

GAGAN



India's First Analog Mission

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Japan's LignoSat:
Pioneering Space with the
World's First Wooden
Satellite

A Historic Partnership:
SpaceX and ISRO
Collaborate to Launch
GSAT-N2

GAGAN is a **monthly magazine** about astronomy and space science published by **PSIT VYOMNAUTS** targeting amateur astronomers. Each issue includes astronomy news, spacelaunches, what's up in the sky every month, events and announcements done by the space team, astrophotographs and articles on astronomy and astrophysics submitted by readers for the general audience, and articles about historical missions and events of astronomy and more. This comes in an easy-to-understand, user-friendly style that's perfect for astronomers at any level.

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Space Insights

Space Missions and Launches

- Artemis Program:** NASA's Artemis program continued its progress toward returning humans to the Moon.
- SpaceX Starship:** SpaceX's ambitious Starship program made significant strides, with several test flights and development milestones.
- Commercial Space Stations:** Companies like Axiom Space and Nanoracks continued their efforts to develop commercial space stations.
- SpaceX Starlink:** SpaceX's Starlink satellite constellation expanded, providing internet access to more remote areas.

Celestial Highlights

- Leonid Meteor Shower:** This annual meteor shower peaked in mid-November, offering a spectacular display of shooting stars.
- Uranus at Opposition:** Uranus reached its closest point to Earth, making it an excellent opportunity for observation through telescopes.
- Full Beaver Moon:** A supermoon graced the night sky, appearing larger and brighter than usual.

Astronomical Discoveries

- Neptune-Sized Exoplanet:** Astronomers have discovered a rare Neptune-sized exoplanet, TOI-3261 b, with an orbital period of just 21 hours. This finding challenges existing models of planetary formation and provides new insights into the diversity of exoplanetary systems.

India's First Analog Mission



On October 27th, we celebrated the inauguration of this landmark habitat, with esteemed guests Vice Chancellor Shri Prof. S.K. Mehta from the University of Ladakh and Shri Xavier Raja, Program Director of ISRO's Human Space Program, gracing the occasion.

A Leap Towards Interplanetary Exploration

The **Indian Space Research Organisation (ISRO)** has embarked on a groundbreaking journey with the launch of its first analog space mission in Leh, Ladakh. This ambitious initiative, set amidst the pristine and isolated terrain of Ladakh, is a testament to India's growing aspirations in interplanetary exploration.



Simulating the Cosmos: Purpose of the Mission

The analog space mission aims to replicate the challenges and conditions of interplanetary missions to celestial bodies like the Moon and Mars. With humanity's eyes set on venturing beyond Earth's orbit, this simulation will provide critical insights and prepare astronauts for the rigors of long-duration space travel.

Key Objectives:

1. Testing Life-Support Systems: Evaluating the efficiency of life-support technologies in extreme environmental conditions.
2. Human Factors Study: Understanding the psychological and physiological impact of isolation and confinement on astronauts.
3. Strategic Development: Crafting robust strategies for survival and productivity in space.

By addressing these objectives, the mission will contribute to ensuring the safety, health, and effectiveness of future space crews.

Why Leh, Ladakh?

Leh was chosen as the mission's location for its stark resemblance to extraterrestrial environments. **With a dry, cold climate, barren landscapes, and high-altitude terrain, Ladakh offers an excellent analog for the Moon and Mars.** The extreme isolation of the region further enhances its suitability, providing an authentic backdrop for the challenges faced during interplanetary missions.



Hab-1: India's Home Away from Earth

Central to this mission is Hab-1, a compact and innovative inflatable habitat designed by Aaka Space Studio. Equipped to support life in harsh conditions, Hab-1 includes:

- A hydroponics farm to explore sustainable food production.
- A fully functional kitchen for long-term sustenance.
- Sanitation facilities essential for maintaining hygiene and health.

This habitat serves as a microcosm of future space habitats, blending cutting-edge technology with practical living solutions.



