

# spacepreneur

A Space Explore Edition...

Volume 1 › Issue 4 › Sept-Oct 2023 › Price ₹500



**PROF. V. BALAKISTA REDDY**  
DEAN-SCHOOL OF LAW  
MAHINDRA UNIVERSITY

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**MR. PRATEEP BASU**  
CEO-SATSURE

**PG 11**

## **SPACEMAN WITH A VISION**

**Dr. Subba Rao Pavuluri**  
CMD – Ananth Technologies Ltd

**PG 26**



Bhumandal Se Brahmaand Tak

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October 11th, 2023  
Shri Nitin Gadkari  
Hon'ble Minister For Road Transport & Highway, Government of India



**Chief Guest**  
October 9th, 2023  
Dr Jitender Singh  
Hon'ble Minister of State of the Space, Science and Technology Prime Minister's Office



**Guest of Honor**  
October 9th, 2023  
Mme Sylvie Retailleau  
Minister of Higher Education & Research, Government of France



**Special Invitee**  
October 9th, 2023  
H.E. Mr Emmanuel Lenain  
Ambassador of France to India



**Special Invitee**  
October 9th, 2023  
Shri S Somanath  
Secretary, Department of Space and Chairman, Indian Space Research Organization (ISRO)



**Special Invitee**  
October 11th, 2023  
Dr Philippe Batiste  
President, CNES (French Space Agency)



**Special Invitee**  
October 11th, 2023  
Dr Pawan Goenka  
Chairman, Indian National Space Promotion and Authorization Centre (IN-SPACe)



**Special Invitee**  
October 9th, 2023  
Astronaut Thomas Pesquet  
European Space Agency

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- Ministry of Electronics & Information Technology
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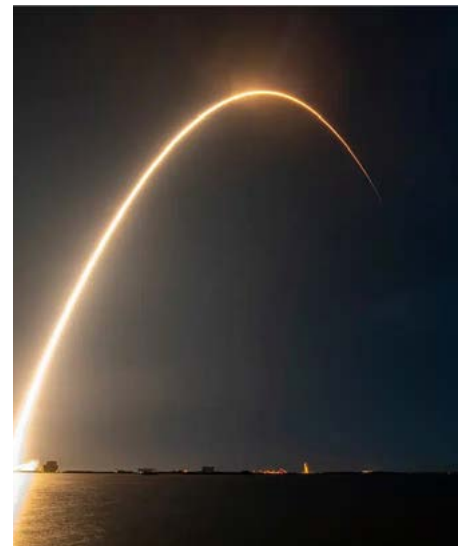
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**B. KARTIKEYA**

Hello my dear readers,

The most thrilling, aesthetically fascinating, and relevant coverage of the skies above is present in this edition of Spacepreneur magazine. The issue features thorough sky coverage, knowledgeable observing advice, insightful expert evaluations, and professional scientific reporting. All of these are in an approachable manner that is ideal for space enthusiasts of any level.

Get the most recent information regarding the space sector in the Global News area. In-depth information regarding Firefly Aerospace and Millennium Space Systems, prepared for flexible U.S. Space Force missions, is in this section. Virgin Galactic Holdings, Inc. also declared that "Galactic 02," its first private astronaut trip, had successfully concluded.

The entire information regarding Chandrayaan-3's successful lunar landing is available in the lunar section. News on the most recent rocket launches is also general in the Launch section.

Three interviews with various figures in the space industry are in this new issue of Spacepreneur Magazine. The first interview is with Mr Prateep Basu, CEO of Satsure, who discusses the potential problems he has observed in the Indian Space Market. The second interview is on the many goods and solutions Erisha Space is now providing with DR. Darshan Rana, Chairman and Managing Director. The following discussion concerns the recently launched AFR Satellite and its purpose with Mr. Srinivas Reddy Male, MD - Azista Aerospace.

Interview with Dr. Subba Rao Pavuluri, CMD of Ananth Technologies Ltd., is on the cover page. He explains why private sector involvement is essential to India's success in the industry even as the global space competition heats up. The following interview was with Prof. V. Balakista Reddy, Dean-Mahindra University's School of Law. Additionally, he served as the Center For Aerospace and Defence Laws' (CADL) former Registrar and Director. He refers to the regulations governing lunar real estate and properties, which let any people, businesses, or governments sell lands.

*Kartikeya*

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## Thales Alenia Space Creates Space Business Catalyst, the 1st Industry Accelerator Dedicated to Space

Thales Alenia Space, the joint venture between Thales (67%) and Leonardo (33%), announces the creation of the Space Business Catalyst, a unique industry accelerator dedicated to the space sector to coincide with the Assises du New Space opening in Paris on July 5.

The Space Business Catalyst is a first and is designed to explore, create and secure the conditions needed for the emergence of new players in the space sector by supporting the development of disruptive projects. As an industry accelerator, the Space Business Catalyst supports intrapreneurs and startups during their early growth phase and helps them define and implement their industrial scale-up strategies. This agile structure facilitates the emergence of solutions likely to generate a genuine market dynamic, technological breakthroughs and new avenues of development for existing

solutions.

Since 2014, Thales Alenia Space has pursued a pioneering strategy focused on New Space within its Innovation Cluster. This approach has led to the launch of disruptive intrapreneurship projects, such as Space Edge Computing in collaboration with Microsoft, as well as open collaborations with over 700 startups. The Space Business Catalyst was launched in 2023 to strengthen and develop Thales Alenia Space's strategy, focused on providing selective, qualitative support for innovative projects that will nurture future markets.

Based in Toulouse and Turin, the Space Business Catalyst's 400 square-meter (4,300 sq.ft) facilities are already hosting some 10 startups and intrapreneurs from all over the world. Working with entrepreneurship experts, Thales Alenia Space has designed a support program that offers

“

The Space Business Catalyst promises much more than a traditional accelerator,” said Vincent Clot, Business and Open Innovation Director at Thales Alenia Space. “Having established strategic partnerships with Axiom, BlackSky, Space Cargo, Omnispace, Kinéis, Anywaves, Geoflex and SpaceLocker, Thales Alenia Space has become the go-to partner for strategic long-term alliances and shaping the future of space. We're committed to attracting top talent by offering opportunities to innovate within an ecosystem at the forefront of the sector.

”

technical, commercial, relational and financial support for project leaders, giving them an exceptional opportunity to build strategic collaborations with a major player in the space industry. The Space Business Catalyst is in line with Thales Alenia Space's Space For Life vision to integrate projects that are especially conducive to the development of responsible space, such as modular space infrastructure and space's contribution to sustainable finance.

The Space Business Catalyst is fully in line with the ethos of the Assises du New Space forum in Paris, which takes place on July 5 and 6. This event is a chance for French space organizations to discuss and build around the challenges and opportunities ahead in space. The strategic, high-impact space sector is now more accessible, offering a host of technological and business opportunities for all stakeholders.



## RTX Selected for Crossover Task Order under NASA xEVAS Contract

Collins Aerospace, an RTX business announced it has been awarded a new task order under NASA's Exploration Extravehicular Activity Services ("xEVAS") contract to modify the company's current spacesuit to support lunar endeavors.

The follow-on task order allows Collins to add on to the company's new spacesuit design, developing elements that are compatible for use on the lunar surface as part of NASA's Artemis missions.

Collins was awarded a task order valued at five million dollars, following a proposal process that required the company to identify the methodologies to develop a crossover product.

Collins' next-generation suit is lower in weight than the current extravehicular mobility unit and will improve astronaut efficiency, range of motion, and comfort. Designed to fit nearly any body type, it also has an open architecture design that enables the suit to be easily modified as missions change and evolve.

As NASA and Collins continue to advance the xEVAS program with events like Collins' upcoming Critical Design Review and testing, such as a thermal vacuum test and underwater tests held at NASA's Neutral Buoyancy Lab, Collins stands ready to help NASA and its international and commercial partners from low Earth Orbit to deep space.

“Our next-generation spacesuit design is nearly 90% compatible with a lunar mission,” said Dave Romero, director, EVA & Human Surface Mobility Systems for Collins Aerospace. “This formal contract award will support continued efforts to modify our next-generation spacesuit, making it suitable to tasks on the Moon.”



## Exolaunch Deploys the 1st Indo-German Satellite for Azista BST Aerospace on SpaceX's Transporter-8 Mission

Azista BST Aerospace (ABA), the Indo-German joint venture aiming to revolutionize the mass production of small satellites for mega-constellations, and Exolaunch, a leading global provider of mission management, integration services and smallsat deployment technologies have launched and deployed AFR-1, ABA's first satellite, with SpaceX's Falcon 9 on the Transporter-8 rideshare mission from Vandenberg Space Force Base in California on June 12, 2023 2:35pm PT.

The ABA First Runner (AFR-1) is carrying a payload destined for Earth observation, using an electro-optical sensor with a medium-resolution Ground Sample Distance (GSD) to image a large area. AFR-1 rolled off the ABA factory floor as a showcase of the joint venture's manufacturing capabilities catering to mass producing satellites in a short amount of time. The satellite model spearheaded by AFR-1 is based on a modular bus which can host a wide variety of payloads with little to no software or hardware updates.

For M Srinivas Reddy, Managing Director at Azista BST Aerospace, “This successful launch is a decisive first step towards delivering a transformative Henry Ford moment for small satellites.”

Exolaunch provided Azista BST Aerospace with its end-to-end mission management as well as its industry-leading CarboNIX microsatellite separation system, which deployed AFR-1 flawlessly in its target orbit. Exolaunch's CarboNIX guarantees stable and smooth separations thanks to a patented low-shock design that has proven its reliability through 13 missions and over 60 successful deployments. Azista BST Aerospace awarded the launch agreement to Exolaunch for its extensive experience in rideshare missions and its reputation as a trusted provider of mission management and integration services with both incumbent and new satellite manufacturers.

“Exolaunch is thrilled to support Azista BST Aerospace with their first satellite launch,” said Nadine Smolka, Mission Manager at Exolaunch. “This was a great opportunity to help international teams come together around a joint mission, share approaches, and solidify partnerships throughout the launch campaign. SpaceX's rideshare program has opened up so many new possibilities for cooperation in the field of commercial smallsat manufacturing, and we're proud to be able to facilitate it on a global scale.”



## ESA Chooses Thales Alenia Space for SOLARIS Feasibility Study

Thales Alenia Space, the joint company between Thales (67%) and Leonardo (33%), has been chosen by the European Space Agency (ESA) to conduct a feasibility study for the SOLARIS initiative, which will determine the viability of a project to provide clean energy from spaceborne solar power plants to meet requirements down on Earth.

Europe is targeting net zero emissions from greenhouse gases by 2050. To achieve this ambitious goal, Europe's energy industry has to call on renew-

able, controllable and affordable energy sources, available worldwide. Solar energy from space is a promising solution to meet this need.

Thales Alenia Space is leading a consortium to come up with an ambitious solution for Europe: "harvesting" solar energy in orbit, where it's available without having to worry about the weather or nighttime, then send it back down to Earth. The SOLARIS studies should allow Europe to make an informed decision by 2025 on whether or not to embark on a development

program for the commercialization of space-based solar energy, with an initial objective of designing a small-scale in-orbit demonstrator.

SOLARIS was supported at ESA's Ministerial Council in November 2022, with the aim of making Europe a key player, and possibly a leader, in the international race to develop clean and sustainable energy solutions to attenuate human-caused global warming. Thales Alenia Space will lead this feasibility study, which aims to develop new concepts for a system to provide solar energy from space, with enabling technologies including high-efficiency space solar panels, wireless power transmission and robotized assembly in orbit. These studies will guide the follow-on research & development activities.

The space solar power concept complements renewable energy sources on Earth, rather than competing with them, because solar power from space is available 24/7, thus ensuring electrical supply continuity without the need for significant storage systems.

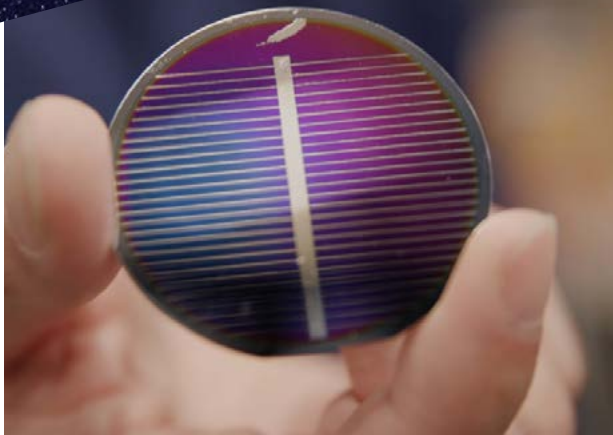
The European consortium handling these studies offers a wide array of complementary areas of expertise, spanning orbital systems (Thales Alenia Space), aviation (Dassault Aviation), strategic consulting (Arthur D. Little) and above all energy (Engie, ENEL, Air Liquide), clearly illustrating the project's strong potential for the global energy industry.

## NGC CELEBRATES THE ANNIVERSARY OF 1ST IMAGES THAT CHANGED OUR UNDERSTANDING OF THE UNIVERSE

Northrop Grumman Corporation (NYSE: NOC) marks the one year anniversary of the first revolutionary images and scientific data coming from NASA's James Webb Space Telescope (Webb).



Today, along with our partners and pioneering team, we celebrate one year of breathtaking discoveries by the James Webb Space Telescope, a feat of engineering that has marked a new era in humanity's understanding of our universe, said Tom Wilson, corporate vice president and president, Northrop Grumman, Space Systems. "As the prime contractor on Webb, Northrop Grumman led the design, development, and integration of this groundbreaking observatory and we continue to support its operations and maintenance as we explore the origins of our universe."



## Blue Origin Awarded NASA Partnership to Turn Lunar Regolith into Solar-Power Systems on the Moon

NASA awarded Blue Origin a \$35 million Tipping Point partnership to continue advancing its innovative Blue Alchemist breakthrough revealed earlier this year.

Blue Alchemist is a proposed end-to-end, scalable, autonomous, and commercial solution that produces solar cells from lunar regolith, which is the dust and crushed rock abundant on the surface of the Moon. Based on a process called molten regolith electrolysis, the breakthrough would bootstrap unlimited electricity and power transmission cables anywhere on the surface of the Moon. This process also produces oxygen as a useful by product for propulsion and life support.

According to NASA, a technology like Blue Alchemist is considered at a Tipping Point if the agency's investment can help grow the innovation into a viable commercial solution. Today's investment will result in a demonstration of autonomous operation in a simulated lunar environment by 2026.

“Harnessing the vast resources in space to benefit Earth is part of our mission, and we're inspired and humbled to receive this investment from NASA to advance our innovation,” said Pat Remias, vice president, Capabilities Directorate of Space Systems Development. “First we return humans to the Moon, then we start to ‘live off the land.’”



## Rocket Lab Signs Multi-Launch Deal to Further Deploy Synspecive Constellation

Rocket Lab USA, Inc. a global leader in launch services and space systems announced it has signed a deal with Japanese Earth imaging company Synspecive to launch two dedicated Electron missions. The new missions bring the total number of Electron launches contracted by Synspecive to six.

Rocket Lab has been launching for Synspecive since 2020 when the Company deployed the first satellite in Synspecive's synthetic aperture radar (SAR) constellation, which is designed to deliver imagery that can detect millimetre-level changes to the Earth's surface from space. Since that first mission, Rocket Lab has been the sole launch provider for Synspecive's StriX constellation to date, successfully deploying three StriX satellites across three dedicated Electron launches. Including the two new missions, Rocket Lab is now scheduled to launch three missions for Synspecive beginning in late 2023 from Launch Complex 1 in New Zealand.

In addition to providing Synspecive with a high degree over schedule and orbit by flying as a dedicated mission, Rocket Lab also delivers the unique ability to perform an advanced mid-mission maneuver with the Electron rocket's Kick Stage to shield the StriX satellite from the sun to reduce radiation exposure ahead of payload deployment.

Synspecive founder and CEO, Dr. Motoyuki Arai, says: “As we celebrate our three-year partnership with Rocket Lab, which began with our first StriX-α satellite in 2020, we are thrilled to entrust them with two more contracts for our StriX satellite launches. Their unwavering reliability and precision have been pivotal to our successful deployments. We're looking forward to the upcoming launches and the new insights to enhance our satellite data and solution service in line with our customer needs.”

“Rocket Lab founder and Chief Executive, Peter Beck, says: “It's an honor to be entrusted with the continued deployment of Synspecive's constellation. We're proud to enable them to build out their constellation with precision and efficiency, giving Synspecive ultimate schedule and orbit flexibility with frequent dedicated launch opportunities. We're delighted to continue delivering this unique ability to Synspecive through our continued partnership.””



# LM SELECTED TO DEVELOP NUCLEAR-POWERED SPACECRAFT



Lockheed Martin has won a contract from the Defense Advanced Research Projects Agency (DARPA) to develop and demonstrate a nuclear-powered spacecraft under a project called Demonstration Rocket for Agile Cislunar Operations (DRACO). The project will represent a rapid advancement in propulsion technology to benefit exploration and national defense. DARPA partnered with NASA's Space Technology Mission Directorate on the DRACO project, as both agencies will benefit from this leading edge technology. The in-space flight demonstration of a nuclear thermal rocket engine vehicle will take place no later than 2027.

Chemical propulsion engines have long been the standard for spaceflight, but for humans to travel to Mars, they will need much more powerful and efficient propulsion. Nuclear thermal propulsion (NTP) engines offer thrust as high as conventional chemical propulsion with two-to-five times higher efficiency, which means the spacecraft can travel faster and farther and can significantly reduce propellant needs. They also enable abort scenarios on journeys to Mars that are not possible with chemical propulsion systems.

