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Technology

Business

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Eminent Indian Aeronautical and Aerospace Personalities in India

Series:9

V. S. Arunachalam



Vallampadugal Srinivasaraghavan Arunachalam is an Indian Scientist. He is the Founder and Chairman of CSTEP, Centre for Study of Science, Technology and Policy

Education

Dr.Arunachalam holds Bachelor's and Master's degrees in Science and received his PhD Degree in Materials Science and Engineering from the University of Wales, UK in 1965 and an Alumnus of Sharada Vilas College Mysuru.

Continued.....

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Career

Dr VS Arunachalam served as the longest Scientific Adviser to the Defence Minister Government of India. After his education in 1965, until 1969, Dr Arunachalam worked as Scientific Officer in the Metallurgy Division of the Atomic Energy Establishment at Bombay, where he first came into contact with Dr Brahm Prakash. This tenure was followed by his appointment as Scientist at National Aeronautical Laboratory, Bangalore, Aerospace Research Laboratory, Dayton, USA and later as Director at Defence Metallurgical Research Laboratory, Hyderabad. He took up the appointment as the Scientific Adviser in 1982 and held the office till 1992, serving ten Defence Ministers and five Prime Ministers, and as Secretary, Department of Defence Research for Government of India. He advised the government on the definition, assessment and review of a number of major technological and societal programs such as optical fibre communications for India, development of indigenous iron and steel Technologies, Scientific and Technological missions for the country to eradicate illiteracy, infant mortality etc. He also advised the Government in the area of Graduate Education in Engineering.

Dr Arunachalam is a Fellow of the Indian National Science Academy, Indian Academy of Sciences and was also the Vice- President and fellow of the Indian National Academy of Engineering. His principal work relating to metals is concerned with Structure and Mechanical Properties of Ordered Alloys, Titanium and Zirconium Alloys and Powder Metallurgy. He has Edited a Book on Advances in Powder Processing which has been being published simultaneously in India and USSR.

Dr Arunachalam emphasised and gave thrust to the indigenisation of many materials, components and systems. High volume consumable component like brake pads and clutch liners for military aircraft, needs special mention where the technology is now pioneered, and nation is made self reliant and self-sufficient. He gave sterling directions and decisions for LCA project, making LCA an enviable success story. He also steered Missile programs by forming IGMDP team and made the Country from strength to greater strength in terms of building weapon systems to the tri services of Indian Defence. He nurtured management leaders. He was President of The Aeronautical Society during 1984-86.

Awards

Dr Arunachalam added values to the numerous Awards and Medals which were bestowed on him in recognition of his scientific and technical contributions. He was the first Indian to be elected as a Fellow of the Royal Academy of Engineering, UK. He was conferred Padma Bhushan (1985) and Padma Vibhushan (1990) for his contribution to Indian science. In 2015, he was awarded Defence Research and Development Organisation's (DRDO's) lifetime Achievement Award for his outstanding contribution in the field of Scientific Research and Technology.

Dr Arunachalam devoted and dedicated himself immensely to Steering Scientific Research and Management of Strategic Technologies from materials to missile systems and enabled making every denial of technology to opportunity and explored to make successful globally competitive indigenous systems.

CURRENT AFFAIRS

ISRO and MVA collaborate for the outreach of the Chandrayaan-3 Mission

The Moon Village Association and the Indian Space Research Organisation (ISRO) are happy to announce to host global outreach activities in connection with the proposed Chandrayaan-3 launch by Indian Space Research Organisation. The common goal of these activities is to increase the impact of the ISRO lunar programme on a global scale and foster further international cooperation. The two organisations are cooperating to focus on the global aspect of lunar exploration and identify, communicate, and encourage the youth to focus on the mutual benefits that the entire world gets at every lunar mission.

The topics proposed for possible cooperation are the following:

1. **Global Video Competition:** A global video competition wishing the Chandrayaan-3 mission a great ride and a successful landing on the Moon by discussing the importance of the Chandrayaan-3 Mission for India and the Global Moon Exploration and Settlement.
2. **Webinars** to brief the global audience about the mission; the challenges and the benefits.

Statements:

Giuseppe Reibaldi, President of the Moon Village Association, stated that This joint activity with ISRO is an important collaboration that demonstrates the relevance of MVA as a platform to multiply national lunar program outreach efforts. With MVA hoping to grow and support developing countries, established and emerging space countries, and many more, we look forward to working with ISRO on this outreach effort. Sudheer Kumar N, Director, Capacity Building and Public Outreach, ISRO Headquarters, stated that The Chandrayaan-3 mission is going to be an important milestone in the Indian Space programme, which is aimed to demonstrate the critical technologies to land the spacecraft on the south pole of the moon. The mission encompasses critical technologies that should reach the global youth to encourage the scientific temperament on lunar missions.