Collaboration: A Unified Vision

The mission exemplifies collaboration at its finest. It brings together diverse expertise from:

- **ISRO**, India's premier space agency.
- **Aaka Space Studio**, a trailblazer in space architecture.
- **University of Ladakh** and **IIT Bombay**, which provide academic and technological support.
- The **Ladakh Autonomous Hill Development Council**, fostering local engagement.

This synergy highlights the importance of multidisciplinary efforts in advancing space science.



A Gateway to the Stars

This analog mission is more than a simulation—it is a leap forward in India's quest to explore the unknown. The data collected will be instrumental in designing missions that are safer, more efficient, and better prepared for the myriad challenges of interplanetary exploration.

As the habitat in Leh echoes with the sounds of innovation and discovery, one thing becomes clear: India is steadfast in its journey to the stars. Through missions like this, the dream of interplanetary travel moves closer to reality, inspiring a new generation of space enthusiasts and scientists.



Japan's LignoSat

Pioneering Space with the World's First Wooden Satellite

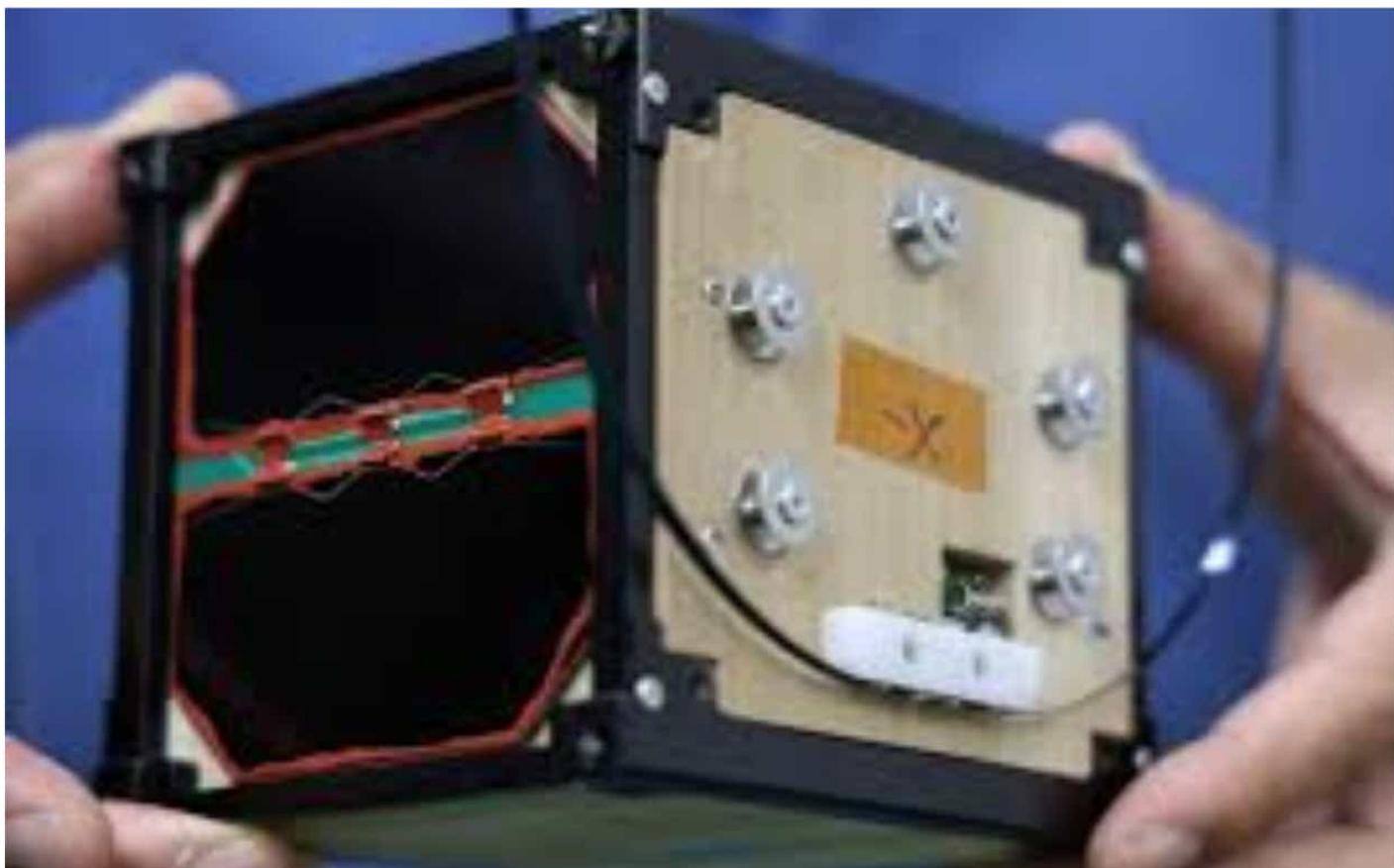
In an unprecedented move, Japanese researchers have launched **LignoSat, the world's first wooden satellite**, showcasing a novel and sustainable approach to space exploration. **This groundbreaking project, developed through a partnership between Kyoto University and Sumitomo Forestry**, is a testament to Japan's innovative spirit in addressing pressing environmental concerns while pushing the boundaries of space science.