An NTP system uses a nuclear reactor to quickly heat hydrogen propellant to very

high temperatures and then funnels that gas through the engine nozzle to create powerful thrust. The fission-based reactor will use a special high-assay low-enriched uranium, or HALEU, to convert the cryogenic hydrogen into an extremely hot pressurized gas. The reactor will not be turned on until the spacecraft has reached a nuclear safe orbit, making the NTP system very safe.

Lockheed Martin has partnered with BWX Technologies to develop the nuclear reactor and produce the HALEU fuel.

"In the past several years, BWXT has been maturing its nuclear thermal propulsion fuel and design, and we are excited to further expand into space with our ability

to deliver nuclear products and capabilities to the U.S. Government," said Joe Miller, BWXT Advanced Technologies LLC president. "We look forward to building the reactor and manufacturing the fuel at our Lynchburg, Virginia, facilities."

While nuclear systems are an emerging field, Lockheed Martin has a long history and expertise in nuclear controls and has built many of NASA's radioisotope thermoelectric generators for NASA's planetary missions. Lockheed Martin has also invested heavily in cryogenic hydrogen storage and transfer. This key technology will be needed in deep space exploration not only for NTP, but for conventional propulsion systems.

"These more powerful and efficient nuclear thermal propulsion systems can provide faster transit times between destinations. Reducing transit time is vital for human missions to Mars to limit a crew's exposure to radiation," said Kirk Shireman, vice president of Lunar Exploration Campaigns at Lockheed Martin Space. "This is a prime technology that can be used to transport humans and materials to the Moon. A safe, reusable nuclear tug spacecraft would revolutionize cislunar operations. With more speed, agility and maneuverability, nuclear thermal propulsion also has many national security applications for cislunar space."

# REACTION ENGINES CHOSEN FOR HIGH-SPEED TRANSPORTATION CONCEPTS UNDER THE UK SPACE AGENCY'S INTERNATIONAL BILATERAL FUND

Reaction Engines is actively pursuing the future of space access through high-speed horizontal launch vehicles with a view to fulfilling critical missions for stakeholders in both the U.K. and the U.S. The project, "Combining innovative UK air-breathing propulsion with US airframe capability for space access" was competitively selected for a Phase 1 award under the UK Space Agency's new International Bilateral Fund.

Reaction Engines is well known for its development of hypersonic technology focused on air-breathing propulsion. By enabling high-speed flight, well beyond the capabilities of current aircraft systems, Reaction Engines offers a step-change in efficiency compared with conventional rocket propulsion.

Reaction Engines has chosen to work with Virgin Galactic on this project. Virgin Galactic's unique, reusable, suborbital spaceflight system allows them to fly aircraft to the boundary between air and space. After extensive development, Virgin Galactic recently began commercial operations with monthly flights to space for private astronaut and research customers.

Under the planned bilateral activity, the U.K. and U.S. Companies will explore the combination of their capabilities, potential use-cases, and development paths. Neither Virgin Galactic or Reaction Engines are strangers to the benefits of strong U.S. and U.K. collaboration and this opportunity to engage is in step with Reaction's strategic mission of developing hypersonic and space access solutions, by harnessing the allied capabilities and a shared vision of the future. This joint undertaking, as supported by the UKSA, elevates this mission to the global stage and has the potential to set the course for future collaboration.

Oliver Nailard, Senior Business Development Manager at Reaction Engines said: "Innovation and collaboration has always been key in progressing our technology. Working alongside Virgin Galactic, a Company already operating spaceplanes, fits our company mission and offers an interesting U.S. opportunity for us to explore."

Steve Justice, Senior Vice President, Space-



line Programs & Engineering at Virgin Galactic said: "We are seeing the emergent benefits of what the U.S. and U.K. can achieve in the joint pursuit of space access and operations. This collaboration with Reaction Engines, studying advanced airframe-propulsion integration concepts, contributes to building a legacy." Reaction Engines is actively pursuing the future of space access through high-speed horizontal launch vehicles with a view to fulfilling critical missions for stakeholders in both the U.K. and the U.S. The project, "Combining innovative UK air-breathing propulsion with US airframe capability for space access" was competitively selected for a Phase 1 award under the UK Space Agency's new International Bilateral Fund.

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Spacepreneur magazine Editor Kartikeya in conversation with

## **MR. PRATEEP BASU CEO, SATSURE**

**Q** Please brief us about the Journey from engineer to becoming an entrepreneur?

**A** I started my career at ISRO, after graduating as a member of the first batch of the Indian Institute of Space Science & Technology (IIST), which was established by the Department of Space in 2007. At ISRO I was stationed at Sriharikota, from where our space agency launches India's ambitious missions. There, my daily affair was with ISRO's currently most powerful rocket, the GSLV Mk-III,

which was still under development and testing back in 2013.

But I wanted to understand the space industry better, and strived to expand my knowledge and experience in the management aspects of commercial space activities. Hence, through a SES sponsored scholarship I went to pursue a Masters in Space Studies at the International Space University, in Strasbourg, France! In this pursuit, I explored and observed the Global space sector, and after graduation I went to work for Northern Sky

Research, now an Analysis Mason Company based out of Boston, USA.

While everything was good, the pay, social life, and growth, I felt something was missing - a direction in life. Through my friends and subsequently, the news, I came to know a lot more about the problems in rural India, primarily pertaining to financing agriculture and its connection to farmer suicides. I spent my personal time trying to unravel the reasons why more farmers preferred taking loans from private moneylenders instead

## FOCUS ON START-UP



of banks by talking to different stakeholders - farmers, cooperatives, bureaucrats, bankers, and extension office workers.

The problem was big enough and I had saved enough funds from my professional stint. Hence I decided to step out of my comfort zone, and start SatSure with the vision of solving real life problems using space technology. I went to villages, spent time there, understood their problems, and that's how I realized the last mile gap in the reach of Earth observation data.

**Q** What are the Products & services currently offered by SatSure?

**A** We started SatSure with the motive to solve India's most pressing problems, in which agriculture finance was the first. We still intend to follow the same motive, to address issues that hinders the growth of our country, or of the world, hence today we have solutions that are built to solve today, and tomorrow's problems, hence enabling the world to make "Smart Decisions, with intelligence derived from space".

Today, we have solutions in the name of:

**SatSure Sparta:** A Data Product Platform that hosts analytical ready data products derived from satellite imagery, machine learning and big data analytics to offer actionable insights and decision making support across industries. Further it also has low code APIs and Tools Build customized solutions by utilizing low code APIs, SDKs and tools that are equipped with pre-built components and templates for rapid developments. Hence offering tailored and customer centric solutions that fits our customer-centric approach helps tailor a solution fit for each client's unique needs, delivering value and driving success for them.

**SatSure Sage:** This particular solution is focused on enabling financial inclusion of farmers by working with financial institutions through faster turnaround time for loan disbursements. It also provides access to land score with historical farm metrics through instant report generation to improve turnaround time in crop loan processing. The credit managers at banking firms are also enabled to monitor

loan portfolios remotely. Besides providing access to SaaS-based web terminals for loan monitoring at individual and portfolio level. Further providing spatial crop intelligence for loan collections which is now analytically driving field force management to reach customers intelligently and help them do collections efficiently.

**SatSure Skies:** This solution addresses the pressing issues of the infrastructure sector, with near real time analytics from high resolution earth observation data integrated for efficient process planning and key decision making for infrastructure. Skies Planning, monitoring, and reporting Digital utility asset management Airport utility asset management Impact assessment of a natural calamity.

**Q** What are the challenges & opportunities you see in Indian space Market? What are your current global projects?

**A** I think the challenges in any sector are ever evolving, and the same is the case with the space sector in India. Until 5 years back, there was no policy or regulatory clarity for private actors but with the

## FOCUS ON START-UP

formation of InSpace, that vacuum has been filled. There continue to be challenges as FDI in the space sector still requires government approval, while even defense is now exempted from it.

At SatSure, since we are working with satellite imagery at the core of the solutions we have built, getting access to different types of commercial satellite imagery has been a challenge, along with the availability of ground truth data to validate the insights generated. Today, the industry needs near-real-time data, if not real-time-data. The onus lies on us to acquire images from the satellite operators for images as per their operation cycle, hence long waiting period and then the low swath images limited our ability to open new markets, where the power of AI and ML to create insights on changes in natural and manmade objects goes unused properly.

Our venture KaleidEO, which is launching four optical and multispectral imaging microsatellites, aims to address this issue with a high-swath of 65 km swath, with a spatial resolution of a meter. The mission is designed with edge-processing capabilities that provide processed data to the end-users and us. This way, we have complete control over image frequency, data quality, and satellite positioning.

When it comes to our global projects, it's about entering and positioning our solutions to address the specific needs of those specific geographic areas like North and South America, Latin America, MENA, and APAC. In These regions we are focusing on the agricultural, banking and the infrastructure sectors.



**Q Can you brief us about your agriculture solutions to farmers? What are the hurdles you have faced while implementing? How can an Individual farmer will be benefited directly from your services?**

**A** SatSure Sparta and SatSure Sage are two of our most important agricultural solutions. For instance, SatSure Sparta enables continuous monitoring capability of vegetation and environment for historical and near real time. Moreover it provides niche data products like Farm boundary, Irrigation condition, Cropping intensity, Sown area progression, Crop identification, Harvest area progression, Crop damage assessment, super-resolution images and synthetic satellite images for training AI/ML models. The users of such data products and the platform range from agri-chemical companies, FMCG companies, insurance and reinsurance companies, governments, multi-laterals, and FinTech players.

On the other hand, SatSure Sage provides insights to increase banking institution's crop loan portfolio size smartly. It also provides historical risk profiles with current season insights to drive directed market planning and loan collections. To

monitor the lending portfolio on the performance and quality of farms in a region SatSure Sage also provides historical and in-season data analysis.

When it comes to farmer's benefit, we have successfully enabled crop loans to over three million farmers and have assisted in settling over 500,000 insurance cases. The issue that we face is the digitalisation of the land records, deploying teams for ground testing and culminating various documents for land parcels and then digitizing it. This in itself, was a huge task in the initial stages of SatSure, as we had to build our solutions based on this information.

**Q Can you share some insights about recent partnership with Rabo Partnerships?**

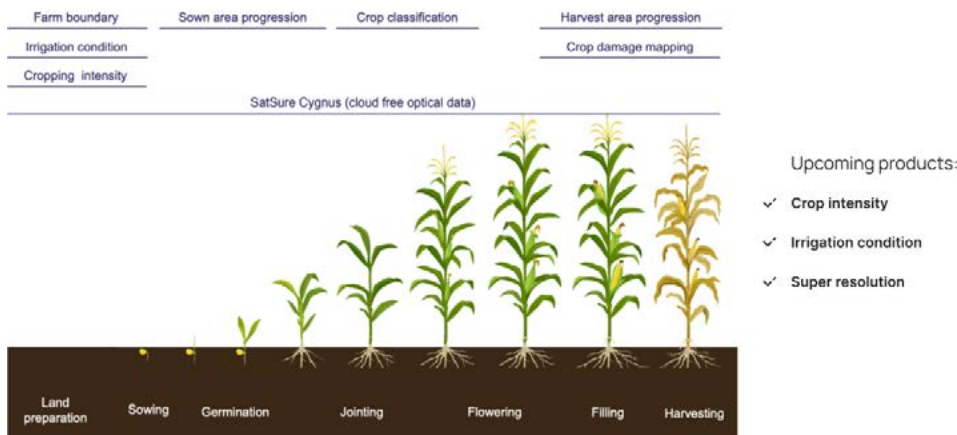
**A** The strategic collaboration between SatSure and Rabobank Partnerships aims to drive the access to cash-flow based lending for smallholder farmers globally. By leveraging SatSure's cutting-edge technology and Rabo Partnership's expertise in financial services, this partnership will tackle the challenges banks face and facilitate financial inclusion for unbanked farmers.

The alliance aligns with SatSure's Banking Solution, SatSure Sage,

# FOCUS ON START-UP

a suite of applications designed to empower lending institutions in making intelligent decisions in agricultural loan management. By harnessing the power of satellite data, location intelligence, and Machine Learning, SatSure Sage bridges information gaps and enables lending institutions to scale operations while reducing costs. Simultaneously, it enables farmer's access to credit through alternate data for banks to assess risk of lending, even in the absence of the necessary data points.

This global partnership will address several challenges faced by banks when developing lending products, including: Continuous monitoring of crop health, stress and associated parameters which impact crop performance and farmer's income potential Farmer credit access problems in developing countries Providing alternate data through SatSure's data products for banks to onboard new to credit and new to bank farmers Efficient risk monitoring and mitigation for post loan disbursement with insights from satellite imagery Efficient planning of loan collections driven by insights from satellite imagery.



**Q** What are the leading space applications in all segments that you think can shape up the Indian space industry in coming years?

**A** Leading space applications that are of interest to us today, beyond the current suite of solutions, goes across climate change solutions like parametric insurance and long term forecasting to tracking space debris and predicting potential collisions in orbit. 'The scope of going deep into our existing markets itself is so high that we may venture into new markets inorganically, rather than trying to build everything in-house.

I believe that urban planning and climate tech solutions have a high potential in India due to the focus of the government in these two sectors.

**Q** Where do you see the Space industry by 2030 & how do you visualise SatSure by 2030?

**A** By 2030 we expect to see the world go beyond the orbit in full force, and see some private participation in space exploration as well. As for India, the startups we see today in the space sector, will be matured and commercially delivering solutions to all the segments of downstream, midstream and upstream industries. What will lead the industry will be a

balance of both space applications (software) and space instruments (hardwares, Launch vehicle, satellites and sensors). As of SatSure, we are sure about our solution becoming the foundation for banking, agriculture, and the infrastructure industry based on which they will take their decision, for today, tomorrow and for the days to come.

**Q** Can you share your feelings on the recent success of Chandrayaan -3 & Adithya-L1 Mission?

**A** ISRO has made every Indian proud by successfully landing Chandrayaan-3 on the moon and making India only the 4th country to achieve this feat. I hope that the scientific data collected by our 3 lunar missions become useful for the global community to plan their missions, and such successes (including the solar mission of Aditya-L1) inspires more Indians to take up STEM education and contribute to nation building like ISRO has done always.

**Q** What is your suggestion to youngsters who wish to choose space as their careers?

**A** The message to youngsters who wish to pursue space is to be curious and observant of what's going on in the global space industry. Try understanding the problems and how they are impacting people. One can work in the space sector having come from any academic background that is one message which most people may not be aware about. It is not only the engineers, but entrepreneurs, economists, policy makers, and lawyers who together form the ecosystem.

I would recommend the youngsters to work hard, never take any success for granted, and network to know more people via various space forums and events.



## FIREFLY AEROSPACE AND MILLENNIUM SPACE SYSTEMS STAND READY FOR RESPONSIVE U.S. SPACE FORCE MISSION

Firefly Aerospace, Inc., an end-to-end space transportation company, and Millennium Space Systems, a Boeing Company small satellite constellation prime, have entered the hot standby phase for VICTUS NOX, a Tactically Responsive Space mission led by Space Systems Command's (SSC) Space Safari Program Office. The team stands ready for the 24-hour callup and orbit requirements to complete final operations and launch at the first available window.

"Challenging missions like this is where Firefly excels, and we are extremely humbled and proud to provide the U.S. Space Force and the nation with the critical capability to launch on-demand in support of national security," said Bill Weber, CEO of Firefly Aerospace. "Together with our mission partners, we'll be setting

a new standard, proving nominal launch operations can be completed in a matter of hours rather than weeks to months."

Millennium and Firefly have entered a six-month hot standby phase and will wait for activation at an intentionally unknown time. During this phase, the U.S. Space Force will give the mission team an

alert notification, kicking off a 60-hour window to transport the payload to Vandenberg Space Force Base, conduct fueling operations, and integrate it with Firefly's Alpha payload adaptor.

Space Force officials will then issue Firefly a launch notice with the final orbit requirements. The Firefly team will have 24 hours to update the trajectory and guidance software, encapsulate the payload, transport it to the pad, mate to Alpha, and stand ready to launch at the first available window. Once the payload is deployed in low Earth orbit, Millennium will attempt to fully initialize the space vehicle in less than 48 hours and then begin operations for its Space Domain Awareness (SDA) mission.

"What we're doing with VICTUS NOX has never been done before, and I attribute our success to the dedication and teamwork of our collective team – Millennium, Firefly, and SSC's Space Safari and Rocket Systems Launch Program (RSLP) offices," said Jason Kim, CEO of Millennium Space Systems. "You need to have the willingness to know that there will be changes – whether requirements or processes. That's where the teamwork and close partnerships really came into play. It's about what help is needed to address a challenge – on all sides – and everyone pitching in to support that."

In preparation for the mission, Firefly manufactured and acceptance tested each critical component, engine, and vehicle stage for its Alpha rocket in addition to conducting a static fire to verify all systems operate within flight parameters. Firefly and Millennium also completed multiple rehearsals in preparation for launch, which included packing and delivering a satellite mockup to Firefly's integration facility at Vandenberg Space Force Base to practice all launch operations within the prescribed 24 hours.



"The U.S.'s ability to rapidly respond to on-orbit needs is critical to our national defense, particularly in today's evolving space environment," said Lt. Col. MacKenzie Birchenough, Materiel Leader for Space Safari. "The accelerated build time the team demonstrated for VICTUS NOX, combined with the demanding launch and on-orbit goals, exemplifies our strong commitment to preserving our nation's dominance and ability to freely operate in the space domain."