About the Moon Village Association

The Moon Village Association (MVA) is an international non-governmental organisation (NGO) based in Vienna, founded in 2017. Its goal is the creation of a permanent global informal forum for stakeholders like governments, industry, academia and the general public interested in the development of the Moon Village. The MVA is assembling all efforts from private industry, governments, and others aimed to explore and use the Moon sustainably. The MVA fosters cooperation for existing or planned Moon exploration programs, whether public or private. It comprises more than 600 participants in MVA activities and 27 institutional members from more than 60 countries, representing a diverse array of technical, scientific, cultural, and interdisciplinary fields. The MVA partners with non-space organisations to promote international discussions and formulation of plans to foster the development of the Moon Village, and is creating international, national and regional networks to engage civil society around the world. The Moon Village Associations mission is unique, bridging together both spacefaring and non-spacefaring nations offering them the opportunity to play a role in its realisation. There is no other organisation on the international scene having such a mission.

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

ISRO successfully conducts the Reusable Launch Vehicle Autonomous Landing Mission (RLV LEX)

ISRO successfully conducted the Reusable Launch Vehicle Autonomous Landing Mission (RLV LEX). The test was conducted at the Aeronautical Test Range (ATR), Chitradurga, Karnataka in the early hours on April 2, 2023. The RLV took off at 7:10 am IST by a Chinook Helicopter of the Indian Air Force as an underslung load and flew to a height of 4.5 km (above MSL). Once the predetermined pillbox parameters were attained, based on the RLV's Mission Management Computer command, the RLV was released in mid-air, at a down range of 4.6 km. Release conditions included 10 parameters covering position, velocity, altitude and body rates, etc. The release of RLV was autonomous. RLV then performed approach and landing maneuvers using the Integrated Navigation, Guidance & control system and completed an autonomous landing on the ATR air strip at 7:40 AM IST. With that, ISRO successfully achieved the autonomous landing of a space vehicle. The RLV LEX demanded several state-of-the-art technologies including accurate Navigation hardware and software, Pseudolite system, Ka-band Radar Altimeter, NavIC receiver, indigenous Landing Gear, Aerofoil honey-comb fins and brake parachute system. In a first in the world, a winged body has been carried to an altitude of 4.5 km by a helicopter and released for carrying out an autonomous landing on a runway. RLV is essentially a space plane with a low lift to drag ratio requiring an approach at high glide angles that necessitated a landing at high velocities of 350 kmph. LEX utilized several indigenous systems. The IAF team hand in hand with the Project team and multiple sorties were conducted to perfect the achievement of release conditions. Dr. S Unnikrishnan Nair, Director, VSSC, and Shri Shyam Mohan N, Programme Director, ATSP guided the teams. Dr. Jayakumar M, Project Director, RLV was the Mission Director, and Shri Muthupandian J, Associate Project Director, RLV was the Vehicle Director for the mission. Shri Ramakrishna, Director, ISTRAC was present on the occasion. Chairman, ISRO/Secretary, DOS Shri S Somanath witnessed the test and congratulated the team. With LEX, the dream of an Indian Reusable Launch Vehicle arrives one step closer to reality.



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

DRDO & Indian Navy Conduct Successful Trial of BMD Interceptor from Naval Platform

Defence Research and Development Organisation (DRDO) and Indian Navy successfully conducted a maiden flight trial of sea-based endo-atmospheric interceptor missile off the coast of Odisha in the Bay of Bengal on April 21, 2023. The purpose of the trial was to engage and neutralize a hostile ballistic missile threat thereby elevating India into the elite club of Nations having Naval BMD capability.

Prior to this, DRDO has successfully demonstrated land-based BMD system with capability to neutralize ballistic missile threats, emerging from adversaries. Raksha Mantri Shri Rajnath Singh congratulated DRDO, Indian Navy and Industry involved in successful demonstration of ship based Ballistic Missile defence capabilities. Secretary DDR&D and Chairman DRDO Dr Samir V Kamat complimented the teams involved in the design and development of the missile. He said that nation has achieved self-reliance in developing highly-complex network-centric anti-ballistic missile systems.

