Dr. MGR-ACS Space Technology Centre

SPACE EXPLORER

"An Ingress to Borderless world"

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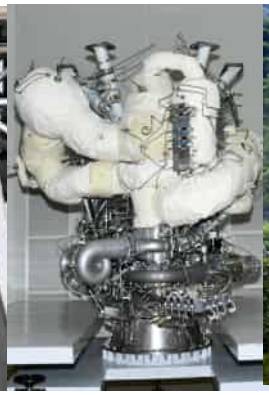
ISRO Successfully Commences Testing Of Semi-Cryogenic Engine



The Liquid Propulsion Systems Centre (LPSC) of ISRO has undertaken the design & development of a semi-cryogenic engine with 2000 kN thrust with Indian industry participation, and it will power the booster stages of future launch vehicles. The Indian Space Research Organisation has sucessfully commenced testing of its semi-cryogenic engines that would power future launch vehicles. The very first integrated test on an intermediate configuration of the 2000 kN (Kilonewton) semi-cryogenic engine carried out at the newly-commissioned Semicryogenic Integrated Engine & Stage Test facility at ISRO Propulsion Complex (IPRC) at Mahendragiri in Tamil Nadu on Wednesday was successful, the Bengaluru headquartered national space agency said. The test is a step towards developing a 2000 kN thrust engine, which works on Liquid Oxygen (LOX)-Kerosene propellant combination, for future launch vehicles, an ISRO statement said. The intermediate configuration, designated as Power Head Test Article (PHTA), comprises all the engine systems except the thrust chamber.

It was the first of a series of tests planned to validate the design of the propellant feed system, including the low-pressure and high-pressure turbo-pumps, the gas generator, and control components. This test demonstrated the complex chill-down operations spanning about 15 hours duration that was conducted successfully, meeting all the required conditions for engine start. After the chill down of the LOX circuit, the feed circuit of kerosene was filled, and LOX was admitted into the gas generator by opening the injection valve. Successful performance of the test article helps derive the sequence of operations for further tests," it said. The new facility at IPRC with a state-of-the-art Programmable Logic Controllers-based control system and data acquisition system, is capable of testing semi-cryogenic engines up to 2600 kN thrust and will support the subsequent testing and qualification of the fully integrated semi-cryogenic engine and stage, ISRO said. This test, the space agency said, has demonstrated the successful performance of the test facility and PHTA in the first attempt itself.

Rocket Lab launches 2 NASA satellites to study tropical storms and hurricanes like never before

The TROPICS cubesats lifted off today (May 7) from New Zealand. The first two satellites in NASA's new hurricane-hunting constellation have taken to the skies. The two cubesats, the founding members of the agency's TROPICS network, launched today (May 7) atop a Rocket Lab Electron rocket, which lifted off from the company's New Zealand site at 9 p.m. EDT (0100 GMT and 1 p.m. on May 8 local New Zealand time). About 33 minutes after lift-off, the Electron deployed the shoebox-sized TROPICS cubesats into low Earth orbit, about 340 miles (550 kilometers) above Earth. The TROPICS constellation (short for "Time-Resolved Observations of Precipitation Structure and Storm Intensity with a Constellation of Smallsats") will consist of four cubesats in low Earth orbit.

Rocket Lab will launch the other two satellites about two weeks from now, if all goes according to plan. (For the constellation to function properly, all four TROPICS satellites must be deployed within a same 60-day period.) The TROPICS cubesats will measure the hour-by-hour formation and progression of tropical cyclones and hurricanes with enhanced specificity.

"We'll be getting data that we've never had before, which is this ability to look in the microwave wavelength region in the storms, with hourly cadence to look at the storm as it forms and intensifies," TROPICS principal investigator Bill Blackwell said during a prelaunch press conference on April 28. "We hope to improve our understanding of the basic processes that drive the storms, and ultimately improve our ability to forecast and track intensity."