Spacepreneur Editor Kartikeya  
In conversation with

**MR. SRINIVAS REDDY MALE**  
**MD - AZISTA AEROSPACE**



**Q** How best can you describe the journey from Component Manufacturer to Satellite Manufacturer?

**A** It is a significant leap for our organization to become a system player. To become a satellite manufacturer, we had to embrace a new mindset and a different approach to business - to be more research oriented and take system level risks. This change didn't happen overnight, it took us a few years to get here. We are now a vertically integrated satellite manufacturing company that not only builds the satellite systems but also designs and fabricates the

smaller components that go into the satellite. This makes us the only Indian company to be able to build 70% of the satellite hardware in-house, giving us great control over the delivery schedules and reliability of the satellites.

**Q** Can you brief us about the recently launched AFR Satellite & its purpose?

**A** AFR is an 80kg earth observation satellite designed to generate medium resolution, wide swath images. These images are particularly relevant for Maritime Domain Awareness (MDA) in the defense

sector. In the commercial sector, these images are useful for crop health monitoring among other applications. The satellite is currently in good health, and we have customer contracts to utilize the data. We will release the satellite images very soon.

**Q** How many satellites you are planning to launch in next 2 years? Who will be your primary customers?

**A** We intend to launch 5 satellites within the next 2 years. All these missions are focused on remote sensing applications. These missions would





carry one of these two payloads – 5m and 150km swath imaging payload or 0.5m resolution PAN and MX imaging payload. These satellites would serve dual use applications, so we anticipate serving customers from both commercial and strategic sectors.

**Q** What are the challenges & opportunities you see in the Indian Private Space industry?

**A** The growing and continuously changing Indian space sector poses both challenges and opportunities.

Challenges include evolving laws and regulations, a nascent ecosystem for procurement of satellites. Opportunities include the high potential domestic market in both civilian and strategic sectors. The key to success lies in a company's ability to navigate through this phase and demonstrate its capabilities.

**Q** Are you seeking any support from government for upcoming missions?

**A** Yes, we are seeking greater launch cadence of SSLV/ PSLV to enable us to launch our

satellites from Indian soil. If government could clearly specify its needs, we are keen to take up the challenge of developing solutions that meet the requirements.

**Q** What is your Vision for next 5 - 10 years?

**A** To be a leading global satellite manufacturer focused on remote sensing applications. We see ourselves building reliable satellites for end users and also contract manufacturing for constellation operators.

## NASA Begins Integrating ‘Nervous System’ for Roman Space Telescope



NASA’s Nancy Grace Roman Space Telescope team has begun integrating and testing the spacecraft’s electrical cabling, or harness, which enables different parts of the observatory to communicate with one another. Additionally, the harness provides power and helps the central computer monitor the observatory’s function via an array of sensors. This brings the mission a step closer to surveying billions of cosmic objects and untangling mysteries like dark energy following its launch by May 2027.

Weighing around 1,000 pounds, the harness is made up of approximately 32,000 wires and 900 connectors. If the wires were laid out end-to-end, they would span 45 miles. Directed upward, they would reach eight times higher than the peak of Mount Everest. Achieving this milestone was no small task. Over the course of about two years, a team of 11 Goddard technicians spent time at the workbench and perched on ladders, cutting wire to length, meticulously cleaning each component, and repeatedly connecting everything together.

The entire harness was built on an observatory mock-up structure before being transported to Goddard’s Space Environment Simulator – a massive thermal vacuum chamber used in this case for “bakeout.” When observatories like Roman are sent to space, the resulting vacuum and orbital temperatures can cause certain materials to release harmful vapors, which can then condense within electronics and create problems like short circuits or deposits on sensitive optics, degrading the telescope’s performance. Bakeout releases these gases on Earth so they aren’t emitted inside the spacecraft when in space. Now, engineers will weave the harness through the flight structure in Goddard’s big clean room. This ongoing process will continue until most of the spacecraft components are assembled.

In the meantime, the Goddard team will soon begin installing electronics boxes that will eventually provide power via the harness to all the spacecraft’s science instruments.

“

Just as the nervous system carries signals throughout the human body, Roman’s harness connects its components, providing both power and commands to each electronic box and instrument,” said Deneen Ferro, the Roman harness project development lead at NASA’s Goddard Space Flight Center in Greenbelt, Maryland. “Without a harness, there is no spacecraft.

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## BlackSky Signs New Block Buy for 5 Rocket Lab Launches



Rocket Lab USA, Inc a leading launch and space systems company, has announced it has signed another block buy deal for five Electron launches with BlackSky a leading provider of real-time geospatial intelligence and global monitoring services.

Rocket Lab has launched six Electron missions for BlackSky since 2019, becoming the primary launch provider for BlackSky’s constellation.

With these five new launches added to the manifest, BlackSky has contracted more Electron launches than any other single commercial customer. The launches are expected to begin in 2024 from Rocket Lab’s Launch Complex 1 in Mahia, New Zealand.

BlackSky’s next-generation Gen-3 satellites are designed to produce images with up to 35-centimeter resolution. Increased resolution and enhanced spectral diversity extend BlackSky’s ability to provide real-time insights to its customers in a broad set of conditions, including nighttime, low light and challenging weather.

The new BlackSky launches join a busy Electron manifest in 2024 featuring missions for commercial constellation operators Capella Space, Kinéis, Hawkeye 360, and Synspecive, as well as a variety of government missions.

“After four years of launching for BlackSky, we’re delighted to continue our partnership with more dedicated launches on Electron,” said Rocket Lab founder and CEO Peter Beck. “Building and maintaining a constellation requires precision deployment to unique orbits and a dependable launch schedule. We’re proud to deliver this dependable and tailored capability launch after launch, year after year.”



## RTX Space Sensor to Monitor Coastal Ecosystem Health

Raytheon, an RTX business, announced that its Geostationary Littoral Imaging and Monitoring Radiometer, or GLIMR, sensor has completed its Critical Design Review and is now in the build and test phase of the program.

NASA selected GLIMR to be the agency's first hyperspectral imager in geostationary orbit. GLIMR will collect and process information from across the electromagnetic spectrum, including visible light, infrared and ultraviolet frequencies, to create a highly detailed view of physical and biological conditions in coastal waters.

"GLIMR will help enable us to better study our planet's oceans," said David Broadbent, president of Space Systems at Raytheon. "With this new capability, we'll be able to better track coral bleaching, chlorophyll and plankton health, oil spills and Harmful Algal Blooms, otherwise known as red tide." The instrument will provide high-sensitivity, high-spatial and high-temporal resolution measurements of coastal and ocean ecosystems in the Gulf of Mexico, parts of the southeastern U.S. coastline and the Amazon River plume. Decision-makers will use GLIMR data to respond rapidly to natural and manmade coastal water disasters, such as harmful algae blooms and oil spills. It will also help improve the coastal ecosystem's sustainability and resource management.

Raytheon also recently completed their

final review for NOAA's Geostationary Extended Observations satellite system, or GeoXO, and is taking lessons learned from GLIMR to design the next generation operational weather satellite payload that will launch in 2032.

The University of New Hampshire is NASA's lead organization for the GLIMR contract, led by principal investigator Dr. Joseph Salisbury, with a team of scientists from partnering universities, NOAA and NASA. The instrument will launch in the 2026-2027 timeframe, and its data will be available soon after to scientists, researchers and educators around the world.

Work for both programs is being executed in El Segundo, California.

## Rocket Lab to Launch Climate Change Research Mission Focused on Arctic Ice Caps for NASA



Rocket Lab USA, Inc a global leader in launch services and space systems announced it has signed a double-launch deal with NASA to deliver the Agency's climate change research-focused mission, PREFIRE, to low Earth orbit in 2024.

The two dedicated missions on Electron will deploy one small satellite each to a 525km circular orbit from Rocket Lab Launch Complex 1 in New Zealand from May 2024. The PREFIRE mission has specific LTAN (Local Time of the Ascending Node) requirements and a need for the second satellite to be deployed to space shortly after

the first, which is made possible by Electron's unique ability to deploy dedicated small satellite missions on highly responsive timelines. The launches will be the 7th and 8th missions Rocket Lab has launched for NASA since 2018.

NASA's PREFIRE (Polar Radiant Energy in the Far-Infrared Experiment) mission will help close a gap in understanding of how much of Earth's heat is lost to space, especially from the Arctic and Antarctica. Analysis of PREFIRE's measurements will inform climate and ice models, providing better projections of how a warming world will affect sea ice loss, ice sheet melt, and sea level rise. Improving climate models can ultimately help to provide more accurate projections on the impacts of storm severity and frequency, as well as coastal erosion and flooding. PREFIRE consists of two, 6U CubeSats with a baseline mission length of 10 months.

Rocket Lab founder and CEO, Peter Beck, said: "Missions like these are core to the whole reason why Rocket Lab was founded in the first place - to open up access to space to improve life on Earth - and climate change is a hugely urgent cause for us all. It's a privilege to be able to support this important mission and an honor to be a continued trusted launch provider for small satellite missions with big impact."

The PREFIRE mission was awarded to Rocket Lab through NASA's Venture-class Acquisition of Dedicated and Rideshare (VADR) program, a \$300 million dollar five-year contracting vehicle for placing NASA's science and technology payloads on U.S. commercial launchers.

PREFIRE joins a long list of NASA missions awarded to Rocket Lab, including the CAPSTONE mission to the Moon on Rocket Lab's Electron launch vehicle and Lunar Photon satellite bus, the back-to-back launches in May 2023 of the TROPICS satellites for NASA's hurricane monitoring mission, and the NASA Starling mission launched last month on Rocket Lab's most recent Electron recovery launch.



# KBR JV AWARDED \$719M CONTRACT TO AID NASA'S DEVELOPMENT OF SPACE ORBITAL SYSTEMS

KBR is pleased to announce NASA's award to the Space & Technology Solutions team, a KBR joint venture with Intuitive Machines (Nasdaq: LUNR, LUNRW), to provide multidisciplinary engineering for some of NASA's most critical space orbital systems in its Applied Engineering and Technology Directorate at Goddard Space Flight Center (GSFC) in Maryland. The Government Accountability Office (GAO) has denied all protests of this award.

The Omnibus Multidiscipline Engineering Services (OMES) III contract has a five-year period of performance with a total value of \$719 million. The cost-plus-fixed-fee indefinite-delivery, indefinite-quantity

contract directly aids the primary support vehicle for the Joint Polar Satellite System program, the backbone of both short- and long-term weather forecasts, as well as NASA's Exploration and In-space Services projects division, which develops groundbreaking, more sustainable technologies to service spacecraft and pioneer in-space assembly and manufacturing.

As a part of OMES III, KBR will provide electrical engineering, instrument systems and technology services, exploration and mission support services, as well as mission engineering and systems analysis for the study, design, development, fabrication, integration, testing, verification and operations of spaceflight, airborne, and

ground system hardware and software.

"We are pleased with this new business award. The world's leading government agencies and commercial enterprises rely on KBR's innovative solutions to complex challenges both on and off the planet," said Byron Bright, President of KBR Government Solutions U.S. "As a partner with Intuitive Machines, we are proud to support NASA's development of space orbital systems with our unparalleled spaceflight engineering expertise."

KBR has been supporting GSFC for more than 35 years and has extensive experience in all phases of mission operations, ground systems engineering and spaceflight instrument development.

## Viasat Real-Time Earth Opens Ground Station in Japan

Viasat Inc. announced the opening of a Real-Time Earth (RTE) ground station in Hokkaido, Japan, now enabling RTE customers the ability to downlink Ka-band payload data in the northwestern Pacific at the site hosted by RTE partner Infostellar. This new ground site gives RTE customers unique access to a strategic location that reduces the time it takes to deliver mission critical data.

Viasat is establishing itself as a global leader in Ka-band support for low earth orbit (LEO) missions with its ability to downlink Ka-band payload data with a 7.3m full motion antenna at the Hokkaido site and is postured to support current and future government and commercial satellite programs. For Viasat, the Hokkaido ground station is a vital link in supporting high data rate remote sensing missions in polar and inclined orbits through the RTE network of Ka-band antenna systems.



"We've already proven our ability to rapidly integrate with a civilian space agency to receive Ka-band payloads over our fully automated commercial service and have multiple contracts with commercial satellite operators who understand the value proposition of Ka-band," said Steve Tanous, vice president, Real-Time Earth at Viasat. "Ka-band more than triples the capacity available to downlink earth observation data,

compared to traditional high data rate X-band, which translates into more effective and cost-efficient passes for satellite operators."

Tom Pirrone, CEO of Infostellar U.S., Inc added, "Infostellar is very pleased that our partnership with Viasat RTE also now includes an RTE 7.3M S/X/Ka-band antenna at our hosting site in Taiki City located in the Hokkaido Prefecture. This new capability is already producing fruit for both Viasat and Infostellar clients. We look forward to the continued expansion of our partnership services as our companies continue to expand our reach in Japan and around the globe."

The Viasat RTE Ka-band footprint now includes sites in Sweden, Ghana, South Africa, and Australia. RTE plans to expand the Ka-band capability with sites in Alaska and Argentina later this year. RTE offers global S/X-band services at all sites.



# VIRGIN GALACTIC COMPLETES FIRST PRIVATE ASTRONAUT SPACEFLIGHT 'GALACTIC 02'

Virgin Galactic Holdings, Inc. announced the completion of its first private astronaut flight, 'Galactic 02.' The mission achieved multiple historic milestones, showcasing how Virgin Galactic spaceflights are broadening access to space for a diverse, global community of astronauts.

Flying private astronauts Jon Goodwin from the United Kingdom, and Keisha Schahaff and Anastatia Mayers from Antigua and Barbuda, 'Galactic 02' achieved the following:

- First female astronauts from the Caribbean
- First mother-daughter duo to go to space
- Most women flown in a single space mission
- Youngest person to go to space
- First Olympian to go to space
- First majority female spaceflight
- The sixth and seventh Black women to go to space

- Second person with Parkinson's to go to space
- Third oldest person to go to space
- 'Galactic 02' in-flight facts are as follows:
  - Take-off Time: 08:30 am MDT
  - Altitude at Release: 44,300 ft
  - Apogee: 55 Miles
  - Top Speed: Mach 3

**Landing Time:** MICHAEL COLGLAZIER, CEO of Virgin Galactic said: "Today Virgin Galactic took another historic leap forward by flying our first private astronaut mission and demonstrating how our spaceflights will broaden access to space. Jon, Keisha and Ana each embody our fundamental belief that space is for everyone, and we are proud that today's flight has inspired people and communities around the world. This is just the beginning, as we plan to continue flying monthly spaceflights while also developing our Delta Class production space-

ships to scale our business."

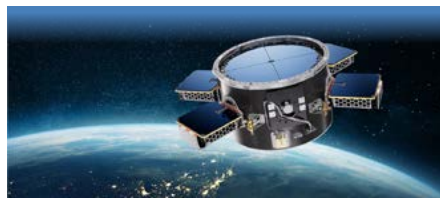
CJ STURCKOW, VSS Unity Commander said: "It is a surreal and humbling experience to have flown Unity today. The wonder and excitement of spaceflight never loses its magic. I had the honor of being joined in the cockpit by Kelly Latimer, one of the first female commercial spaceship pilots. I'm proud of the work we're doing here at Virgin Galactic to fly more people to space."

KELLY LATIMER, VSS Unity Pilot said: "In my entire career, from the Air Force Academy to being a test pilot for NASA, nothing tops what I have just experienced at the controls of VSS Unity. Going to space today fulfilled an ambition I've had since I was a child. It is a privilege to be part of a majority-women crew making history as the most female astronauts flying to space in a single mission."

## Firefly Aerospace Debuts Elytra Orbital Vehicles with Enhanced On-Orbit Mobility and Services

Firefly Aerospace, Inc., an end-to-end space transportation company, announced the expansion of its on-orbit services with a line of highly mobile and scalable orbital vehicles named Elytra. As the wings of a firefly, Elytra (pronounced ella-truh) offers on-orbit mobility, hosting, delivery, and servicing across cislunar space and beyond. When launched on Firefly's small- and medium-lift launch vehicles, Elytra can service the entire lifecycle of government and commercial missions.

"Elytra further expands Firefly's on-orbit services by opening access to more orbits, extending the life of each mission, and providing deorbiting services to help minimize space debris," said Bill Weber, CEO of Firefly Aerospace. "Our robust vehicle line gives us a unique advantage to quickly launch, deploy, and service sat-



ellites on-orbit in response to dynamic changes in space."

Formerly known as Firefly's Space Utility Vehicle, Elytra offers three vehicle models – Elytra Dawn, Elytra Dusk, and Elytra Dark – that travel further into space to support larger, more advanced on-orbit missions. Optimized for low Earth orbit (LEO), Elytra Dawn can be rapidly launched to support responsive hosting, ride-share, and delivery missions. Elytra Dusk offers enhanced maneuverability, power, and autonomy to provide responsive on-orbit tasking, such

as relocation, space domain awareness, and deorbiting services, from LEO to geosynchronous orbit (GEO). Elytra Dark is ruggedized to serve as persistent orbital infrastructure and support transfers from LEO to lunar orbit and beyond.

Designed, manufactured, and tested in-house, Elytra utilizes flight-proven hardware flown on Firefly's Alpha vehicle and qualified systems common to Firefly's Blue Ghost lunar lander, including the carbon composite structures, core avionics, and propulsion systems. Elytra also utilizes the on-orbit heritage and learnings from Spaceflight's Sherpa vehicle following Firefly's recent acquisition of the company. Firefly's first Elytra mission is scheduled to launch in 2024 aboard Firefly's Alpha vehicle.