Source: <https://pib.gov.in/>

India successfully tests maiden ship-based interceptor missile

India has successfully conducted the maiden flight of an endo-atmospheric interceptor missile from a naval ship to counter an enemy missile, taking the first step to have an indigenous naval ballistic missile defence capability that only a handful of nations possess. The Defence Research and Development Organisation (DRDO) and Indian Navy carried out the first test of a sea-based interceptor missile off the coast of Odisha on April 21. An endo-atmospheric system means that the missile can engage with the oncoming weapon up to an altitude of 30 km. "The DRDO and Indian Navy successfully conducted a maiden flight trial of a sea-based endo-atmospheric interceptor missile on April 21. The purpose of the trial was to engage and neutralise a hostile ballistic missile threat thereby elevating India into the elite club of nations having Naval BMD capability," the defence ministry said in a statement on Saturday. Earlier DRDO has demonstrated its land-based BMD system in a series of trials over the last decade and half showing India's capability to counter ballistic missile threats, emerging from adversaries. In phase-1 of the BMD programme, two missile defence systems were created. One of them was named Prithvi Air Defence, which is an exo-atmosphere hypersonic interceptor to intercept at an altitude of 80-120 km, while the second one is Advanced Air Defence – an endo-atmospheric missile that can intercept enemy missiles at an altitude of 15-30 km. Last November, DRDO conducted the maiden flight-test of phase-II of the BMD programme by launching the interceptor AD-1 missile with a large kill altitude bracket. While AD-1's range has not been officially disclosed, there are reports saying it potentially has a range of around 200 km. Following the successful launch of naval BMD on Friday, Defence Minister Rajnath Singh congratulated DRDO, Indian Navy and industry partners while DRDO chairman Samir V Kamat complimented the teams involved in the design and development of the missile. "The nation has achieved self-reliance in developing highly-complex network-centric anti-ballistic missile systems," said Kamat, who is also the secretary, Department of Defence Research and Development.



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

ISRO's PSLV rocket lifts off with 2 Singapore satellites

Carrying two Singapore satellites and seven non-separating Indian payloads, Indian Space Research Organisation's (ISRO) PSLV rocket blasted off successfully from the first launch pad of the Sathish Dhawan Space Centre in Sriharikota, 110 km from here on Saturday. PSLV-C55, which is a dedicated commercial mission of NewSpace India Limited (NSIL), took off at 2.19 pm with TeLEOS-2 and Lumelite-4, Singapore satellites, and seven non-separating Poem-2 payloads such as Aris-2, PiLOT, Arka200, Starberry, DSOL, DSOD-3U, and DSOD-6U. "Congratulations PSLV and NSIL for this successful launch... There are interesting things lined up in the near future," ISRO chairman Mr S Somnath said, adding that the PSLV has once again demonstrated its high reliability. Somnath further said the ISRO in this mission had a core alone configuration of the PSLV which has many specialities and improvements made to bring down the cost of the rocket as well as its integration time. "And this is the goal—to have increased production and launches of PSLV in the times to come," he added. The mission has the PSLV Orbital Experimental Module (POEM), where the spent PS4 stage of the launch vehicle would be utilized as an orbital platform to carry out scientific experiments through non-separating payloads. While TeLEOS-2 will provide all-weather day and night coverage, and

capable of imaging at 1m full-polarimetric resolution, LUMELITE-4 is an advanced 12U satellite developed for the technological demonstration of the high-performance space-borne VHF Data Exchange System (VDES). Using the VDES communication payload developed by I2R and STAR's scalable satellite bus platform, it aims to augment Singapore's e-navigation maritime safety and benefit the global shipping community. While TeLEOS-2 is the primary satellite, Lumelite-4 is the co-passenger satellite and this is 57th flight of PSLV and 16th mission using the PSLV Core Alone configuration (PSLV-CA).

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

TECHNOLOGY

Successful completion of System Demonstration Model (SDM) tests for Crew Module Propulsion System for the Gaganyaan Programme

The crew module of Gaganyaan has got a bipropellant-based Propulsion System for providing 3-axis control (Pitch, Yaw & Roll) to Crew Module following Service Module separation during re-entry i.e from an altitude of 170 km to 7 km till the deployment of the parachute-based deceleration system. It also provides attitude control in the ascent phase abort, if any, from 3 km to 70 km. The crew module propulsion system hardware consists of 12 nos. of 100 N thrusters and associated flow control components. On April 5, 2023, the hot test of the Crew Module Propulsion System for demonstrating the nominal re-entry for the duration of 650 s was successfully conducted at ISRO Propulsion Complex, Mahendragiri. Prior to this, a series of tests were carried out with six nos. of Thrusters. This system was designed, developed, and realized by Liquid Propulsion Systems Centre, Valiamala. Completing this test is a major step in qualifying the Crew Module Propulsion System for the Gaganyaan Programme.