A Wooden Wonder in Space

Launched aboard a **SpaceX mission** to the **International Space Station (ISS)**, LignoSat will orbit Earth at an altitude of approximately **400 kilometers**. What makes this satellite remarkable is its **primary material—wood**. The mission aims to evaluate the durability of timber in the harsh environment of space, including exposure to extreme temperatures, cosmic radiation, and microgravity.

The Science Behind LignoSat

The satellite's research objectives go beyond testing the **endurance of wood**. Scientists are particularly interested in its potential for **shielding sensitive components** like **semiconductors** from cosmic radiation. If successful, this innovative approach could pave the way for **lightweight, cost-effective, and environmentally friendly materials in space technology**.



Why Wood in Space?

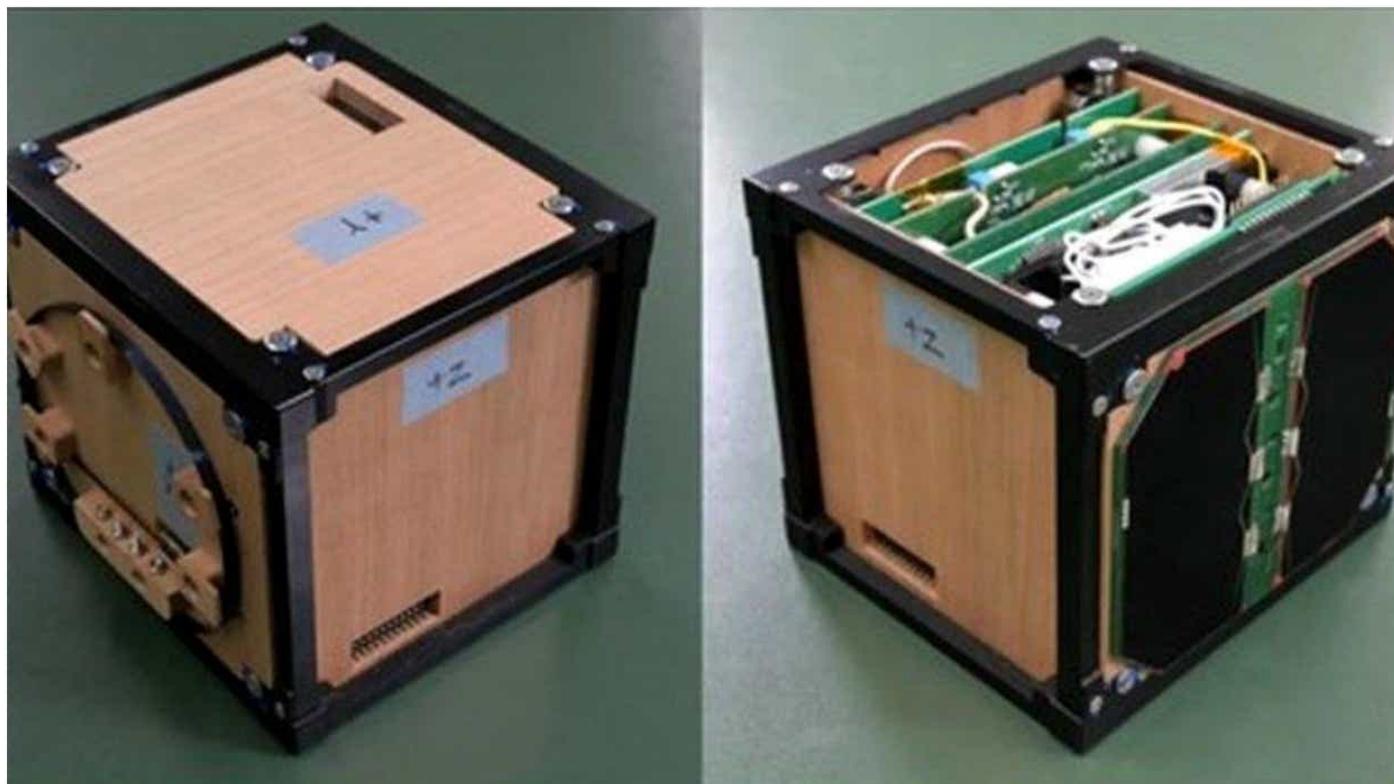
- **Sustainability:** Traditional satellites often contribute to space debris after decommissioning. Wooden satellites, being biodegradable, could mitigate this issue and mark a shift towards eco-friendly space missions.
- **Material Properties:** Wood is lightweight, durable, and abundant, making it an excellent candidate for cost-effective satellite construction.
- **Radiation Shielding:** Early studies suggest that wood may have unique properties for protecting electronic components from radiation.