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The ELT is the largest of the next generation of ground-based optical and near-infrared telescopes and the one that is most advanced in its construction. Reaching 50% completion is no small feat, given the challenges inherent to large, complex projects, and it was only possible thanks to the commitment of everyone at ESO, the continued support of the ESO Member States and the engagement of our partners in industry and instrument consortia. I am extremely proud that the ELT has reached this milestone.

**ESO Director General Xavier Barcons says:**

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of finalising the design of the vast majority of components to be manufactured for the ELT. In addition, some of the elements, such as mirror segments and its supporting components and sensors, required detailed prototyping and significant testing before being produced en masse. Furthermore, construction was affected by the COVID-19 pandemic, with the site closing for several months and production of many of the telescope components suffering delays. With production processes now fully resumed and streamlined, finalising the remaining half of the ELT is anticipated to take only five years. Nonetheless building such a large and complex telescope like the ELT is not free of risks until it's finished and working.

Planned to start scientific observations in 2028, ESO's ELT will tackle astronomical questions such as: Are we alone in the Universe? Are the laws of physics Universal? How did the first stars and galaxies form? It will dramatically change what we know about our Universe and will make us rethink our place in the cosmos.

## ESO's Extremely Large Telescope is Now Half Completed

The European Southern Observatory's Extremely Large Telescope (ESO's ELT) is a revolutionary ground-based telescope that will have a 39-metre main mirror and will be the largest telescope in the world for visible and infrared light: the world's biggest eye on the sky. Construction of this technically complex project is advancing at a good pace, with the ELT now surpassing the 50% complete milestone.

The telescope is located atop Cerro Armazones in Chile's Atacama Desert, where engineers and construction workers are currently assembling the structure of the telescope dome at a staggering pace. Visibly changing each day, the steel structure will soon acquire the familiar round shape typical of telescope domes.

The telescope mirrors and other components are being built by companies in Europe, where work is also progressing well. ESO's ELT will have a pioneering five-mirror optical design, which includes a giant main mirror (M1) made up of 798 hexagonal segments. More than 70% of the blanks and supports for these segments have now been manufactured, while M2 and M3 are cast and in the process of being polished. Progress on M4, an adaptive, flexible mirror that will adjust its shape a thousand times a second to correct for distortions caused by air turbulence, is particularly impressive: all six of its thin petals are fully finalised and

being integrated into their structural unit. Further, all six laser sources, another key component of the ELT's adaptive optics system, have been produced and delivered to ESO for testing.

All other systems needed to complete the ELT, including the control system and the equipment needed to assemble and commission the telescope, are also progressing well in their development or production. Moreover, all four of the first scientific instruments the ELT will be equipped with are in their final design phase with some about to start manufacturing. In addition, most of the support infrastructure for the ELT is now in place at or near Cerro Armazones. For example, the technical building that, among other things, will be used for storage and coating of different ELT mirrors is fully erected and fitted out, while a photovoltaic plant that supplies renewable energy to the ELT site started operating last year.

Construction of ESO's ELT was kick-started nine years ago with a groundbreaking ceremony. The top of Cerro Armazones was flattened in 2014 to allow for space for the giant telescope.

Completing the remaining 50% of the project, however, is anticipated to be significantly quicker than building the first half of the ELT. The first half of the project included the lengthy and meticulous process

# AXIOM SPACE AWARDED CONTRACT TO PURSUE SPACESUIT DEVELOPMENT FOR ISS



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We are excited to add our orbital spacesuits as an option for NASA,” said Mark Greeley, Axiom Space EVA Program Manager. “The team is truly humbled to be a provider of spacesuits for the NASA Artemis missions and now a developer of spacesuits for future ISS missions. Aligning our spacesuit architecture for commercial LEO, lunar, and ISS is proving to be of great benefit in terms of streamlining designs and continuing to deliver the best value to NASA, while serving our future commercial astronauts on Axiom Station by the end of the decade.

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Axiom Space announced that NASA has awarded the Houston-based company an International Space Station (ISS) Extravehicular Activity (EVA) spacesuit task order, with an initial commitment of \$5 million and a potential value of \$142 million over four years, to modify its Artemis III lunar spacesuit design for advancing NASA’s ISS spacewalking capabilities.

This is the second spacesuit task order to be awarded to Axiom Space by NASA, the first being the \$228 million task order in 2022 to develop the lunar spacesuit for the Artemis III mission back to the Moon. The new NASA task order further enables Axiom Space to take advantage of its plans to use a single, foundational architecture to complete the designs of the two spacesuits in parallel, one for the ISS and one for the lunar surface.

The Axiom Space low-Earth orbit (LEO) spacesuit effort is already underway for use on the world’s first commer-

cial space station, Axiom Station, being designed to serve the next generation of private space explorers from around the world.

Similar to the Artemis III spacesuit, the Axiom Space ISS suit will be built to accommodate a wide range of crew members and provide increased flexibility and specialized tools. The design includes life support systems, pressure garments, and power avionics and communication. The Axiom Space team will offer design, certification and hardware to support EVA

systems training and real-time operations support to NASA, among other services.

Both spacesuit task orders awarded to Axiom Space fall under NASA’s Extravehicular Activity Services (xEVAS) contract, which enables Axiom Space to compete for contracts that will provide a full suite of capabilities for NASA’s spacewalking needs during the period of performance through 2034. The milestone-based xEVAS contract has a combined maximum potential value of \$3.5 billion for all task order awards.

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“Imagining astronauts performing EVAs outside the ISS wearing Axiom Space spacesuits, borne from the original NASA design, would honor everyone who ever worked on the NASA suits of the past and those who are working on the NASA spacesuits of the future,” said Russell Ralston, Axiom Space EVA Deputy Program Manager.

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## ESA SUPPORTS ISRO'S CHANDRAYAAN MOON MISSION

# INDIA'S CHANDRAYAAN-3 SUCCESSFULLY LANDS ON THE MOON

The Indian Space Research Organisation (ISRO) has successfully landed its Chandrayaan-3 Lander Module on the surface of the Moon.

### What happened?

Chandrayaan-3 launched from the Satish Dhawan Space Centre in Sriharikota Range (SDSC SHAR), India, on 14 July 2023 on a mission to demonstrate new technologies and to achieve India's first soft landing on another celestial body.

The spacecraft arrived in lunar orbit on 5 August. On 17 August, the lander module separated from the propulsion module and soon after began its descent to the surface. On 23 August, after a nail-biting wait, ISRO confirmed that Chandrayaan-3's lander had successfully touched down in the Moon's southern polar region as planned.

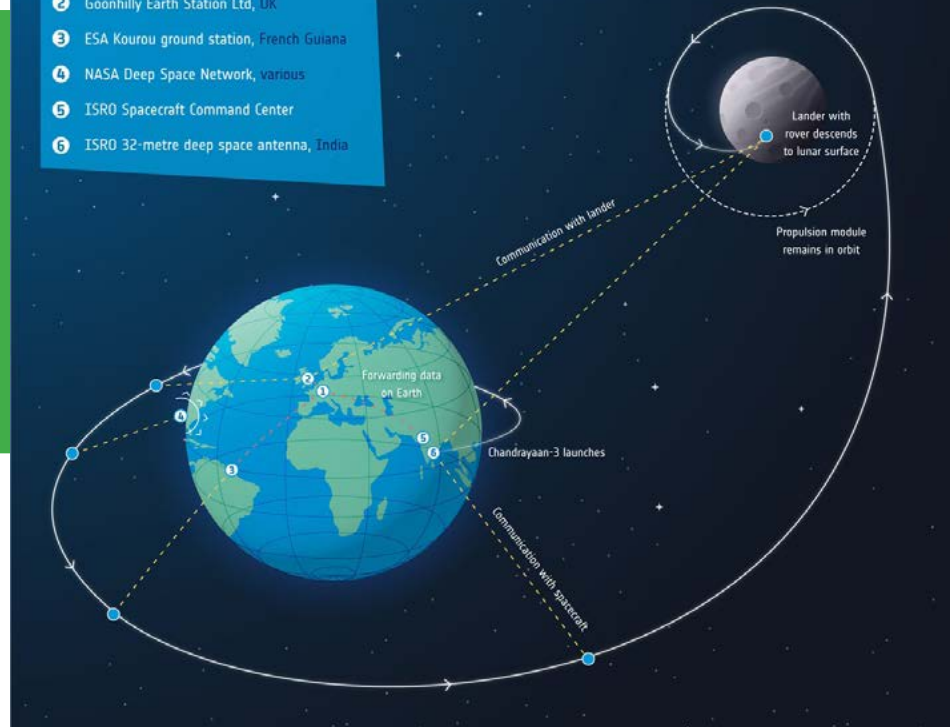
"Congratulations ISRO on this historic landing. ESA is proud to support the Chandrayaan-3 mission. Our ground stations are a core element of ESA's support to its international partners, and I am pleased that with this activity, we are further strengthening ESA's relationship with ISRO and with India. I look forward to supporting further pioneering ISRO missions, such as Aditya-L1, in the future," says Rolf Densing, Director of Operations at ESA's ESOC mission operations centre in Darmstadt, Germany.

### How was ESA involved?

ESA is providing deep space communication support to the Chandrayaan-3 mission.

Communication is an essential part of every space mission. Ground stations on Earth keep operators connected to space-

- 1 ESA's ESOC mission control centre, Germany
- 2 Goonhilly Earth Station Ltd, UK
- 3 ESA Kourou ground station, French Guiana
- 4 NASA Deep Space Network, various
- 5 ISRO Spacecraft Command Center
- 6 ISRO 32-metre deep space antenna, India



craft as they venture into the unknown. Without ground station support, it's impossible to get any data from a spacecraft, to know how it's doing, to know if it is safe or even to know where it is.

For the Chandrayaan-3 mission, ESA is coordinating routine support from its Kourou station in French Guiana and from Goonhilly Earth Station Ltd in the UK. These stations compliment support from NASA's Deep Space Network and ISRO's own stations.

ESA's 35-metre antenna in New Norcia, Australia, provided additional tracking support during the lunar landing, serving as a back-up for ISRO's own ground station.

New Norcia received the stream of vital signs from the Chandrayaan-3 lander – information about its health, location and trajectory – in parallel with the ISRO station. This type of back-up support is common during key moments of a space mission such as a landing. It was this stream of telemetry that was ultimately used to confirm the success of the landing.

### ESA's deep space support to international partners

Many national space agencies operate deep space tracking stations that enable them to

locate, track, command and receive telemetry and scientific data from their distant spacecraft.

But sometimes, particularly for deep space missions, operators need to track and command a spacecraft when it is outside the field of view of their own antennas, or to have a second 'pair of eyes' on their spacecraft during crucial moments.

Thanks to its global 'Estrack' network of ground stations, ESA can help its partners track, command and receive data from spacecraft almost anywhere in the Solar System via its ESOC mission operations centre in Darmstadt, Germany. The Estrack network consists of ESA's own ground stations, located across the globe, and ESA-coordinated support from third-party stations such as Goonhilly Earth Station Ltd.

### What happens next?

The lander will soon deploy its rover. During its mission on the surface, which will last for one lunar day (14 days on Earth), the rover will carry out a number of scientific experiments.

ESA stations will continue to relay telemetry and scientific data gathered by the mission's rover and lander module until the end of the surface operations.





## IAI' DS-SAR Satellite has Been Successfully Launched - and Entered Earth Orbit in Space

The DS-SAR radar satellite, developed and produced by IAI, was successfully launched into space on a PSLV-C56 (Polar Satellite Launch Vehicle) rocket, this morning at 04:00 from the launch site SDSC SHAR Sriharikota, India.

In line with the original launch program, the satellite entered its orbit around the Earth, began transmitting data, and underwent a series of preliminary performance tests, conducted by IAI's engineers, who validated the correct functioning and performance level of the systems. While in orbit, the satellite will begin a preplanned series of tests, and following their completion, will be formally handed over to its Singaporean customers DSTA and ST Electronics.

The DS-SAR satellite was developed based on the experience accumulated by IAI in developing a series of advanced observation satellites: OptSat and TecSAR, which are launched into space, in new generations, since 1988. The SAR sensor payload enables the collection of a wide range of data, in terms of both coverage and resolution, day and night, and under all weather conditions.

Israel Aerospace Industries, Israel's largest defense technology company, is a national knowledge hub and world leader, in developing and producing advanced systems for use in space, aviation, marine, land and cyber applications, for both the military and civilian market. The company is a world leader in the fields of missiles, radars, satellites, unmanned platforms, civil aviation and cyber. IAI's Systems Missiles and Space Group is tasked with the development and building of air-defense systems, including Arrow-2 and Arrow-3, Barak 8, loitering munitions, and numerous missile systems, advanced satellite systems such as observation satellites, nanosatellites, satellite launchers, communications satellites, the national 'Dror' communications satellite, and more. The Group also developed the Beresheet Lunar lander whose pathbreaking mission took it to the moon.

# Rocket Lab Launches 40th Electron Mission, Successfully Flies Reused Engine

Rocket Lab USA, Inc. a leading launch and space Systems Company successfully launched a dedicated Electron mission for Capella Space (Capella). The mission demonstrated several significant milestones for Rocket Lab's reusability program, including an ocean splash-down of the Electron rocket's first stage and the successful flight of a previously flown Rutherford engine. The mission was also Rocket Lab's 40th Electron launch since the Company began launches in 2017, further cementing Electron's position as the leading commercial small launch vehicle globally.

The 'We Love The Nightlife' mission lifted-off on August 24th at 11:45 am NZST from Rocket Lab Launch Complex 1 on New Zealand's Mahia Peninsula, deploying Capella's next-generation Acadia satellite for its synthetic aperture radar (SAR) constellation to a 640km circular low Earth orbit.

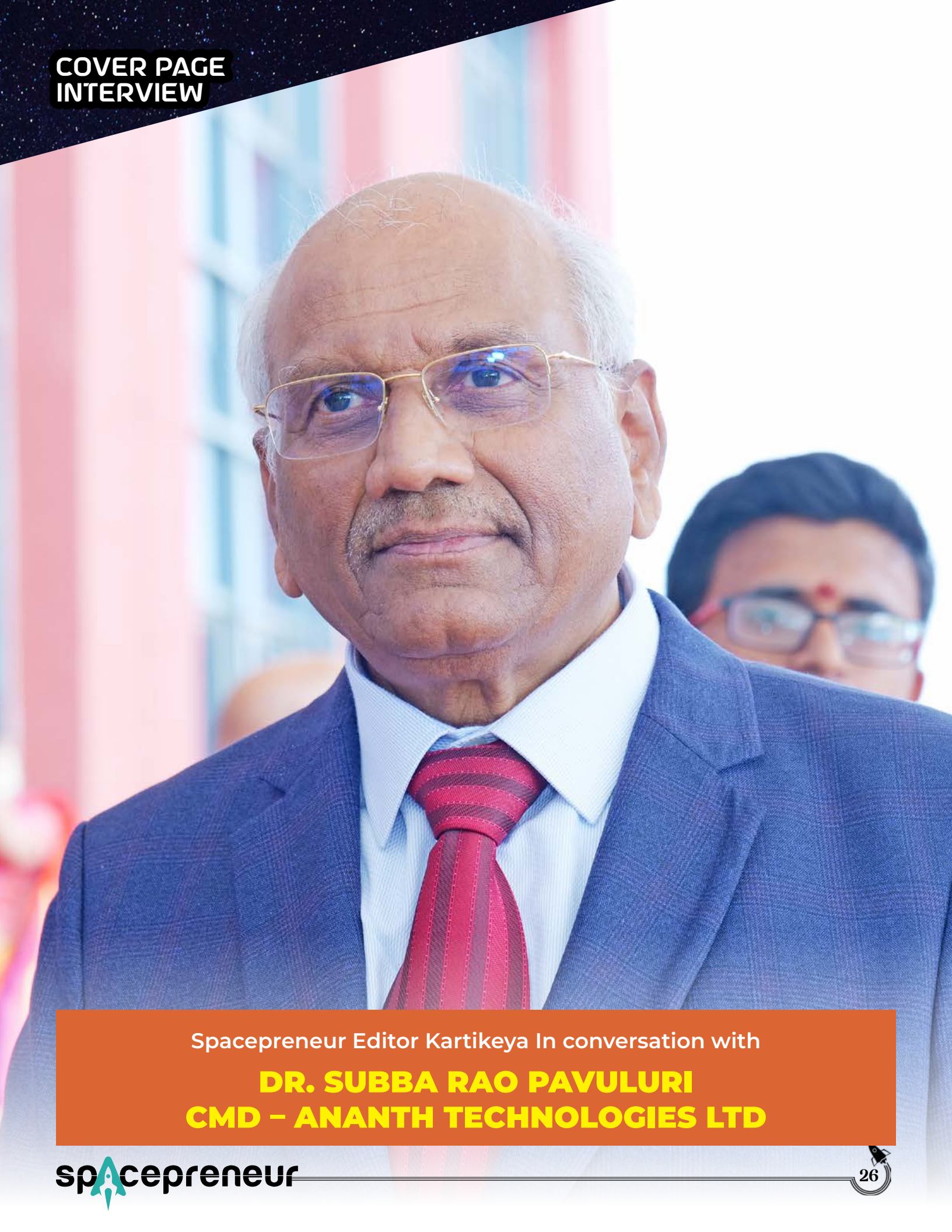
As a recovery mission, Electron's first stage returned to Earth under a parachute after launch and splashed down in the Pacific Ocean several hundred kilometers down range from Launch Complex 1. Rocket Lab's marine recovery vessel will soon extract the stage from the ocean and transport it back to Rocket Lab's production complex for analysis and testing to inform future recovery efforts. In addition to recovering the booster, Rocket Lab launched a pre-flown 3D printed Rutherford engine for the first time. The engine previously flew on the first stage of the 'There and Back Again' mission, launched in May 2022. The engine performed on par with new Rutherford engines, completing a successful first stage burn.