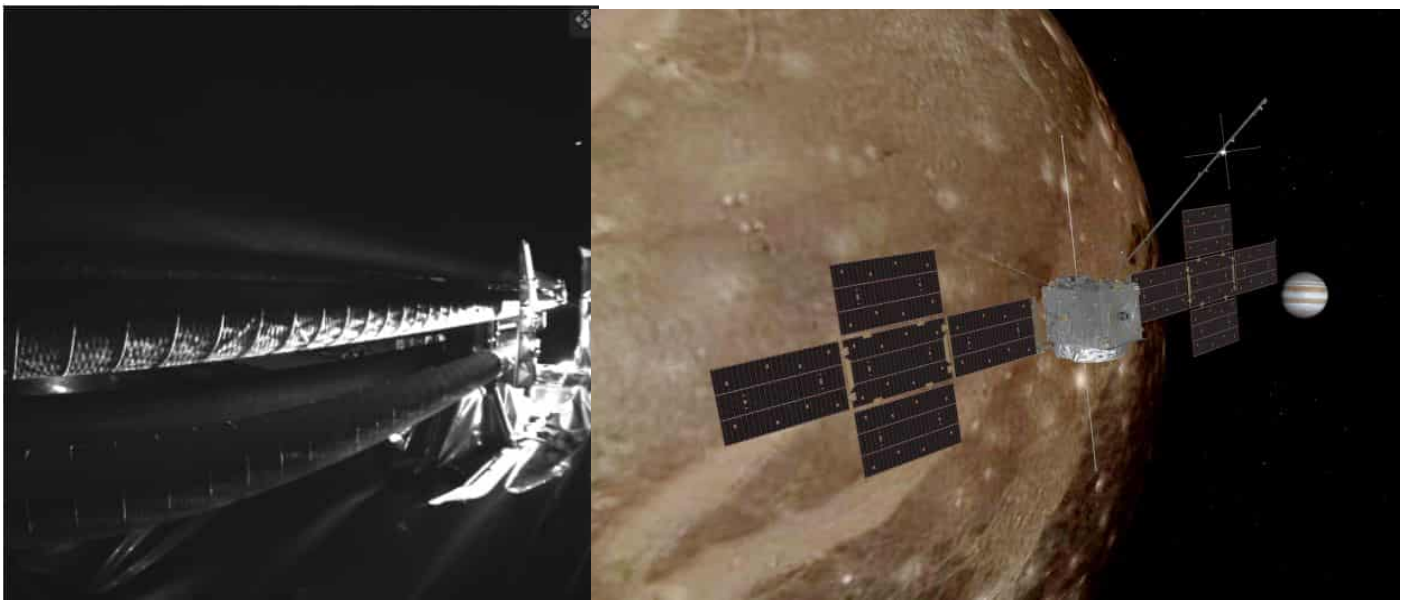
Researchers for the TROPICS program in NASA's Earth Science Division, such as Will McCarty, see missions like TROPICS as part of an innovation leap to augment much heftier, weather-focused satellites.

"It's the cubesat revolution," McCarty told reporters during the April 28 press conference. "In complementing the larger weather satellites, we are also getting some new innovation as well in these tiny compact sizes. These cubesats are about the size of a loaf of bread. So I would really like to stress the innovation on this mission."

"If we only get one of the two [launches] and we still have two satellites, there's still a lot to learn from these data," McCarty said during the April 28 press call, adding that the TROPICS observation cadence would be slowed if only two cubesats ended up making it to orbit.

Rocket Lab has been working to make the Electron's first stage reusable, recovering boosters on several previous flights. No recovery operations were performed today, however.

Europe's JUICE Jupiter probe fixes antenna glitch in deep space



JUICE finally managed to deploy its radar instrument.

Europe's flagship Jupiter probe finally managed to fix its antenna problem.

The Jupiter Icy Moons Explorer, or JUICE, just deployed its Radar for Icy Moons Exploration (RIME) antenna after more than three weeks of intense troubleshooting efforts, European Space Agency (ESA) officials announced on May 12.

That success is a big deal, because RIME is a key piece of JUICE's scientific package.