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

Successful completion of human rated Vikas engine test campaign for the L110 stage of Gaganyaan programme

The final long duration hot test of human rated L110-G Vikas Engine is successfully accomplished for the planned qualification duration of 240 s on April 6, 2023 at ISRO Propulsion Complex (IPRC), Mahendragiri. The successful completion of this test marks a major milestone in the human space flight programme, Gaganyaan, of ISRO. The air-lit liquid core stage of human-rated launch vehicle (LVM3-G) uses two L110-G Vikas engines in clustered configuration. With this test all the planned qualification tests of the engine are completed successfully. Design and realization of L110 stage for Gaganyaan is carried out at Liquid Propulsion Systems Centre (LPSC), assembly and integration and

testing is carried out at IPRC. Engine Gimbal Control system was developed by VSSC. Human rated Vikas engine has higher structural margins for sub-systems, improved assembly process and additional measurements for health monitoring. Human rated Vikas Engine development hot tests were conducted in a step-by-step manner at Principal Test Stand, IPRC. Nine engines had undergone 14 hot tests with a cumulative duration of 1215 s, including four long duration tests of 240 s each. Drawn from the extensive legacy and experience of liquid rocket engine development, the test campaign envelopes extreme operating durations, off-nominal mixture ratios and thrust level conditions as compared to flight operating conditions. Four sets of hardware used for this test programme were fabricated at various Indian industries. Electro-mechanical Gimbal actuators and Command System module for engine pilot pressure control, with multiple redundancies were also qualified in the test. ISRO could complete the human rated L110-G Vikas engine qualification within a short span of three years.

The test was witnessed by Shri S Somanath, Chairman ISRO/ Secretary DoS, Dr. V Narayanan, Director, LPSC, Dr. S Unnikrishnan Nair, Director, VSSC, Shri J Asir Packiaraj, Director, IPRC and other functionaries.



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

India successfully achieves autonomous landing of space vehicle

The Indian Space Research Organisation on Sunday successfully conducted the Reusable Launch Vehicle Autonomous Landing Mission (RLV LEX). The test was conducted at the Aeronautical Test Range (ATR), Chitradurga, Karnataka, the national agency headquartered here said. “With that, ISRO successfully achieved the autonomous landing of a space vehicle”, it said in a statement. “With LEX, the dream of an Indian Reusable Launch Vehicle arrives one step closer to reality”, ISRO said. In a first in the world, a winged body has been carried to an altitude of 4.5 km by a helicopter and released for carrying out an autonomous landing on a runway. RLV is essentially a space plane with a low lift to drag ratio requiring an approach at high glide angles that necessitated a landing at high velocities of 350 kmph. The RLV took off at 7:10 am IST by a Chinook Helicopter of the Indian Air Force (IAF) as an underslung load and flew to a height of 4.5 km (above Mean Sea Level). Once the predetermined pillbox parameters were attained, based on the RLV’s Mission Management Computer command, the RLV was released in mid-air, at a down range of 4.6 km. Release conditions included 10 parameters covering position, velocity, altitude and body rates, etc. The release of RLV was autonomous. RLV then performed approach and landing maneuvers using the Integrated Navigation, Guidance & control system and completed an autonomous landing on the ATR air strip at 7:40 AM IST. The autonomous landing was carried out under the exact conditions of a Space Re-entry vehicle’s landing — high speed, unmanned, precise landing from the same return path — as if the vehicle arrives from space. Landing parameters such as Ground relative velocity, the sink rate of Landing Gears, and precise body rates, as might be experienced by an orbital re-entry space vehicle in its return path, were achieved.