The mission follows on from Rocket Lab's two previous launches for Capella, including the "Stronger Together" mission launched in March 2023 from Rocket Lab Launch Complex 2 in Virginia, and the "I Can't Believe It's Not Optical" mission in August 2020 from Launch Complex 1 in New Zealand, which deployed the first satellite in Capella's SAR constellation. 'We Love the Nightlife' was the first of four new dedicated launches on Electron for Capella, announced in February 2023, to deploy Capella's next-generation Acadia satellites.

Capella's existing satellite constellation delivers the highest quality and resolution SAR imagery commercially available, with the ability to penetrate all weather conditions and capture clear imagery 24-7, day and night, delivered through a fully-automated ordering and delivery platform. The next-generation Acadia satellites include several enhancements, including increased bandwidth and power and faster downlink speeds. When combined with Capella's existing long-dwell imaging capability and extended duty-cycle – which results in more images collected per orbit than other SAR systems – Acadia will continue to set the benchmark within the SAR industry.

Rocket Lab founder and CEO, Peter Beck, says: "We've been a trusted launch partner to Capella since 2020 and we're delighted to deliver mission success once again. Electron has played a crucial role in helping constellation operators like Capella deploy their spacecraft on time and on target, and we look forward to continuing building out Capella's constellation with more dedicated launches this year. "Congratulations also to our team on delivering 40 Electron launches, completing another booster recovery, and proving Rutherford engines can be flown multiple times. One mission is an enormous achievement in this industry, but 40 is a rare achievement and testament to the relentless drive, innovation and dedication of the Rocket Lab team.



Spacepreneur Editor Kartikeya In conversation with

**DR. SUBBA RAO PAVULURI**  
**CMD – ANANTH TECHNOLOGIES LTD**

**Q** How old is ATL's association with ISRO?

**A** ATL is associated with Indian Space programs since 1993. Before that Dr. Subba Rao Pavuluri was working in ISRO.

**Q** What are some of the notable projects that you have successfully executed for the national space agency over the years?

**A** ATL is a long time committed partner for Indian space programs and contributed to 97 satellites and 77 launch vehicles so far. Below are few major programs ATL is a proud partner for ISRO:

- Aditya-L1 program
- Chandrayaan missions – 1, 2 & 3
- Mars Orbiter Mission
- Crew module checkout systems, food heater & food containers for Gaganyaan program
- The only company contributed to W2M & HYLAS satellites supplied to EADS (now Airbus) through ISRO
- Sub-assembly integration of PSLV-C51, C52, C53, C54, C55, C56, C57



**Q** Why is private sector participation critical to India's success in the sector even as the global space race intensifies?

**A** Private sector investment can supplement government funding, allowing for the execution of more ambitious projects and a higher frequency of launches.

- Private companies often have greater flexibility to innovate and experiment with new technologies.
- Private participation gives advantages like – cost optimization, faster collaboration with global space agencies, competitiveness, diverse services, job creation and economic growth, etc.





**Q** As the Country's space programme is all set to move to the next level, are you currently working on any other solutions for ISRO or in spacetechnology for future projects?

**A** ATL is working with its foreign partners offering TWTA systems under MAKE IN INDIA guidelines. ATL is also working with global partners to manufacture satellites for global usage.

■ Building constellation of 190 satellites in LEO for mapping

**Q** Anything else that you may wish to add from your side?

**A** Ancient India indeed possessed a rich and

profound understanding of various aspects related to space, astronomy and mathematics. Positional astronomy, calendar system, predicting eclipses, etc. are few examples. The space industry holds endless possibilities, from exploring distant planets to advancing technology for Earth's benefit. ATL created world class Satellite manufacturing facilities.

**Q** Has ATL engaged in other areas of Space activities?

**A** Yes – Space programme has three distinctive areas – namely, Launch Vehicle, Satellite and satellite applications. ATL is actively working in all three areas through its centers located in Hyderabad, Bangalore and Thiruvananthapuram

**Q** What are the areas / segments Ananth works for ?

**A** Space programme caters to Launch vehicle , Satellites and satellite applications .

**Q** What are subsystems Ananth makes for Launch Vehicle and Satellite programmes ?

**A** Navigation Systems, Command and Control Systems , Power systems , sensors , Telemetry Systems ; Assembly, integration and Testing ( AIT) PSLV - and many other systems for Satellites and Launch Vehicles .

**Q** What are the areas of work for Satellite applications Ananth is involved?

**A** Satellites data are used in many areas of development such as Water Resources management , Soil resources management, Agricultural sector , disaster management , identification of minerals , Urban development , Intelligence , Surveillance , reconnaissance ( ISR) for defence sector etc . Infact satellite data is part of every aspect of development. Use cases are immense . We work in this area too and contributed immensely for ' Space Economy' of Bharat.



# NASA'S SPACEX CREW-7 LAUNCHES TO INTERNATIONAL SPACE STATION



An international crew of four representing four countries is in orbit following a successful launch to the International Space Station at 3:27 a.m. EDT Saturday, Aug. 26, from Launch Complex 39A at NASA's Kennedy Space Center in Florida. The agency's SpaceX Crew-7 mission is the seventh commercial crew rotation mission for NASA.

A SpaceX Falcon 9 rocket launched the Dragon spacecraft into orbit carrying NASA astronaut Jasmin Moghbeli, ESA (European Space Agency) astronaut Andreas Mogensen, JAXA (Japan Aerospace Exploration Agency) astronaut Satoshi Furukawa, and Roscosmos cosmonaut Konstantin Borisov, for a science expedition aboard the orbital laboratory.

"Crew-7 is a shining example of the power of both American ingenuity and what we can accomplish when we work together," said NASA Administrator Bill Nelson. "Aboard station, the crew will conduct more than 200 science experiments and technology demonstrations to prepare for missions to the Moon, Mars, and beyond, all while benefitting humanity on Earth. By partnering with countries around the world, NASA is engaging the best scientific minds to enable our bold missions, and it's clear that we can do more – and we can learn more – when we work together."

During Dragon's flight, SpaceX will monitor a series of automatic spacecraft maneuvers from its mission control center in Hawthorne, California, and NASA teams will monitor space station operations throughout the flight from the Mission Control Center at the agency's Johnson Space Center in Houston.

Named Endurance, the Dragon spacecraft will dock autonomously to the space-facing port of the station's Harmony module at 8:39 a.m. Sunday, Aug. 27. NASA Television, the NASA app, and the agency's website will provide live coverage of docking and hatch opening. NASA also will cover the welcome remarks by crew aboard the orbital outpost at 11:30 a.m.

Crew-7 will join the space station's Expedition 69 crew of NASA astronauts Stephen Bowen, Woody Hoburg, and Frank Rubio, as well as UAE (United Arab Emirates) astronaut Sultan Alneyadi, and Roscosmos cosmonauts Sergey Prokopyev, Dmitri Petelin, and Andrey Fedyayev. For a short time, the number of crew aboard the space station will increase to 11 until Crew-6 members Bowen, Hoburg, Alneyadi, and Fedyayev return to Earth a few days later.

Crew-7 will conduct new scientific research to benefit humanity on Earth and prepare for human exploration beyond low Earth orbit. Experiments include the collection of microbial samples from the exterior of the space station, the first study of human response to different spaceflight durations, and an investigation of the physiological aspects of astronauts' sleep. These are just some of the science experiments and technology demonstrations that will take place during their mission.

"The International Space Station is an incredible science and technology platform that requires people from all around the world to maintain and maximize its benefits to people on Earth," said Ken Bowersox, associate administrator, Space Operations Mission Directorate at NASA Headquarters in Washington. "It's great seeing Crew-7 launch with four crew members representing four countries who will live and work on humanity's home in space as we continue the nearly 23 years of a continuous human presence aboard the microgravity laboratory."

The Crew-7 mission enables NASA to maximize use of the space station, where astronauts testing technologies, performing science, and developing the skills needed to operate future commercial destinations in low Earth orbit and explore farther from Earth. Research conducted aboard the space station provides benefits for people on Earth and paves

the way for future long-duration trips to the Moon through NASA's Artemis missions.

**Meet Crew-7:** This is Moghbeli's first trip into space since her selection as a NASA astronaut in 2017. The New York native earned a bachelor's degree in aerospace engineering with information technology at the Massachusetts Institute of Technology in Cambridge, and a Master of Science in aerospace engineering from the Naval Postgraduate School in Monterey, California. Moghbeli, a helicopter and Marine Corps test pilot, has more than 150 combat missions and 2,000 hours of flight time in over 25 different aircraft. She also is a graduate of the U.S. Naval Test Pilot School in Patuxent River, Maryland. As mission commander, she is responsible for all phases of flight, from launch to re-entry. She will serve as an Expedition 69/70 flight engineer aboard the station. Follow @astrojaws on X.

Mogensen was selected as an ESA astronaut in 2009 and became the first Danish citizen in space after launching aboard a Soyuz for a 10-day mission to the space station in 2015. Mogensen is from Copenhagen, Denmark. He completed undergraduate studies and received a master's degree in aeronautical engineering from Imperial College London in England before gaining his doctorate in aerospace engineering from the University of Texas at Austin. Mogensen has since served as a crew member for NASA Extreme Environment Mission Operations undersea missions 17 and 19. Mogensen was the European astronaut liaison officer at NASA Johnson from 2016 to 2022, working as a capsule communicator for astronauts aboard the station and as ground support for spacewalks. As the pilot on Crew-7, he is responsible for spacecraft systems and performance aboard the station, he will serve as an Expedition 69 flight engineer and Expedition 70 commander. Follow @astro\_andreas on X.

Furukawa is making his second trip to space, having spent 165 days aboard the space station as part of Expeditions 28 and 29 in 2011. Furukawa is from Kanagawa, Japan, and was selected as a JAXA astronaut in 1999. He is a physician and received his medical degree from the University of Tokyo, and later a doctorate in medical science from the same university. Furukawa served as a crew member on the 13th NEEMO mission, and later, was appointed head of JAXA's Space Biomedical Research Group. Aboard the station, he will become a flight engineer for Expedition 69/70. Follow @astro\_satoshi on X.

Borisov is making his first trip to space and will serve as a mission specialist, working to monitor the spacecraft during the dynamic launch and entry phases of flight. He entered the Roscosmos Cosmonaut Corps as a test cosmonaut candidate in 2018 and will serve as a flight engineer for Expedition 69/70.



## Peraton Supporting \$513.5M Deep Space Network (DSN) Program

Peraton was awarded a competitive subcontract to NASA's Jet Propulsion Laboratory with a total contract value of the \$513.5 million. The company has a history with DSN dating back to 2004 – including helping the James Webb Space Telescope communicate across the cosmos, linking mankind and the moon, and supporting the Perseverance rover on Mars.

The work involves the highly technical sustainment of four antenna stations – each equipped with large parabolic dish antennas and ultra-sensitive receiving systems – capable of detecting incredibly faint radio signals from distant spacecraft. The project scope also entails base support functions, including operator to depot level maintenance of the antennas and infrastructure along with providing armed security for the complex.

"We look forward to continuing our strong relationship with JPL to further enable assured communications for our Nation's space exploration missions," said Roger Mason, Ph.D., president, Space & Intelligence sector. "The Deep Space Network is the critical link that connects NASA's lunar and planetary spacecraft with mission control here on Earth."

When NASA presented the first images gathered by the James Webb Space Telescope (JWST) on July 12, it marked a significant step in realizing the 20-year mission's ambitious dream to explore the first galaxies that formed in the universe and to watch as stars began forming planetary systems. Image Credits: NASA, ESA, CSA, and STScI

Peraton is a national security company that drives missions of consequence spanning the globe and extending to the farthest reaches of the galaxy. As the world's leading mission capability integrator and transformative enterprise IT provider, we deliver trusted, highly differentiated solutions and technologies that protect our nation and allies from threats across the digital and physical domains. Peraton supports every branch of the US Armed Forces, and we serve as a valued partner to essential government agencies who sustain our way of life. Every day, our employees do the can't be done by solving the most daunting challenges facing our customers. Visit [peraton.com](http://peraton.com) to learn how we're safeguarding your peace of mind.



## Voyager Space and Airbus Announce JV to Build and Operate Starlab

Voyager Space (Voyager), a global leader in space exploration, and Airbus Defence and Space (Airbus), the largest aeronautics and Space Company in Europe, announced an agreement paving the way for a transatlantic joint venture to develop, build, and operate Starlab, a commercial space station planned to succeed the International Space Station. The US-led joint venture will bring together world-class leaders in the space domain, while further uniting American and European interests in space exploration.

Voyager was awarded a \$160 million Space Act Agreement (SAA) from the National Aeronautics and Space Administration (NASA) in December 2021 via Nanoracks, part of Voyager's exploration segment. Part of NASA's Commercial Low Earth Orbit Development Program, this SAA sets the foundation to create Starlab, a continuously crewed, free-flying space station to serve NASA and a global customer base of space agencies and researchers. The program's mission is to maintain continued human presence and American leadership in low-Earth orbit (LEO). Today's announcement builds on an agreement made public in January 2023, where Voyager selected Airbus to provide technical design support and expertise for Starlab.

"With a track record of innovation and technological firsts, Airbus prides itself on partnering with companies that are looking to change history," said Jean-Marc Nasr, Head of Space Systems at Airbus. "This transatlantic venture with footprints on both sides of the ocean aligns the interests of both ourselves and Voyager and our respective space agencies. This pioneers continued European and American leadership in space that takes humanity forward. Together our teams are focused on creating an unmatched space destination both technologically and as a business operation."

In addition to the US entity, Starlab will have a European joint venture subsidiary to directly serve the European Space Agency (ESA) and its member state space agencies.

This announcement follows a major design milestone in Starlab's development, the Systems Requirements Review (SRR), which baselines the major space systems, technical readiness, and ability to meet NASA's mission and safety requirements. The Starlab SRR, was completed in June 2023 in coordination with NASA's Commercial LEO Development Program team. "Today marks a major step forward for the future of commercial space destinations," continues Kuta. "We are proud to have NASA's trust to build the replacement for the ISS, a partnership that expands Starlab's ecosystem to global space agencies, and a team that is mission driven and dedicated to reimagining the future." The implementation of the joint venture will be subject to applicable regulatory approvals.

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We are proud to charter the future of space stations with Airbus," says Matthew Kuta, President at Voyager Space. "The International Space Station is widely regarded as the most successful platform for global cooperation in space history, and we are committed to building on this legacy as we move forward with Starlab. We are establishing this joint venture to reliably meet the known demand from global space agencies while opening new opportunities for commercial users.

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## Rocket Lab Inks New Deal to Launch HASTE Mission from Virginia

Rocket Lab USA, Inc. a global leader in launch services and space systems announced it has signed a new launch services agreement with a confidential customer for a HASTE (Hypersonic Accelerator Suborbital Test Electron) mission from Launch Complex 2 at Virginia's Mid-Atlantic Regional Spaceport within NASA's Wallops Flight Facility in 2024.

The contract signing with a new customer came just days after Rocket Lab successfully launched the first HASTE mission on 17 June 2023 for Leidos under the Multi-Service Advanced Capability Hypersonic Test Bed (MACH-TB) program. The mission was Rocket Lab's third mission from Launch Complex 2 at Virginia's Mid-Atlantic Regional Spaceport since the Company began launches from U.S. soil in January this year, demonstrating rapid and reliable launch capability for government and commercial programs.

"After delivering mission success with our HASTE launch in June, we're delighted to be selected once again to deliver this crucial capability, enabling our customers to accelerate hypersonic innovation," said Brian Rogers, Senior Director – Global Launch Services. "We're immensely proud to be delivering a vital capability to the nation by increasing the cadence and availability of hypersonic and suborbital flight testing to enable technology maturation."

Rocket Lab's HASTE suborbital launch vehicle is derived from the Company's workhorse Electron rocket – the world's most frequently launched commercial small launch vehicle. Leveraging Electron's deep flight heritage, HASTE offers true commercial testing capability on rapid schedules and at a fraction of the cost of current full-scale tests. Tailored specifically for suborbital and hypersonic test flight capability, HASTE has a modified Kick Stage, a larger payload capacity of up to 700 kg / 1,540 lbs, and options for tailored fairings to accommodate larger payloads.

HASTE is operated under Rocket Lab National Security (RLNS), the Company's wholly owned subsidiary created to serve the unique needs of the U.S. defense and intelligence community and its allies.



## NGC's NG-19 Launch Marks 10 Years of SS Cargo Resupply Missions

Northrop Grumman Corporation has successfully launched its 19th resupply mission (NG-19) to the International Space Station (ISS) under NASA's Commercial Resupply Services-2 (CRS-2) contract aboard the company's Antares rocket. This launch commemorates ten years of Northrop Grumman Cygnus missions.

NG-19 is carrying over 8,200 pounds of equipment, science experiments and supplies to the crew on the ISS.

The Cygnus spacecraft has delivered roughly 130,000 pounds of equipment and supplies to the crews aboard the ISS over the past decade.

After ISS separation, Cygnus will host NASA's Spacecraft Fire Safety Experiment (SafeFire) to investigate how fires grow in microgravity. This will inform future human spaceflight design to ensure crew safety.