A Collaboration for the Future

LignoSat is the result of years of collaboration between academia and industry. **Kyoto University** provided scientific expertise, while **Sumitomo Forestry** contributed its experience in **timber technology**. Together, they have demonstrated the potential of merging traditional materials with cutting-edge technology for futuristic applications.

Toward a Pollution-Free Space

One of the most significant challenges facing space exploration is the growing problem of **space debris**. With thousands of satellites orbiting Earth, the risks of collision and environmental degradation are increasing. Wooden satellites like LignoSat represent a bold step towards creating a **more sustainable approach** to space exploration.



The Road Ahead

LignoSat is not just a scientific experiment; it's a statement of intent. By reimagining materials used in satellite design, Japan is addressing the dual challenges of **advancing space technology** and **protecting the environment**. The insights gained from this mission could revolutionize the design of future space-based infrastructure, including data centers and long-term habitats.

A Step Closer to Sustainable Space Exploration

As LignoSat embarks on its journey around Earth, it **symbolizes a new era of innovation, sustainability, and environmental responsibility**. This mission serves as a reminder that our exploration of the cosmos should not come at the expense of our planet's health.

By turning to wood—a material as old as humanity itself—for cutting-edge space missions, Japan has shown that even in the pursuit of the stars, sustainability must remain at the forefront of our ambitions. LignoSat is a beacon of hope, proving that the future of space exploration can be as green as it is exciting.

A Historic Partnership: SpaceX and ISRO Collaborate to Launch GSAT-N2



On **November 19, 2024**, space enthusiasts worldwide witnessed a groundbreaking event as **SpaceX and the Indian Space Research Organisation (ISRO) joined forces for the first time**. This milestone collaboration marked the **launch of ISRO's GSAT-N2 communication satellite**, developed by **New Space India Limited (NSIL)**, aboard **SpaceX's reliable Falcon 9 rocket**. The mission took place from **the Cape Canaveral Space Force Station in Florida**, opening new horizons for international partnerships in space exploration.

A First-of-Its-Kind Collaboration

The **GSAT-N2 mission** marks the **first collaboration** between ISRO and SpaceX, uniting **SpaceX's advanced reusable rockets** with **ISRO's expertise in cost-effective space missions**. This partnership highlights the growing spirit of global cooperation in space exploration. The mission is significant for enhancing **India's communication capabilities**, promoting high-speed connectivity across urban and rural areas, and supporting ISRO's efforts to address socio-economic challenges through space technology.