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

NISAR Satellite to Map Himalayas' Seismic Zones

A forthcoming satellite, NISAR, jointly developed by the Indian Space Research Organisation (ISRO) and the National Aeronautics and Space Administration (NASA) of the U.S. will map the most earthquake-prone regions in the Himalayas with unprecedented regularity. The data this will generate can potentially give advance warning of land subsidence, as recently observed in Joshimath, Uttarakhand, as well point to places that are at greatest risk from earthquakes. The NISAR satellite, expected to cost approximately \$900 million (with ISRO contributing about one-tenth) will use two frequency bands: the L-band and S-band to image the seismically active Himalayan region that will, every 12 days, create a "deformation map", said Prakash Chauhan, Director, ISRO-National Remote Sensing Centre at a seminar here this week. "The geoscience community can use this to determine how strain is building up in various parts of the Himalayas," he said. These two frequency bands will together provide high-resolution, all-32 weather data from the satellite that is expected to follow a sun-synchronous orbit and will be launched in January 2024. Strain refers to the deformation that occurs in rocks when it is under pressure from other rocks, usually due to movements of continental plates that are sliding, colliding, or subducting against each other. The Indian Plate, for instance, collided into the Eurasian plate forming the Himalayas and continues to incrementally push it upwards. Based on the intensity of past earthquakes, the knowledge of the speed at which plates move and the locations at which plates interact (called faults) can help geologists and seismologists map out regions that are most vulnerable to earthquakes and estimate how far the resultant tremors can spread. What can't be deduced however is the timing. Ground-based observatories can pick up underground waves that result from an earthquake and provide early warning. Satellites, depending on how they are positioned and by virtue of their distance from the Earth can image a wide swathe and, if monitored frequently, can show how mountains and geological formations are changing over time. Scientists from the Geological Survey of India in 2021 published a "strain map" of the Himalayas based on data from 1,252 GPS stations along the Himalayas. It identified regions that had the greatest odds of generating earthquakes of magnitude above 8 and their extent. "These many stations are still too few and there's only one satellite (Sentinel) that we rely on...with NISAR, the costliest space mission ever, we can have a game-changer in earth-science observation," said Dr. Chauhan. While satellite imagery to study deformation in land is already employed, the frequency at which observations are taken and the clarity of the images are critical, V.K. Gahalaut, of the National Geophysical Research Institute (NGRI), told The Hindu. "With a frequency of 12 days and the ability to be able to provide images even under cloudy conditions, NISAR would be a valuable tool to study deformation patterns, such as in Joshimath," he added. Land subsidence or the loosening of the sub-surface had caused several parts of Uttarakhand to "sink" and this caused water to seep via cracks and crevices into houses. In 2021, a large landslide of rock and ice triggered a flash flood in Chamoli, Uttarakhand that claimed close to 200 lives and destroyed two hydropower projects. It was satellite imagery that helped scientists decipher the cause of the flash floods.

Source: <https://www.thehindu.com/news/national/nisar-satellite-to-map-himalayas-seismiczones/article66738274.ece>

BUSINESS

Indian, US fighter jets take part in joint exercise at Bengal's Kalaikunda

Fighter jets of the air forces of India and the United States took part in a joint exercise at Kalaikunda Air Force Station in West Bengal's Paschim Medinipur district, an official said on Monday. As part of the Cope India 2023 exercise, five top-notch fighter jets of the two air forces took off in quick succession from the air force base. The Indian Air Force has employed Tejas, Rafale, Jaguar and Su-30 MKI fighter jets while the F-15 is representing the United States Air Force in the exercise. The exercise, which began on April 10, will conclude on Monday. A simultaneous 12-day exercise of transport aircraft was held at Panagarh Air Force Station in Paschim Bardhaman district from April 10.

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



Special Issue on Pad Abort Test – Crew Escape System

Edited by

Shri. S. Somanath, Dr. S. Unnikrishana Nair

Shri. K. Kumar, Shri. T. Sivamurugan, Dr. S. L. N. Desikan

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The Publication on **PAD Abort Test - Crew System** was released by Shri S. Somanath, Chairman ISRO as a Special Issue (Vol 75, Issue 1A) of the Journal. This edition is essentially an outcome of successful R & D efforts and eventually a technology demonstration of crew escape system in a emergency situation during human mission launch program, Gaganyaan. It is a system with critical technology of utmost relevance to human space flight where in PAD Abort test demonstrates how crew can escape while at launch pad under an exigency. The crew escape system weighs a little more than 12 tons and designed to peak acceleration of 10g under the power of its 5 specifically engineered quick acting solid motors to take away the crew module to a safe distance. As many as 300 sensors detail the numerous mission parameter and three recovery boats were deployed to retrieve the module. The successful demonstration is a significant milestone in human space flight program. The R&D efforts include mission design, Configuration control, Aerothermal design, Deployment of solid motors, Structural aspects of crew pad and the grid fin.

In the Special issue there are 11 technical papers from Scientists and Engineers of ISRO-VSSC, DRDO, IIST and the team. The areas covered include separation mechanism, simulation studies, management of thermal aspects, static motor testing and system reliability assurance as key technologies which are of stupendous challenge and fascinating explorations. The Editorial team of Journal of Aerospace Sciences and Technologies takes pride in bringing out the Special Issue to make it as exotic reading to the scientific community at large and aerospace professionals in particular which is one of the preludes to Gaganyaan Programme.





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