**Expert:** Steve Krein, vice president, civil and commercial space, Northrop Grumman: "Our proven, adaptable Cygnus spacecraft has been essential to support the critical work of resupplying the ISS. Since our first mission in 2013, we have continued to improve its capabilities while increasing cargo mass capacity and supporting secondary mission capability such as reboosting the orbit of the ISS."

**Details on Cygnus:** NG-19 launched from the Mid-Atlantic Regional Spaceport at NASA's Wallops Flight Facility on Wallops Island, Virginia.

The company also manufactures the spacecraft structures, propellant tanks, UltraFlex solar arrays, and loop heat pipe radiators for thermal control – all essential components for successful mission launches.

Northrop Grumman names each Cygnus spacecraft in honor of an individual who has made great contributions to human spaceflight. For the NG-19 mission, Cygnus is named for Laurel Clark, NASA astronaut, medical doctor, United States Navy captain and Space Shuttle mission specialist. She was selected for NASA Astronaut Group 16 in 1996 and flew aboard Space Shuttle Mission STS-107, spending 16 days in space. This year marked the 20th anniversary of the Columbia tragedy when Laurel and six additional crew lost their lives.



## BlackSky Signs New Block Buy for 5 Rocket Lab Launches

Rocket Lab USA, Inc a leading launch and space systems company, has announced it has signed another block buy deal for five Electron launches with BlackSky a leading provider of real-time geospatial intelligence and global monitoring services.

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After four years of launching for BlackSky, we're delighted to continue our partnership with more dedicated launches on Electron," said Rocket Lab founder and CEO Peter Beck. "Building and maintaining a constellation requires precision deployment to unique orbits and a dependable launch schedule. We're proud to deliver this dependable and tailored capability launch after launch, year after year."

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Rocket Lab has launched six Electron missions for BlackSky since 2019, becoming the primary launch provider for BlackSky's constellation. With these five new launches added to the manifest, BlackSky has contracted more Electron launches than any other single commercial customer. The launches are expected to begin in 2024 from Rocket Lab's Launch Complex 1 in Mahia, New Zealand.

BlackSky's next-generation Gen-3 satellites are designed to produce images with up to 35-centimeter resolution. Increased resolution and enhanced spectral diversity extend BlackSky's ability to provide real-time insights to its customers in a broad set of conditions, including nighttime, low light and challenging weather.

The new BlackSky launches join a busy Electron manifest in 2024 featuring missions for commercial constellation operators Capella Space, Kinéis, Hawkeye 360, and Syn-

spective, as well as a variety of government missions.



## Intelsat Galaxy 37/ Horizons-4 Satellite Successfully Launched

Intelsat, operator of one of the world's largest integrated satellite and terrestrial network and leading provider of inflight connectivity, announced the successful launch of Galaxy 37/ Horizons-4 (G-37/H-4), setting a new record for the commercial satellite industry by sending eight geostationary satellites into space within 10 months.

The Maxar-manufactured satellite launched aboard SpaceX's Falcon 9 rocket from Cape Canaveral Space Force Station in Florida at 1:00 a.m. EDT. G-37/H-4 separated from the vehicle at 1:33 a.m. EDT, and Intelsat confirmed its signal acquisition at 1:37 a.m. EDT.

When operations start later this year, G-37/H-4 will be positioned at 127 degrees West and deliver a wide range of services and coverage. The G-37 C-Band payload will provide North American capacity for television media and telecommunication network customers. The H-4 Ku-band payload will provide continuity for our mobility, network, and U.S. government customers and will be owned jointly by Intelsat and JSAT International, the U.S.-owned subsidiary of SKY Perfect JSAT Corp.

“

This launch completes our comprehensive Galaxy fleet refresh plan started about 10 months ago," said Dave Wajsgras, CEO at Intelsat. "This milestone is now a part of the 40-year Galaxy legacy – satellites our North American customers have relied on for decades. It also marks the 20-year anniversary of our JSAT partnership. This joint venture has allowed both companies to serve more customers in more places throughout the world."

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## HERA ASTEROID SPACECRAFT ASSEMBLED

**H**era is complete. ESA's asteroid mission for planetary defence was built and prepared in two halves, but now, through a painstaking operation, they have been mated together to make a single spacecraft, ready for full-scale testing of its readiness for space.

The mating took place at OHB Bremen in Germany, with Hera's Core Module raised more than 3 m above its Propulsion Module then gradually and carefully slotted into place, over a three-hour period. The modules had been placed in cages to ensure their correct alignment relative to each other down to a few tenths of a millimetre.

"The mission keeps on hitting milestones right now, but this is a big one, and a very emotional moment for the team," explains Paolo Martino, Hera system engineer. "Previously we had these two modules, now you can say the spacecraft has been born."

Hera is Europe's contribution to an international planetary defence experiment. Following the DART mission's impact with the Dimorphos asteroid last year – modifying its orbit and sending a plume of debris thousands of kilometres out into space – Hera will return to Dimorphos to perform a close-up survey of the crater left by DART. The mission will also measure Dimorphos' mass and make-up, along with that of the larger Didymos asteroid that Dimorphos orbits around.

To make its rendezvous with Dimorphos Hera has to lift off in October 2024. So to maximise working time the mission was constructed by prime contractor OHB as two separate modules, which could be worked on in parallel.

Hera's Propulsion Module incorporates its propellant tanks – housed within a central titanium cylinder, the 'backbone' of the



spacecraft – along with piping and thrusters, which will have the job of hauling the mission across deep space for more than two years, then to manoeuvre around Dimorphos and Didymos.

Meanwhile Hera's Core Module can be thought of as the brains of the mission, hosting its onboard computer, mission systems and instruments.

Manufactured together, the Core Module remained at OHB while the Propulsion Module travelled to Avio near Rome in Italy for the addition of its propulsion system. The pair were then reunited in Bremen to prepare for the mating operation.

"A similar double-module process is often used for telecom missions, but those are usually standardised designs," adds Paolo. "This is the first time it has been applied to a deep space mission, on a much more ad hoc basis."

The mating had been exhaustively simulated in advance using CAD software, but OHB's assembly, integration and testing team were still checking alignment as the crane lowered the Core Module every step of the way. The cleanroom door was kept sealed during the mating to prevent any

distraction.

"We studied a lot together with our designers on which were the most critical parts of the process, so most of them were already taken into account," explains Matteo Grimaldi, Senior Assembly, Integration and Testing technician at OHB.

Once the tip of the Propulsion Module cylinder met the top deck of the Core Module the mating was complete. Then an initial test bolt was inserted to check the alignment was entirely correct in advance of the two modules being fully bolted together.

"The two modules are now together forever, as they will be in space, barring any major unexpected problem," explains Paolo.

"If we need to, we can still access internal units through side panels. Next we will be adding some payload units to the spacecraft's top deck which we are receiving directly from the manufacturers once Hera moves to its next stop.

"That is at the end of this month, when Hera is being transported to the ESTEC Test Centre in the Netherlands, where it will go through a full-scale environmental test campaign to check its flight-readiness."

## SMALL SATELLITE



### LeoStella Debuts Advanced Small Satellite Bus Platform, the LS-300

LeoStella, a U.S.-based satellite design and manufacturing company announced its third-generation small satellite bus product line, the LS-300. The LS-300 introduces significant payload accommodation and other enhanced capabilities.

The LS-300 builds upon LeoStella's successful reputation and accounts for the evolving expectations of government and commercial satellite customers. To date, LeoStella has 19 satellites in orbit, from its established product lines. These satellites have over 37 years of on-orbit heritage and boast 99% mission availability, delivering high performance and remarkable reliability.

"The LS-300 satellite bus is well-positioned to meet the varied needs of customers seeking access to space," stated Pierre-Damien Vaujour, CEO of Loft Orbital. "Loft Orbital has had great success with LeoStella's established bus platforms. I'm confident the updated LS-300 bus platform will enhance the company's already established reputation."

With a focus on delivering exceptional performance and enabling customers to achieve their varied mission goals, the LS-300 bus platform boasts several impressive features. Notably, it can accommodate heavier and larger payloads, up to 250 kilograms. The platform incorporates a space-qualified propulsion system capable of achieving a velocity change of over 200 meters per second. This propulsion capability enhances the satellite's reaction control, precision pointing, and orbital maneuvering, ensuring optimal performance in space. Additionally, the LS-300 platform provides up to one kilowatt of power to enable the spacecraft to perform more demanding missions.

"We've already secured our first LS-300 customer, which is a testament that our updated bus platform meets the evolving needs of the satellite market," said Tim Kienberger, CEO of LeoStella. "LeoStella offers co-engineering services which enable us to efficiently provide satellites that are optimized to specific customer requirements."

From large, interconnected constellations to single-unit prototypes, LeoStella is dedicated to providing customers with critical space infrastructure developed, launched and operating efficiently and effectively. With the introduction of the new LS-300 bus platform, LeoStella will continue to uphold its successful track record of proven on-orbit performance.



### RTX Provides Blue Canyon Satellites for NASA Swarm Test Launch

RTX's small-satellite manufacturer and mission services provider Blue Canyon Technologies (BCT), announces successful launch and initial contact with CubeSats for the NASA Starling mission, a technology demonstration aimed at proving the success of cooperative groups of spacecraft operating in an autonomous, synchronous manner or "swarm."

**"We continue to push the boundaries of what's possible," said John Carvo, Executive Director of CubeSats at BCT. "By providing heritage hardware for a demonstration such as this, we're continually optimizing low-costs and quick turns for small constellation programs."**

BCT provided four 6U CubeSats to NASA's Small Spacecraft Technology program which is managed by NASA's Ames Research Center in California's Silicon Valley for the agency's Space Technology Mission Directorate. The Starling mission is advancing the readiness of various technologies for cooperative groups of spacecraft by demonstrating technologies to enable multipoint science data collection by several small spacecraft flying together. The six-month mission will specifically test onboard swarm maneuver planning and execution, communications networking, relative navigation, and autonomous coordination between satellites.

The satellites will be positioned in a nearly sun-synchronous, low-Earth orbit, with all four spacecraft actively engaged in the

experiment.

BCT delivered the first satellite for the mission in 2021. In addition to manufacturing the satellites, BCT is providing operations support for the Starling mission, named after the bird famous for flying in a synchronous or "swarm" formation. Work on this program was performed in Lafayette, Colorado.

## SMALL SATELLITE



### Rocket Lab Signs Multi-Launch Deal to Further Deploy Synspecive Constellation

Rocket Lab USA, Inc. a global leader in launch services and space systems announced it has signed a deal with Japanese Earth imaging company Synspecive to launch two dedicated Electron missions. The new missions bring the total number of Electron launches contracted by Synspecive

to six.

Rocket Lab has been launching for Synspecive since 2020 when the Company deployed the first satellite in Synspecive's synthetic aperture radar (SAR) constellation, which is designed to deliver imagery that can detect millimetre-level changes to

the Earth's surface from space. Since that first mission, Rocket Lab has been the sole launch provider for Synspecive's StriX constellation to date, successfully deploying three StriX satellites across three dedicated Electron launches. Including the two new missions, Rocket Lab is now scheduled to launch three missions for Synspecive beginning in late 2023 from Launch Complex 1 in New Zealand.

In addition to providing Synspecive with a high degree of schedule and orbit by flying as a dedicated mission, Rocket Lab also delivers the unique ability to perform an advanced mid-mission maneuver with the Electron rocket's Kick Stage to shield the StriX satellite from the sun to reduce radiation exposure ahead of payload deployment.

Synspecive founder and CEO, Dr. Motoyuki Arai, says: "As we celebrate our three-year partnership with Rocket Lab, which began with our first StriX-α satellite in 2020, we are thrilled to entrust them with two more contracts for our StriX satellite launches. Their unwavering reliability and precision have been pivotal to our successful deployments. We're looking forward to the upcoming launches and the new insights to enhance our satellite data and solution service in line with our customer needs."

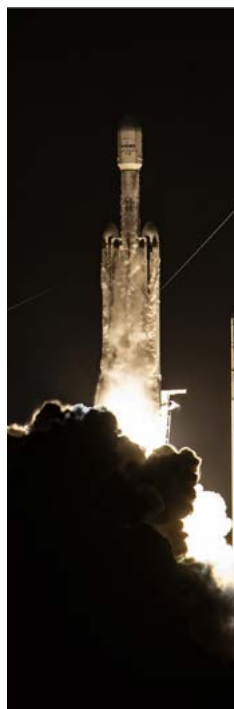
### HUGHES JUPITER 3 SATELLITE SUCCESSFULLY LAUNCHES, HERALDS THE START OF A NEW ERA OF CONNECTIVITY

Hughes Network Systems, an EchoStar company announced its JUPITER™ 3 ultra high-density satellite has successfully launched on a SpaceX Falcon Heavy rocket from historic Kennedy Space Center Launch Pad 39A in Florida. Also known as EchoStar XXIV, JUPITER 3 was built by Maxar Technologies in Palo Alto, CA, and is engineered to deliver gigabytes of connectivity to customers across North and South America.

On July 29 at 2:32 a.m. EDT, three hours and twenty-eight minutes after lift-off, JUPITER 3 successfully deployed from the launch vehicle. The satellite began sending and receiving its first signals, and engineers deployed the JUPITER 3 solar arrays, which unfolded in space to their full ten-story span.

"JUPITER 3 is the highest capacity, highest performing satellite we've ever launched. As the leading provider and inventor of satellite internet, we're proud to herald the start of a new era of connectivity and serve more customers where cable and fiber cannot," said Hamid Akhavan, CEO, EchoStar. "This purpose-built satellite is engineered uniquely to meet our customers' needs and target capacity where it's needed most, such as the most rural regions of the Americas, so they can stay connected to the applications and services they depend on every day."

Over the next several weeks, JUPITER 3 will travel into a



geosynchronous orbit 22,236 miles (35,786 kilometers) above the Earth to its destination at the 95 degrees west orbital slot. It will then undergo extensive bus and payload testing before entering service and augmenting the Hughes JUPITER fleet with more than 500 Gbps of additional capacity.

"Whether helping a student in Mexico expand her horizons with access to technology, connecting a farmer in Idaho with the tools to monitor his crops, or connecting a senior in Montana to her doctor via a telehealth appointment, JUPITER 3 will connect our customers to what matters most," added Akhavan.

With JUPITER 3, Hughes will enhance its HughesNet® offerings for customers in the U.S. and Latin America with more broadband capacity overall and higher speed plans in many markets—some with download speeds up to 100 Mbps. The company will also offer higher speed HughesNet Fusion® plans, the innovative low-latency home internet that leverages multipath technology to blend satellite and wireless technologies seamlessly into a low-latency satellite internet experience.

With dense, high-throughput capacity across the Americas, JUPITER 3 will also support applications such as in-flight Wi-Fi, enterprise networking and cellular backhaul for mobile network operators (MNOs).

## SMALL SATELLITE



### Intelsat Galaxy 37/ Horizons-4 Satellite Successfully Launched

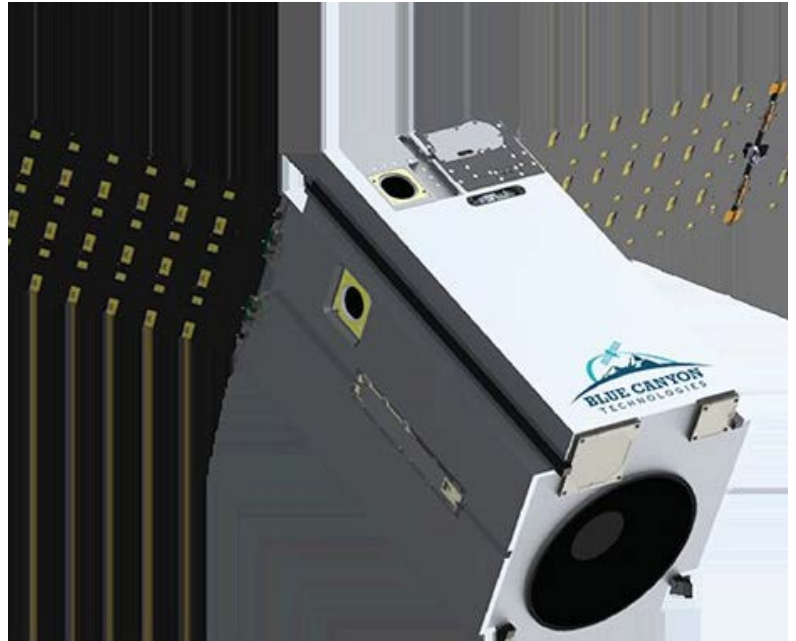
Intelsat, operator of one of the world's largest integrated satellite and terrestrial network and leading provider of inflight connectivity, announced the successful launch of Galaxy 37/Horizons-4 (G-37/H-4), setting a new record for the commercial satellite industry by sending eight geostationary satellites into space within 10 months.

The Maxar-manufactured satellite launched aboard SpaceX's Falcon 9 rocket from Cape Canaveral Space Force Station in Florida at 1:00 a.m. EDT. G-37/H-4 separated from the vehicle at 1:33 a.m. EDT, and Intelsat confirmed its signal acquisition at 1:37 a.m. EDT.

When operations start later this year, G-37/H-4 will be positioned at 127 degrees West and deliver a wide range of services and coverage. The G-37 C-Band payload will provide North American capacity for television media and telecommunication network customers. The H-4 Ku-band payload will provide continuity for our mobility, network, and U.S. government customers and will be owned jointly by Intelsat and JSAT International, the U.S.-owned subsidiary of SKY Perfect JSAT Corp.