The GSAT-N2 Satellite: A Marvel of Indian Engineering

The GSAT-N2, developed by NSIL—ISRO's commercial arm—carries state-of-the-art communication transponders to meet India's growing demand for data and communication services. The satellite will:

- Boost broadband and communication services in remote regions.
- Support digital initiatives and e-governance projects.
- Strengthen disaster management capabilities by enabling real-time communication during emergencies.

This satellite is a proud example of India's advanced capabilities in building indigenous space technology to meet the demands of a digitally connected future.



The Falcon 9 Launch: Precision and Reliability

SpaceX's Falcon 9 rocket has become synonymous with dependable launches and reusability, making it the ideal choice for deploying GSAT-N2. The launch vehicle, powered by nine Merlin engines, completed the mission flawlessly, placing the satellite in a geostationary transfer orbit.

Highlights of the Launch

- Reusability in Action: True to SpaceX's ethos, the Falcon 9's first stage returned to Earth and landed on the droneship "Just Read the Instructions" stationed in the Atlantic Ocean. This feat not only reduces costs but also reinforces SpaceX's commitment to sustainable spaceflight.
- Streamlined Integration: Coordinating between ISRO and SpaceX involved meticulous planning. Engineers from both agencies ensured seamless integration of GSAT-N2 with the Falcon 9 rocket, underscoring the importance of international teamwork.

