

Determining atmospheric composition

Commemorating Kitty Hawk

A good precedent for debris mitigation

# AEROSPACE

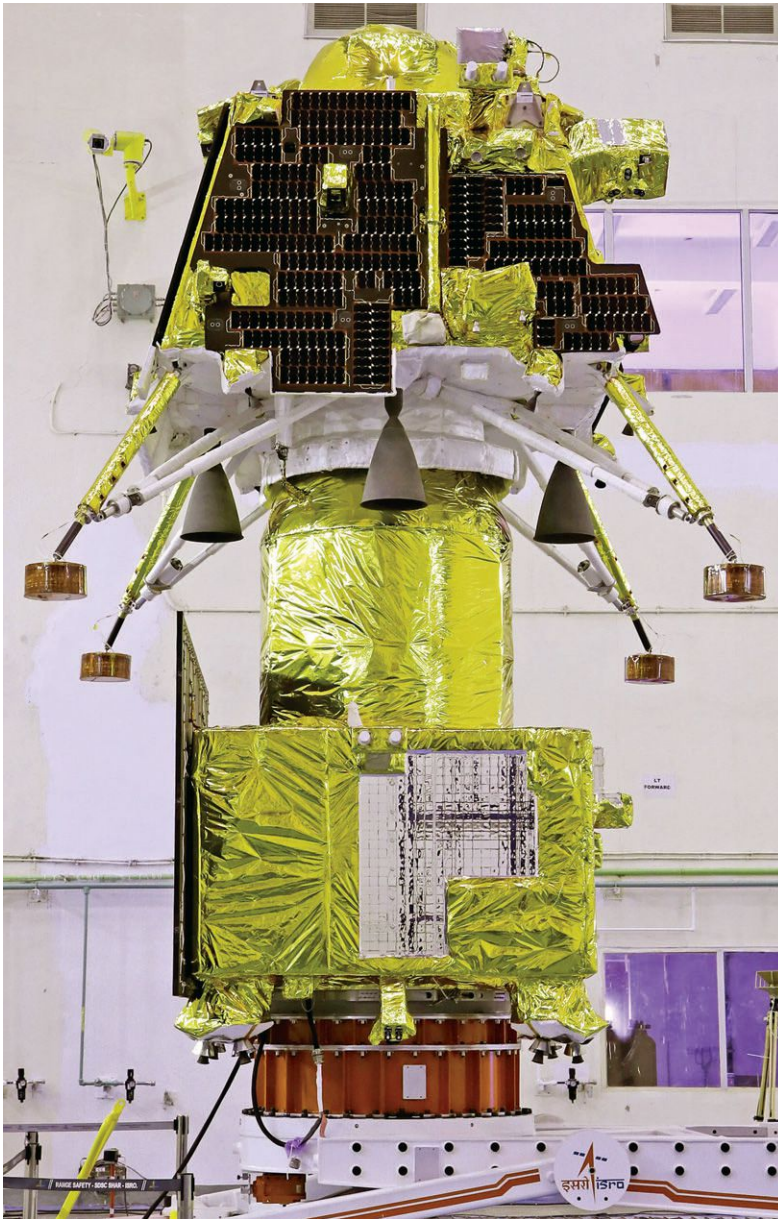
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2023

## YEAR-IN-REVIEW







## Exploration endeavors beyond Earth's orbit

BY GIANG LAM

The **Aerospace Power Systems Technical Committee** focuses on the analysis, design, test or application of electric power systems or elements of electric power systems for aerospace use.

▲ The Indian Space Research Organisation's Vikram lander, shown here ahead of its July launch, touched down near the lunar south pole in August under the Chandrayaan-3 mission. Indian Space Research Organisation

In September, NASA's **Origins, Spectral Interpretation, Resource Identification, Security, Regolith Explorer, or OSIRIS-REx**, returned samples from the asteroid **Bennu**. OSIRIS-REx released its capsule, which parachuted to a landing in Utah. It was the first U.S. mission to collect and return samples from an asteroid. The spacecraft and its capsule, built by **Lockheed Martin**, were launched in 2016 to rendezvous with Bennu, which is 1.36 astronomical units away from

Earth at the farthest point in its orbit. OSIRIS-REx descended toward the surface of Bennu in 2020 and collected an estimated 250 grams of rock and dust. Leading up to the September landing, NASA conducted a series of rehearsals, spacecraft operations and sample curation with the **Lockheed Martin, the U.S. Defense Department and University of Arizona** to prepare. The material collected from Bennu will offer scientists a window into the time when the sun and planets were forming about 4.5 billion years ago. After dropping off the sample capsule, the OSIRIS-REx spacecraft was renamed **OSIRIS-APEX**. It fired its engines to leave Earth orbit and head toward a rendezvous with the near-Earth asteroid Apophis in 2029.

NASA's **Jet Propulsion Laboratory** began the final assembly, test and launch operations for the **Psyche** asteroid probe in June after completing a comprehensive test campaign of the flight software, clearing the hurdle that kept Psyche from making its original 2022 launch window. The spacecraft was launched from Florida in October. Psyche is one of the first missions of its type to study a metal-rich asteroid, not one made of rock and ice, orbiting the sun between Mars and Jupiter. Psyche's two 75-square-meter solar arrays collect the energy to produce electrical power at low illumination solar distances of approximately 3.35 astronomical units. Electric **Hall Effect thrusters** are propelling the spacecraft on its four-year journey to the asteroid. One of the firsts of the Psyche mission was a November test of a sophisticated new laser communication technology — the **Deep Space Optical Communications**, which encoded data in photons at near-infrared wavelengths to transmit data between the probe in deep space and Earth.

In August, the **Indian Space Research Organisation** landed its **Vikram** spacecraft near the lunar south pole. The mission, Chandrayaan-3, was ISRO's second moon landing attempt and the country's third lunar mission. Soon after landing, Vikram deployed its solar-powered rover, **Pragyan**, which traversed the lunar surface. The **Laser-Induced Breakdown Spectroscopy** instrument onboard the rover preliminarily confirmed the presence of **sulfur and metals** on the surface, according to an ISRO statement in late August, with additional measurements showing the presence of **manganese, silicon and oxygen**.

India is the fourth country to land a spacecraft on the moon. Previous unsuccessful attempts include India's Chandrayaan-2 in 2019 and Japan company **ispace** in April, whose **HAKUTO-R** lander ran out of fuel during its descent and crashed. Underscoring the difficulty: Russia's **Luna 25** lander crashed into the moon in August during its attempted landing, just days before the Chandrayaan-3 landing. ★