"This launch completes our comprehensive Galaxy fleet refresh plan started about 10 months ago," said Dave Wajsgas, CEO at Intelsat. "This milestone is now a part of the 40-year Galaxy legacy – satellites our North American customers have relied on for decades. It also marks the 20-year anniversary of our JSAT partnership. This joint venture has allowed both companies to serve more customers in more places throughout the world."

## RTX Introduces Largest Form Factor in CubeSat Product Line



RTX's small satellite manufacturer and mission services provider, Blue Canyon Technologies (BCT), continues to meet the demand for increased payload size, weight, and power (SWaP) by introducing the XB16 CubeSat, now the largest form factor in its CubeSat product line.

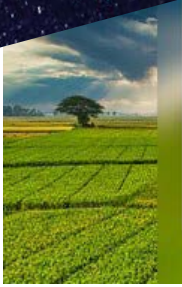
"Firefly's Elytra vehicles are scalable and customizable to support each customer's unique on-orbit needs," said Jana Spruce, Vice President of Spacecraft at Firefly Aerospace. "Utilizing many of the same flight-proven components from Firefly's launch vehicles and landers, Elytra supports rapid mission schedules while providing affordable access across cislunar space and beyond."

The XB16 CubeSat offers 14U of payload volume with a cannister-dependent option for an additional 12,000 cubic centimeters of volume, all while maintaining BCT's robust power systems, secure data handling, resilient performance, and ultra-precise attitude control systems. The larger payload volume capacity of the XB16 provides an ideal solution for remote sensing, earth observation, and in-space communications.

"Our flight-proven products are known for their fine-pointing and agility on orbit," said John Carvo, executive director of CubeSats at Blue Canyon. "Now we are able to offer a larger payload volume with the same high level of accuracy and orbit lifetime."

This addition to the BCT array of peak-performance and cost-effective spacecraft solutions continues the company's ability to support all types of academic, commercial and government space missions.

The new XB16 will be developed at BCT's Spacecraft Manufacturing Center located in Boulder, CO. The office and laboratories are designed specifically for high-volume production of spacecraft systems and components, with the manufacturing capability to handle large constellations of small spacecraft.



**Rabo Partnerships**   
**SATSURE**

## SatSure Partners with Rabo Partnerships to Revolutionize Cash Flow-based Lending for Smallholder Farmers

SatSure, a global leader in EO space data applications, is pleased to announce its partnership with Rabo Partnerships. This strategic collaboration aims to drive the access to cash-flow based lending for smallholder farmers globally. By leveraging SatSure's cutting-edge technology and Rabo Partnerships' expertise in financial services, this partnership will tackle the challenges banks face and facilitate financial inclusion for unbanked farmers.

The alliance aligns with SatSure's Banking Solution, SatSure Sage, a suite of applications designed to empower lending institutions in making intelligent decisions in agricultural loan management. By harnessing the power of satellite data, location intelligence, and Machine Learning, SatSure Sage bridges information gaps and enables lending institutions to scale operations while reducing costs. Simultaneously, it enables farmer's access to credit through alternate data for banks to assess risk of lending, even in the absence of the necessary data points.

"Rabo Partnerships is pleased to work with SatSure to increase farmer livelihoods and sustainable Agricultural Finance across the globe!" says David Gerbrands (Global Head Advisory and Inclusive Business Ventures at Rabo Partnerships). «SatSure's and Rabo Partnerships' combined technology, network and capabilities will allow us to help financial institutions strengthen their risk management, collection, and portfolio growth to the agricultural sector, including small holder farmers.»

Mr Prateep Basu, Founder & CEO of SatSure, expressed his enthusiasm about the partnership, stating "Leveraging our relationship with banks, we are certain that this collaboration will empower the agri-lending ecosystem to create innovative financial products for unbanked farmers based on the cash flow model rather than traditional land-based collateral, where digitization is still work in progress."

This global partnership will address several challenges faced by banks when developing lending products, including:

- Continuous monitoring of crop health, stress and associated parameters which impact crop performance and farmer's income potential

- Farmer credit access problems in developing countries

- Providing alternate data through SatSure's data products for banks to onboard new to credit and new to bank farmers

- Efficient risk monitoring and mitigation for post loan disbursement with insights from satellite imagery
- Efficient planning of loan collections driven by insights from satellite imagery

## ISRO Transfers IMS-1 Satellite Bus Technology to a Private Industry

As yet another step in enhancing the private industry participation in the Indian Space sector, ISRO transferred the IMS-1 Satellite Bus Technology to M/S Alpha Design Technologies Pvt. Ltd. (ADTL). NewSpace India Limited (NSIL), the commercial arm of ISRO, facilitated the technology transfer through an agreement signed during an event held at the NSIL headquarters on August 2, 2023. The Technology Transfer Documents were formally handed over by Shri. D Radhakrishnan, Chairman and Managing Director of NSIL to Col. H. S. Shankar (Retd.) VSM, Chairman and Managing Director of ADTL. ADTL is one of the two private players identified to receive the transfer of this technology through Interest Exploratory Note (IEN) published by NSIL.

This transfer marks the beginning of satellite-bus technologies developed by ISRO being transferred to private industries. Further, the PSLV is under productionisation by a consortium of industries. ISRO has been enabling private players develop Space technologies by facilitating and extending the expertise thus ensuring both the out-bound and in-bound approaches.

The IMS-1 satellite bus, developed by the U R Rao Satellite Centre (URSC/ISRO), is a versatile and efficient small satellite platform designed to facilitate low-cost access to space. The bus serves as a dedicated vehicle for various payloads, enabling Earth imaging, ocean and atmospheric studies, microwave remote sensing, and space science missions while ensuring a quick turnaround time for satellite launches.

IMS-1 bus, weighing about 100 kg, accommodates a 30 kg payload. Solar arrays generate 330 W power with a raw bus voltage of 30-42 V. It offers a 3-axis stabilized with four reaction wheels with a 1 N thruster that provides +/- 0.1 degree pointing accuracy. It is a forerunner for IMS-2 bus technology, capable of improved features. IMS-1 bus is utilised in previous ISRO missions like IMS-1, Youthsat and Microsat-2D.

By transferring the IMS-1 technology to the private sector, ISRO/DoS aims to bolster India's industrial growth in the space sector and foster technological self-reliance. The development opens up new avenues for private players to contribute to space research and exploration, in line with India's vision to expand its presence in the global space market.

NSIL is a wholly owned Government of India company, under the administrative control of the Department of Space (DOS). NSIL enables Indian industries to take up high-technology space-related activities and promotes commercial exploitation of the products and services emanating from the Indian space programme. Technologies ready for transfer by NSIL.

Alpha Design Technologies Pvt. Ltd. (ADTL) is a leading aerospace and defense company based in India. With expertise in engineering, manufacturing, and system integration, ADTL has been a key player in various projects related to defense, space, and homeland security, contributing significantly to India's technological progress in these domains.





Spacepreneur Editor Kartikeya

In conversation with

**DR. DARSHAN RANA**  
**CHAIRMAN & MANAGING DIRECTOR**



**Mr Mishra**  
**Director & COO**

**Q** Can you introduce your COO of Erisha Space to our Readers?

**A** After a successful professional career of 15 plus years at ISRO (2007-2023) where he had the privilege to work on critical systems in Launch vehicles, satellite technology, human space flight program and interplanetary missions such as Chandrayaan-2 & 3 missions, Mars Orbiter Mission (MOM) etc., he joined Erisha Space as COO and taking care of the entire functioning of it with a vision and mission of developing space technology, satellite applications and setting up indigenous technology development for our mother land. In my opinion space technology has endless applications to offer to the industry and common public that will solve many of the current and future concerns like climate change, green energy, disaster management etc. and in this regard Erisha Space is working on a number of innovative initiatives to make space technology affordable, acceptable and accessible for everyone by developing high-resolution remote sensing satellite systems, unmanned aerial systems and a number of remote sensing satellite applications.

**Q** What are the various Products & solutions currently offered by Erisha space?

**A** Erisha Space is currently offering remote sensing solutions to various industries as per their requirements. Industries such as agriculture for which a beta version of a mobile applications has

## FOCUS ON START-UP

been developed for plot scale data collection. Other industries include oil and gas, renewable energy, power transmission, mineral exploration, etc.

B) Erisha Space also plans to build a series of miniaturized satellites with various imaging capabilities catered to specific industry application. Erisha Space also plans to build unmanned aerial vehicle (UAV) with varying payload carrying capacity for aid in remote sensing applications and day-to-day operational activities.

### **Q** What are the challenges & opportunities you see in the space industry? Opportunities:

**A** Space Manufacturing & Production: With the growing number of private space missions the demand for market-ready satellites, sub-systems and space hardware has risen greatly. India has several MSMEs, small scale industries and new players emerging in the space manufacturing and production supply-chain.

Space Based Services: With the growing number of satellite constellations in the low earth orbit, space-based services like remote sensing, communication and navigation are more serviceable and affordable with constellations providing global revisits daily, hence making it possible to monitor and detect change daily, communicate to even remote areas without any terrestrial network infrastructure.

Satellite Launch services: The number of private satellite launches have increased recently due to the disruption in the space industry, this has paved way for private companies to also develop satellite launch vehicles for carrying small satellites to orbit, in standalone and rideshare missions.



Space education and research: With the growing complexity of space missions and the rising interplanetary/ deep space missions, the space education and research industry have a great scope for development in India, by catering to the requirement of the growing private sector in terms of generating Capable talent and employing them into research and development of cutting edge and mass scale space projects.

International Collaborations: India has a great potential in joining hands with the space industry in the overseas countries and jointly progressing towards the development of new technology and services that cater to the growing global demand. The talent and low-cost engineering mindset are a prime driver of India's presence in the global industry.

### **Challenges:**

- Lack of funding sources in the country.
- Lack of supply chain and experienced vendors.
- Lack of facilities and infrastructure to realize high tech enabled satellite systems.

### **Q** Are you seeking any support from the government for upcoming Projects?

**A** Yes, we will need support from government organizations for Authorization, realization and launch of our satellite projects. Any private entity in India aiming towards

conducting any space activity, has to interface with Indian National Space Promotion and Authorisation Centre (IN-SPACE), which is a single window nodal authority under the Department of Space (DOS), this organisation provides Authorisation and facilitates interaction with different departments of DOS/ISRO for realisation of space mission.

### **Q** What are your comments on recent success of Chandrayan-3?

**A** The achievement of landing Chandrayaan-3 on the Moon stands as a testament to ISRO's dedication, hard work, and innovation. This historic milestone not only reflects India's technological prowess but also signifies a global space community achievement. The success of the Chandrayaan mission holds potential benefits for small private space enterprises such as:

- Boosting Public Interest
- Inspiration for Innovation
- Access to ISRO Expertise
- Collaborative Opportunities in International market.
- Government Funding Access
- Global Market Entry for Indian startups.

### **Q** What is your ultimate goal in the next 5-10 years?

**A** Development of self-sustainable network of earth observation satellites to provide comprehensive data meeting global demand.

Development of framework and infrastructure required for indigenous technology development.

Development of advanced satellite technology to acquire high resolution optical, thermal and microwave data.

Development of Vertical takeoff and landing (VTOL) air transportation systems to revolutionize manned and un-manned transportation systems.



## SPACE ROBOTICS STARTUP GITAI RAISES AN ADDITIONAL US\$15 MILLION IN FUNDING

**G**ITAI USA Inc. and GITAI Japan Inc. (GITAI), the world's leading space robotics startup company, has raised an additional US\$15 million for the Series B Extension round. Combined with the US\$30 million funding announced in May of this year, the total amount of the Series B Extension round is now US\$45 million. The additional funds raised in this round will

be primarily used to achieve the following objectives:

- Business expansion in the U.S.
- Partial coverage of the lunar surface demonstration
- In this round, GITAI raised funds through a third-party allotment from the following companies and funds:
  - Green Co-Invest Investment Limited Part-

nership

- Pacific Bays Fund 1 & 1A Investment Limited Partnerships (Pacific Bays Capital)
- MSIVC 2021V Venture Capital Investment Limited Partnership (MITSUI SUMITOMO INSURANCE Venture Capital Co., Ltd.)
- Additionally, GITAI secured funds through a loan from the following company:
  - MUFG Bank, Ltd.

## SatSure raises \$15 million in Series A round led by Baring Private Equity Partners, India and Promus Ventures



**S**atSure, a global leader in satellite Earth observation data and analytics, has closed a Series A round of \$15 million in equity capital and venture debt. The round has been led by Baring Private Equity Partners (BPEP), India and Promus Ventures, with participation from Omidyar Network India, and xto10X. With this investment, SatSure's plans of launching a fleet of four high resolution optical and multispectral satellites continues to be on track for Q4, 2025.

Founded in 2017, SatSure leverages satellite imagery and AI to deliver decision intelligence from space, translating to valuable insights for various industries, including agriculture, banking, and critical infrastructure. The fresh round of financing will also be used by the company to accelerate product innovation and expand its operations across the Americas and Asia-Pacific regions.

Along with the lead investors, this round also saw the participation of existing investors Force Ventures, Luckbox Ventures, and IndigoEdge Advisors. The closure of this round follows the strategic investments which SatSure received from the top private sector Indian banks, announced earlier in February, 2023. SatSure's decision analytics are powering greater profitability, improved operational efficiency, and effective policy decision making for its customers, with the convergence of satellite data and Artificial Intelligence (AI).

Current use cases which the firm caters to are spread across enabling farmer financial inclusion, improved debt service management in the rural areas, mortgage loan monitoring, enabling agrichemicals hyperlocal sales intelligence and distribution strategy, aeronautical data management, vegetation monitoring

for utilities, construction change detection, and commodities procurement intelligence, to name a few.

SatSure expressed enthusiasm about the investment closure, with Prateep Basu, Founder & CEO stating, "We are thrilled to have such a great group of investors, who are supporting us in the journey towards becoming a full stack Earth observation data player. We are committed to expand our outreach, invest in Low-earth orbit satellite assets, and continue developing innovative products that signifies the rise of the India private space sector and its deep rooted alignment to our national space program."

"SatSure is building deep technology expertise and solving tough problems. Our continued confidence in the company's vision is built on the global customer traction, a very talented team, and the large markets they are opening up through their product and business innovation," said Arul Mehra, Partner at BPEP, India, which had also led SatSure's pre-series a round in October, 2021.

Promus Ventures, a leading venture capital firm investing in DeepTech and based in Chicago, San Francisco and Luxembourg, is known for its investments in deeptech early-stage companies, including Space and AI. Pierre Festal, Partner at Promus Ventures said, "Promus Ventures' investment in SatSure is a testament to our confidence in the company's capabilities and the tremendous potential of geospatial analytics for scaling globally. We are excited to partner with SatSure and support their expansion into new markets while fostering innovation in the space industry."



**FOCUS ON  
SPACE LAW**



Spacepreneur Editor Kartikeya In conversation with

**PROF. V. BALAKISTA REDDY**  
**DEAN, SCHOOL OF LAW, MAHINDRA UNIVERSITY**  
**ALSO FORMER REGISTRAR AND DIRECTOR, CENTRE FOR AEROSPACE**  
**AND DEFENCE LAWS (CADL) NALSAR UNIVERSITY OF LAW**

**Q** How best can you describe the space journey of mankind from its humble beginnings to where it is now?

**A** One of the significant achievements of man in the 20th century was his ability to leave the atmospheric surface of this planet, the Earth and allowing a complete view from space. This was achieved through several generations of efforts to take flight of fantasy into outer space through mythology, poetry, fiction etc. Scientists predicted the theoretical possibility of space voyages by 16th century, but it became possible only with the successful launch of the first Sputnik by former Soviet Union on 4th October, 1957. Yuri Gagarin became first man in space on 12th April 1961, and within a decade Neil Armstrong and Edwin Aldrin landed on the Moon on 16th July, 1969. Now new developments including Space stations, space hotels, space tourism, space colonization, buying and selling of plots in space etc. With all these rapid developments, we have now entered a new era---- the era of solving the problems of the earth by using space technology.

**Q** What kind of Clearances, Licensing Regime, and Authorization and Registration activities does the space Legislation envisage to govern the activities of Emerging Indian Companies that deal with Space Domain?

**A** Institutionalising the processes and regulatory

aspects to allow commercialisation is the key. We had the technology for long. But that was limited to government use in a controlled manner. Opening up the sector is where the new agency is going to play a pivotal role in being a single window clearance system. Now multiple organisations are involved which create duplication in the Government regarding all the activities mentioned above. This Bill will help clear such issues and bring in more clarity and synergy in the activities in relation to not just Indian but foreign companies too. This route of transparency will also promote investments and contributions from private entities both national and international.

**Q** Tell me about some Land Mark Successful Developments in India's Space Missions which has made our Country Proud?

**A** The latest mission in India's ambitious space program has blasted off on a voyage towards the centre of the solar system, a week after the country's successful unmanned moon landing. The Aditya-L1, India's first space observatory for solar research, aims to study solar winds which can cause disturbance on earth and are commonly seen as "auroras". The successful arrival of the Chandrayaan 3 mission's Vikram lander on the Moon made India the first country besides China to achieve a successful soft landing on the lunar surface since 1976. At the same time, it is also the first in the world to land on lunar south polar region. All in all, this great feat makes India the

fourth country to successfully land on Moon and the first to do so in the region of the lunar south pole, bring great pride to our country and countrymen.