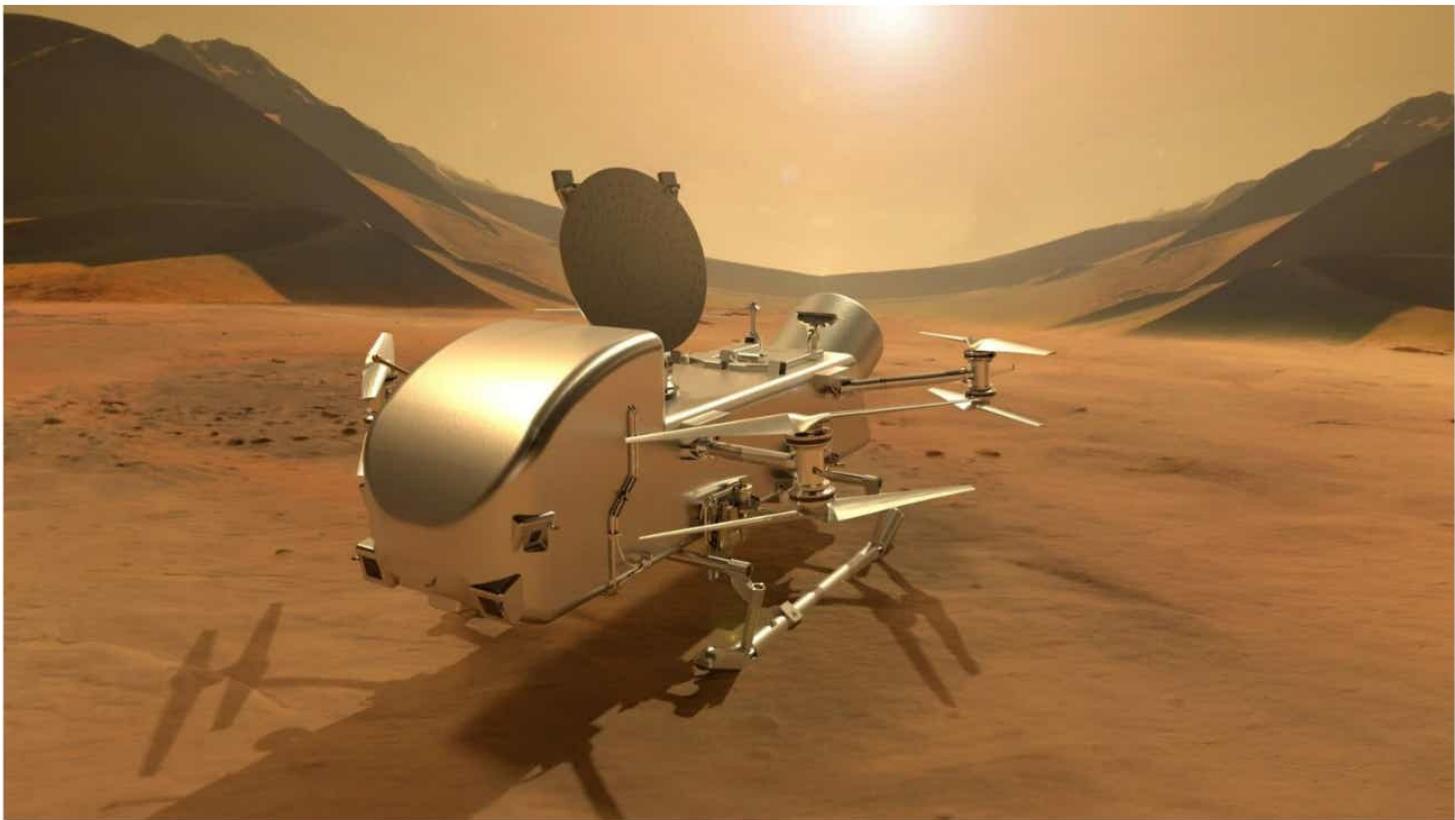


Looking Ahead

The successful launch of GSAT-N2 is just the beginning. With ISRO and SpaceX demonstrating the power of collaboration, the possibilities for future projects are endless. From Mars missions to lunar exploration and beyond, this partnership could redefine the future of space exploration.

For now, space enthusiasts can revel in the excitement of witnessing history unfold. The GSAT-N2 launch is not just a technical achievement; it's a reminder of what humanity can accomplish when we reach for the stars—together.

SpaceX to Power NASA's Titan Exploration Mission



NASA has selected SpaceX to launch its ambitious Dragonfly mission to Saturn's largest moon, Titan. The Falcon Heavy rocket, known for its immense power and reliability, will propel the rotorcraft-lander on its journey to this mysterious world.

A Giant Leap for Dragonfly

Scheduled for launch between July 5 and July 25, 2028, Dragonfly will explore Titan's diverse landscapes, including dunes, craters, and potential liquid hydrocarbon seas. This innovative mission aims to investigate the prebiotic chemistry of Titan, a world with conditions similar to early Earth, and search for signs of past or present life.

This significant contract, valued at \$256.6 million, underscores SpaceX's growing role in space exploration and its ability to deliver reliable launch services. As we eagerly await the launch, the Dragonfly mission promises to revolutionize our understanding of Titan and the potential for life beyond Earth.

