malaysian order for 18 light twin-seat fighter trainers despite strong competition from Chinese JF-17, South Korean FA-50 and Russian MiG-35 and Yak-130 jets. "Moreover, there are also inquiries about the fighter from Argentina, Egypt and the Philippines, among others," a senior official told TOI. The current production rate of Tejas by defence PSU Hindustan Aeronautics (HAL) is eight aircraft per year but "additional capacity is now available" to enhance it. "It is not difficult," the official said. The plan is to progressively scale up the production rate to 16 Tejas per year for deliveries of the 73 "improved" Mark-1A fighters and 10 trainers to the IAF, which are slated to begin in February 2024 and end by February 2029. The Rs 46,898 crore contract for these 83 Tejas was inked with HAL in February 2021. "The production rate can even be increased to 24 aircraft per year if they are export orders or the IAF needs more. If there are confirmed orders, investments can be made to install additional jigs and fixtures," another official said. The Cabinet Committee on Security had last month also approved the over Rs 9,000 crore development of a much more capable and powerful Mark-2 version of the Tejas, which will be followed by another mega project for an ambitious fifth-generation stealth fighter, as was then reported by TOI. The slow production rate of the Tejas, which is now also being armed with the French 'Hammer' air-to-ground precision-guided munitions like Rafale fighter jets, has been a major lingering concern over the years. The two IAF Tejas squadrons, the "Flying Daggers" and "Flying Bullets" at Sullur, have till now inducted only 30 of the original order for 40 Tejas Mark-1 fighters,

which 13 were all slated for delivery by December 2016 under two contracts worth Rs 8,802 crore inked earlier. “Deliveries are now picking up. The first of the eight trainers in the original 40 Tejas is ready. All of the eight trainers will be delivered before the deliveries of the next 83 jets begin in February 2024,” the official said. “Tejas is a very cost-effective aircraft,” he added. The IAF desperately needs these 123 Tejas to add to the strength of its fighter squadrons, which is down to just 32 (each has 16-18 jets) when at least 42 are required for the requisite deterrence against the “collusive threat” from China and Pakistan. The Tejas Mark-1A fighters will have 43 “improvements” over the Mark-1 jets. They include AESA (active electronically scanned array) radars to replace existing mechanically steered radars, air-to-air refuelling, long-range BVR (beyond visual range) missiles and advanced electronic warfare to jam enemy radars and missiles, though the majority of them are designed to improve maintenance. Indigenous content of the jets will also progressively reach 60% by the end of the deliveries. There is acknowledgement in the Indian defence establishment, which has a pronounced ‘Make in India’ thrust now, that the country cannot ill-afford to keep on buying expensive foreign fighters. While the 36 omni-role Rafale jets are very advanced and capable, they cost a whopping Rs 59,000 crore.

Source:<https://timesofindia.indiatimes.com/india/can-scale-up-output-of-tejas-fighters-for-exports-operational-needs-say-officials/articleshow/94440646.cms>

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