The Reusable Launch Vehicle (RLV) is a new launch vehicle that has been developed by ISRO. Designed to be reusable, it makes space launches more efficient and cost-effective. The RLV LEX mission was successfully completed in April 2023. While these are the major achievements in 2023, some other upcoming mission to look forward to includes: 1) Gaganyaan mission, which marks India's ambitious endeavour to send humans into space, 2) The Lunar Polar Exploration (LUPEX) mission, which is a collaborative effort between ISRO and JAXA (Japan), that will explore the lunar polar regions, focusing on permanently shaded areas, 3) X-ray Polarimeter Satellite (XPoSat) and 4) NASA-ISRO SAR (NISAR) will contribute to Earth observation and human spaceflight endeavours. Additionally, Shukrayaan 1, the mission to Venus, promises to unveil the secrets of our neighbouring planet.

**Q** There are few people who are buying stars and naming them. Is it legally valid/ permitted?

**A** The practice of buying and naming stars is a commercial venture offered by various companies, but it does not have any scientific or legal validity in terms of actual ownership or naming rights of celestial bodies. Here's why:

**No Legal Ownership:** Celestial bodies, including stars, planets, and other astronomical objects, are not subject to ownership by individuals or companies. International agreements, such as the Outer Space Treaty, explicitly state that outer space, including celestial bodies, is not subject to national appropriation or private ownership.

**Scientific Nomenclature:** Stars and other celestial objects are named by astronomers and scientists based on internationally recognized systems and guidelines. These names are typically based on scientific principles and are used for astronomical research and cataloguing purposes. Private companies selling star names have no authority or influence over these official naming processes.

**Symbolic Gesture:** When individuals or organizations purchase and name stars through commercial services, it is typically an act of symbolic honouring or novelty gift. The name assigned to the star is very often not officially recognized by the scientific community or the relevant authorities.

**No Legal Registry:** There is no universally recognized legal registry or governing body that maintains an official record of privately named stars. Simply for this reason, names assigned by such companies have no legal standing.

**Consumer Awareness:** Individuals should exercise caution when

considering these services and understand that they are essentially buying a symbolic certificate or gesture rather than acquiring any real ownership or naming rights.

In summary, while purchasing and naming stars through commercial services can be a meaningful and symbolic gesture, it does not confer any legal or scientific authority over the named star. The names assigned are typically not recognized by the astronomical community or relevant legal authorities. It is important for individuals to be aware of the symbolic nature of such transactions when participating in these services.

**Q** Is there any law regarding moon real estate/properties allowing any individuals/companies/governments to sell lands?

**A** No, there is no international law or legal framework that allows individuals, companies, or governments to sell land or claim ownership of lunar real estate. The Moon and other celestial bodies are subject to international agreements and treaties that prohibit private ownership of extra-terrestrial land. The key legal document governing outer space activities, including lunar ownership, is the Outer Space Treaty (OST), which was adopted by the United Nations in 1967.

Here are the key provisions of the OST relevant to lunar ownership:

**Prohibition of National**

**Appropriation:** Article II of the OST explicitly states that outer space, including the Moon and other celestial bodies, is not subject to national appropriation by any means. This means that no country can claim sovereignty or ownership over lunar territory.

**Common Heritage of Mankind:** The OST establishes the principle that celestial bodies and their resources are the “common heritage of mankind.” This principle emphasizes that outer space resources should be used for the benefit of all countries and humanity as a whole, rather than for the exclusive benefit of any individual, entity, or nation.

**Absence of Legal Framework for Ownership:** The OST and subsequent international agreements do not provide a legal framework for private or commercial ownership of lunar land. The concept of private lunar land ownership is fundamentally at odds with the principles of international space law.

**International Consensus:** The OST has been ratified by numerous countries, including major spacefaring nations. The widespread international acceptance of the treaty reinforces the prohibition against lunar ownership.

Given these provisions, any claims of lunar land ownership or the sale of lunar land by individuals, companies, or governments lack legal validity under international law. Such claims are generally considered commercial ventures,

novelty items, or scams.

In summary, there is no international law allowing the sale or ownership of lunar land, and any assertions to the contrary are not recognized by reputable international authorities or legal systems. The Moon is considered part of the common heritage of humanity, and its resources should be used for the collective benefit of all nations and people, in accordance with international space law.

**Q** **There are few people who are buying stars and naming them. Is it legally valid/ permitted?**

**A** The practice of buying and naming stars is a commercial venture offered by various companies, but it does not have any scientific or legal validity in terms of actual ownership or naming rights of celestial bodies. Here's why:

**No Legal Ownership:** Celestial bodies, including stars, planets, and other astronomical objects, are not subject to ownership by individuals or companies. International agreements, such as the Outer Space Treaty, explicitly state that outer space, including celestial bodies, is not subject to national appropriation or private ownership.

**Scientific Nomenclature:** Stars and other celestial objects are named by astronomers and scientists based on internationally recognized systems and guidelines. These names are

typically based on scientific principles and are used for astronomical research and cataloguing purposes. Private companies selling star names have no authority or influence over these official naming processes.

**Symbolic Gesture:** When individuals or organizations purchase and name stars through commercial services, it is typically an act of symbolic honouring or novelty gift. The name assigned to the star is very often not officially recognized by the scientific community or the relevant authorities.

**No Legal Registry:** There is no universally recognized legal registry or governing body that maintains an official record of privately named stars. Simply for this reason, names assigned by such companies have no legal standing.

**Consumer Awareness:** Individuals should exercise caution when considering these services and understand that they are essentially buying a symbolic certificate or gesture rather than acquiring any real ownership or naming rights.

In summary, while purchasing and naming stars through commercial services can be a meaningful and symbolic gesture, it does not confer any legal or scientific authority over the named star. The names assigned are typically not recognized by the astronomical community or relevant legal authorities. It is important for individuals to be aware of

the symbolic nature of such transactions when participating in these services.

**Q** **Who has permission to sell lands on Moon?**

**A** No individual, organization, or country has the legal authority or permission to sell land on the Moon. The Moon, along with other celestial bodies, is governed by international treaties and agreements, most notably the Outer Space Treaty (OST), which was adopted by the United Nations in 1967.

The key provisions of the Outer Space Treaty relevant to lunar land ownership include:

**Prohibition of National Appropriation:** Article II of the OST explicitly states that outer space, including the Moon, is not subject to national appropriation by any means. This means that no country can claim sovereignty or ownership over lunar territory.

**Common Heritage of Mankind:** The OST establishes the principle that celestial bodies and their resources are the "common heritage of mankind." This principle emphasizes that outer space resources should be used for the benefit of all countries and humanity as a whole, rather than for the exclusive benefit of a particular entity or nation.

Given these provisions, no entity, whether it's an individual, company, or nation, has the legal authority to sell or claim ownership of land on the Moon. Claims of

lunar land ownership made by certain organizations or businesses are generally considered to be speculative, lacking legal validity, and often used for novelty or commercial purposes.

It's important to exercise caution and skepticism when encountering offers to purchase land on the Moon or related documents. These claims do not have any legal standing under international law, and any transactions involving lunar land are not recognized by reputable international authorities, including the United Nations.

**Q** **Is these online purchases/certificates have any legal validity?**

**A** Online purchases or certificates claiming to offer ownership of land on the Moon or any celestial body do not have any legal validity under international law. These transactions are typically considered novelty items, commercial gimmicks, or scams and should not be viewed as legitimate property purchases.

The reasons for the lack of legal validity include:

**International Law:** As previously mentioned, international law, particularly the Outer Space Treaty, explicitly prohibits the private ownership of celestial bodies, including the Moon. This prohibition is widely accepted by the international community.

**Sovereignty:** No entity or individual has the legal authority

to claim sovereignty or ownership over celestial bodies. Such claims are not recognized under international law.

**Lack of Territorial Jurisdiction:**

The concept of property ownership relies on the existence of a legal system that can enforce property rights. In the case of celestial bodies, there is no governing legal authority or jurisdiction capable of enforcing property rights.

**Non-Governmental Entities:**

Even if a non-governmental entity claims to sell lunar land, it is subject to the laws and regulations of its home country. These entities cannot grant property rights over lunar land, as this would contradict international space law.

**Consumer Protection:** Authorities in some countries have issued warnings about lunar land sales scams, emphasizing that these transactions do not confer any real property rights and may be fraudulent.

In summary, any online purchase or certificate claiming to offer ownership of lunar land should be regarded as a novelty or symbolic gesture rather than a legally recognized property transaction. Such offerings lack legal validity, and individuals or entities should exercise caution and skepticism when encountering them. It is always advisable to consult legal authorities or experts if you have concerns about the legitimacy of such transactions.

**Q** **Is it true that anyone can buy land on Moon?**

**A** No, it is not true that anyone can buy land on Moon. The idea of buying land on celestial bodies like the Moon has invited numerous scams and misleading advertisements over the years. However, it is foremost essential to understand that the Moon, like all other celestial bodies, is governed by international agreements and treaties. The most important of these is the "Outer Space Treaty," which was adopted by the United Nations in 1967. According to this treaty:

Celestial bodies, including the Moon, are not subject to national appropriation by any means.

Activities on the Moon must be for the benefit of all countries, and no one can claim sovereignty over lunar territory. As a result, the concept of individuals or private entities purchasing land on the Moon is not legally recognized by any reputable international body, including the United Nations. While some companies have sold "lunar deeds" or certificates claiming to represent lunar land ownership, generally considered as novelty items are nothing but scams. As oppose to general understanding, these deeds have no legal standing, and purchasing them does not grant actual ownership rights to lunar land to the buyer.

In summary, the Moon is not available for private ownership or sale, as it is considered part of the common heritage of humanity under international law. Any claims to the contrary should be viewed with scepticism.



## **SANJAY NEKKANTI, CEO & CO-FOUNDER, DHRUVA SPACE**

"It is a very exciting time for the country and the world; I can't complain! The first Chandrayaan mission inspired me to start my own Space Company. ISRO has been the torchbearer for the country's Space programme; we have one of the world's most reliable launch vehicle programmes and ISRO has, till date, launched more than 240 foreign satellites of 28 countries from around the world. Chandrayaan-3 and Aditya-L1 missions are a testament to all of this capacity building that has been happening in the recent years. A little anecdote: back when I was in SRM University, shortly after the first Chandrayaan mission, ISRO approached the university to work on India's first nanosatellite student project, now known as the SRMSAT mission which kicked off my 'Spacepreneurship' career, helping to take forward the privatisation of India's Space industry. I see the impact bolstering Space business in India; there are many opportunities to meet the growing demand customers have to not just launch one satellite, but a constellation of satellites at once."

## **RANJANA KAUL, PARTNER, DUA ASSOCIATES**

specializes in space law & is founding member, Spaceport Sarabhai, the space focused think-tank

The stellar success of Chandrayaan 3 marks India's first lunar goal-post, past two significant milestones - Chandrayaan 2 and Chandrayaan 1. The success of Chandrayaan 3 has far reaching significance for India's space activities in the 21st century. It opens the prospect for ISRO to advance India's lunar programme by undertaking studies and missions for in-situ utilization, for celestial prospecting and for other aspects of extra-terrestrial habitability, as intended in Space Policy 2023. Also, of course, for India to engage with international partners in NASA led Artemis project related to recovery and use of planetary, exclusively for peaceful purpose.



## **LT. GEN. A K BHATT (RETD.)**

### **DIRECTOR GENERAL, INDIAN SPACE ASSOCIATION**

"We applaud ISRO on the successful landing of the Chandrayaan-3 which shows India's strong spirit of space exploration and our prowess in the space domain. The successful landing shows the potential of the Indian space sector and places India among the very few nations in the whole world who have achieved this feat. It is also a harbinger of the exciting opportunities that it brings for private players. It not only encourages the development of the lunar space economy but also signals a major change". "This signifies these moon landings will also further propel our actions towards creating a flourishing lunar economy and will encourage broader celestial exploration, from Mars and beyond. An important step forward in space exploration and commercialization will be with the inclusion of more private players and our growing spacetechnology startups in the future missions to make India a leader in the global space economy" he added.



## CHANDRAYAAN-3 COMMENTS



### PROF. A.V SUBBA RAO, EXPERT MEMBER-GOVT OF AP GUEST FACULTY-DEPARTMENT OF GEOMATICS JNTU-H

Indian Space Research Organisation Launched Chandrayaan 3 on July 14th, 2023, spacecraft entered lunar orbit on 5th August 2023, and successfully touched down near the Lunar South Pole region on 5th August 2023 creating space history and a challenge to masters in space sciences, like NASA, ROSCOMOS, China National Space Administration and many more. First Soft-landing on moon was achieved by USSR in 1966 when it soft-landed Robotic Luna-9 on Mare Plain, Oceanus Procellarum and Bharat became the First Country to Soft-Land Vikram at Lunar South Pole. Lunar South Pole is a mystery because the sun hovers below or just above the horizon over lunar surface, creating temperatures upwards of 130°F (54°C) during sunlit periods, and temperatures as low as -334°F (-203°C). Some of these craters are home to permanently shadowed regions which haven't seen sunlight for billions of years. Chandrayaan 3 Equipped with Laser Induced Breakdown Spectroscope LIBS to study presence of Sulphur, and other minerals like Al,Ca,Fe,Cr,Ti,Mn etc. Chandra's Surface Thermophysical Experiment, ChaSTE to study temperature profiles at 10 centimetre below lunar surface, below built by Laboratory for Electro Optics System. Further Vikram also carried M3 Moon Mineralogy Mapper provided by NASA. ISRO and Government of India aptly named the site of Vikram Lander as "Shiv Shakthi" anticipating many more surprises from Pragyan.

### PROF. VIVEKANANDA.D ADJ FACULTY IIT MUMBAI & IIST THIRUVANANTHAPURAM

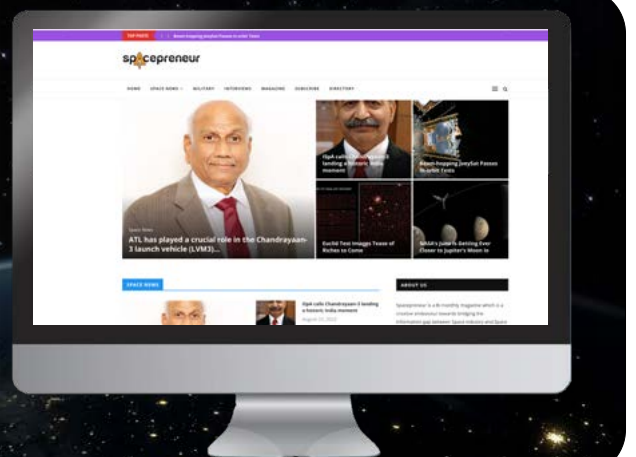
"The Chandrayaan-3 was put into orbit on July 14 in a copybook style by India's heavy-lift rocket LVM3."..... was aired live. After few days of eagerness by the Scientists across the globe when the soft landing happened and later, the six-wheeled rover rolled out to carry out experiments on the lunar surface for one lunar day which is equal to 14 Earth days. The Indian Scientists were looked upon with great warmth and earnestness. The country received accolades from not only Scientists but Geopolitically also, its stature is high and perceived as one of the Super Powers.



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## CHANDRAYAAN-3 COMMENTS

### DR SRIMATHY KESAN FOUNDER & CEO - SPACE KIDZ INDIA

On August 23, India's Chandrayaan-3 mission achieved a remarkable soft landing on the moon's near side, near the South Pole. This feat was orchestrated with unparalleled precision through the Automatic Landing Sequence (ALS) aboard the Vikram lander. In a tense 19-minute descent, the ALS flawlessly executed stages like rough braking, altitude-hold, fine braking, and terminal descent. This historic soft landing makes India the fourth nation to achieve this milestone, joining the elite club of the Soviet Union, the United States, and China. Beyond this achievement lies the promise of lunar economics, as the moon's abundant resources, including water ice and rare minerals, beckon us towards sustainable lunar exploration. The deployment of Pragyan, the rover, marked another milestone in precision engineering. Equipped with scientific instruments like Laser-Induced Breakdown Spectroscopy (LIBS) and the Alpha Particle X-ray Spectrometer, Pragyan has already begun unraveling lunar mysteries, detecting elements like aluminum, iron, calcium, chromium, titanium, and sulphur. Chandrayaan-3's success is a testament to the dedication and ingenuity of the ISRO team, firmly establishing India's position in lunar exploration and paving the way for groundbreaking scientific discoveries and economic prospects on the moon.



### DR. M SURESH KUMAR, PROFESSOR Head dept of Space Engineering Ajeenkya D Y Patil University

India has made remarkable space advances. On August 23, 2023, Chandrayaan 3 landed "Vikram" near the Moon's South Pole. The plane landed at 69.36 south, 32.28 east. Being as close to the South Pole, a "permanently shadowed region" where sunlight does not penetrate, increased the probability of finding frozen water-ice and other "harvestable resources" of the Moon and establishing the "lunar economy." The "lunar economy" includes all lunar resource production, usage, and trading on Earth, in space, and on the Moon. Travel is discussed. Today, more than the US and USSR compete to land on the Moon. In the distant future, governments and businesses will build permanent infrastructure on the Moon, space, and Earth. The US Department of Defense's Luna-10 programme invites private business to develop and produce lunar economic "foundational technologies". Government and corporate space agencies will launch roughly 400 scientific, robotic, and human-crewed Moon missions between 2022 and 2032. Before humans can mine the Moon, these missions must test "foundational technologies". Example: Artemis project. India: On October 22, 2008, India's Chandrayaan-1 probe became the eighth country to strike rather than soft-land on the moon. Chandrayaan-3 deployed the Vikram lander and Pragyan rover, which landed near the moon's South Pole on August 23, 2023. Fourth country to soft-land on moon was India.





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