400 Successful Falcon 9 Missions



SpaceX Soars to New Heights

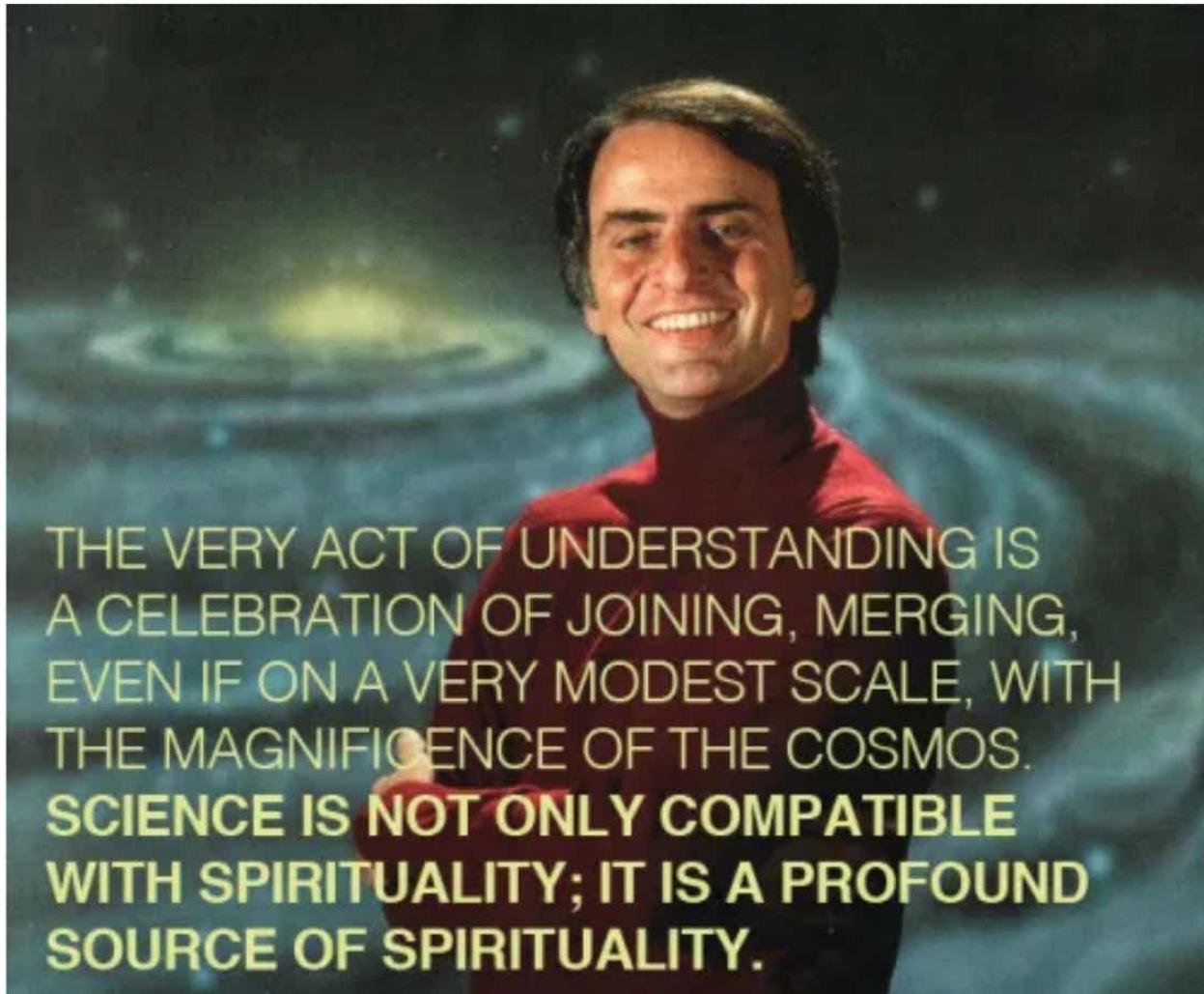
SpaceX, the revolutionary aerospace company led by visionary entrepreneur Elon Musk, has achieved a significant milestone. On November 27, 2024, the company successfully completed its 400th Falcon 9 mission. This remarkable achievement underscores SpaceX's dominance in the commercial space industry and its relentless pursuit of innovation.

A Milestone in Space Exploration

The Falcon 9, a reusable two-stage-to-orbit rocket, has redefined space travel. By pioneering reusable rocket technology, SpaceX has dramatically reduced the cost of accessing space, making it more affordable for both commercial and government entities. This has opened up new possibilities for satellite launches, scientific research, and human spaceflight.

As SpaceX continues to push the boundaries of space exploration, it is poised to shape the future of space travel. With ambitious projects like Starship, the company aims to make human missions to Mars a reality.

MEET THE ASTRONOMER



THE VERY ACT OF UNDERSTANDING IS
A CELEBRATION OF JOINING, MERGING,
EVEN IF ON A VERY MODEST SCALE, WITH
THE MAGNIFICENCE OF THE COSMOS.
**SCIENCE IS NOT ONLY COMPATIBLE
WITH SPIRITUALITY; IT IS A PROFOUND
SOURCE OF SPIRITUALITY.**

Carl Sagan (1934–1996), a renowned astronomer and science communicator, left a lasting legacy of curiosity and wonder about the universe. His pivotal work in NASA's Mariner, Viking, Voyager, and Galileo missions advanced the exploration of the solar system. Sagan's research on extraterrestrial life, including demonstrating amino acid production from basic chemicals, captivated global interest in the cosmos.

As an educator, Sagan's iconic series *Cosmos: A Personal Voyage* and his accompanying book brought astronomy and complex scientific ideas to the public in an accessible way. His writings, including *The Dragons of Eden* and *The Demon-Haunted World*, championed critical thinking and challenged pseudoscience. In *Pale Blue Dot*, Sagan reflected on Earth's fragility and the need for planetary stewardship, inspired by a Voyager 1 photograph of Earth.

Sagan's dedication to science, education, and reason continues to inspire future generations to explore the mysteries of the universe.



PSIT Vyomnauts Illuminate Young Minds with Solar Observation Outreach

The PSIT Vyomnauts Club recently conducted an impactful outreach event at Rajkiya High School, Rampur, Bhimsen District, Kanpur. The primary objective was to ignite curiosity and understanding of space science, specifically focusing on solar phenomena.

The event included a series of engaging activities:

- Interactive Session on Solar Science:** A comprehensive session explaining the Sun's structure, solar flares, and the significance of sunspots was conducted.
- Special Focus on 10th-12th Grade Students:** A dedicated session was held for 10th-12th grade students, providing detailed explanations of sunspots and their role in solar observations.
- Practical Solar Observation:** Participants had the opportunity to directly observe the Sun using solar telescopes equipped with safety filters. This hands-on experience allowed them to witness sunspots firsthand.
- Astronomy Quiz and Creative Activities:** A fun quiz and creative activities were organized to reinforce learning and stimulate critical thinking.

The event was attended by over 150 students from classes 10 to 12, along with 10 faculty members. The active participation of 4 PSIT Vyomnauts Club members, including Anushka V Shukla, Sadaf, Sakshi Bajpai, and Shikha, was instrumental in the success of the event.



The outreach initiative was met with positive feedback from teachers and students alike. The practical solar observation experience and the focused attention given to 10th-12th grade students were particularly appreciated.

The PSIT Vyomnauts Club plans to continue organizing such outreach events to inspire young minds and foster a deeper understanding of space science. By bridging the gap between theoretical knowledge and practical application, these initiatives aim to create a new generation of space enthusiasts.



INTRESTING SPACE FACTS

1.

A Day on Venus is Longer Than a Year

Venus spins so slowly on its axis that one day (243 Earth days) is longer than its year (225 Earth days). On top of that, it spins in the opposite direction of most planets, meaning the Sun rises in the west and sets in the east.

2.

There's a Giant Cloud of Alcohol in Space

Near the center of our galaxy, the Sagittarius B2 cloud contains enough ethyl alcohol to fill 400 trillion pints of beer! While it's not drinkable, it shows that even complex organic molecules can form in space.

3.

Space Smells Like Burnt Steak

Astronauts returning from spacewalks report a strange smell clinging to their suits—described as seared steak, welding fumes, or gunpowder. This is likely caused by dying stars emitting high-energy particles, which interact with materials on the suit.

4.

Diamonds May Rain on Jupiter and Saturn

Deep in the atmospheres of Jupiter and Saturn, immense pressure turns methane into diamonds. Scientists believe that these precious gems literally rain down, making these gas giants a sparkling mystery.

5.

The Largest Volcano in the Solar System is on Mars

Astronauts returning from spacewalks report a strange smell clinging to their suits—described as seared steak, welding fumes, or gunpowder. This is likely caused by dying stars emitting high-energy particles, which interact with materials on the suit.

Want to Join the Cosmic Adventure??

Join the PSIT Vyomnauts Space Club and embark on an extraordinary journey into the cosmos! This club offers unique opportunities for space enthusiasts to dive into hands-on projects, participate in prestigious competitions like NASA's Rover Challenge, and gain industry connections through networking and mentorship. Members can engage in satellite-building, astrophysics workshops, and access internships with organizations like ISRO. Vyomnauts also encourages creative expression through contributions to the space magazine Gagan and participation in cultural events. By joining, you'll help pioneer sustainable and ethical space exploration, working on projects to reduce space debris and innovate eco-friendly aerospace technology.