Once the probe arrives in the Jupiter system in July 2031, "it will use RIME to study the surface and subsurface structure of Jupiter's icy moons down to a depth of 9 km [5.6 miles]," ESA officials wrote in an update today. "RIME is one of 10 instruments on board JUICE set to investigate the emergence of habitable worlds around gas giants and the formation of our solar system."

The $1.1 billion (870 million euros) JUICE mission launched on April 14. Everything went well initially, except for the planned deployment of the RIME antenna: The instrument's 52-foot-long (16 m) boom got stuck.

The mission team suspected that a stuck pin was jamming the segments of the folded-up RIME antenna. They tried a number to tricks to jostle the pin loose — shaking JUICE using its thrusters, for example, and orienting the probe to be warmed by sunlight.

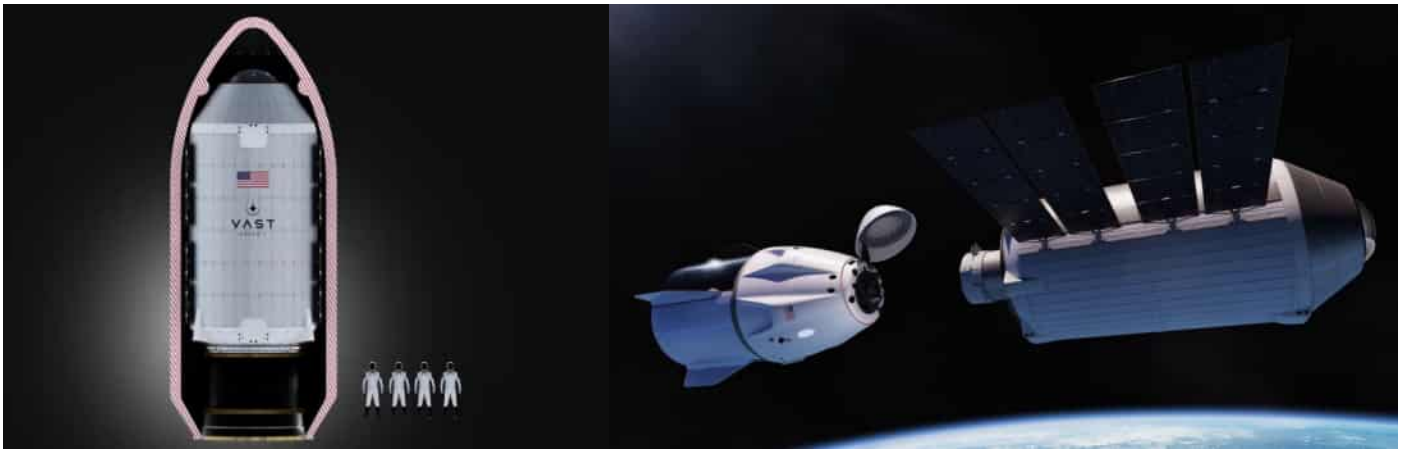
These techniques showed some promise, moving the pin a bit. But success didn't come until today, "when the flight control team fired a mechanical device called a 'non-explosive actuator' (NEA), located in the jammed bracket," ESA officials wrote in the update.

"This delivered a shock that moved the pin by a matter of millimeters and allowed the antenna to unfold," they added.

After arriving in orbit around Jupiter, JUICE will study the moons Ganymede, Callisto and Europa up close during a series of flybys. All three of these moons are thought to harbor oceans of liquid water beneath their icy shells.

If all goes according to plan, JUICE will enter orbit around the 3,270-mile-wide (5,260 km) Ganymede, the largest moon in the solar system, in December 2034. This will be a historic moment: No spacecraft has ever orbited a moon of a planet beyond Earth.

Vast Space to launch 1st private station on SpaceX rocket in 2025



Vast plans to build an artificial-gravity outpost in Earth orbit. The first-ever private space station could launch to Earth orbit a little over two years from now. California-based startup Vast Space plans to loft its Haven-1 outpost aboard a SpaceX Falcon 9 rocket no earlier than August 2025, the companies announced today (May 10).

That initial mission will be followed in quick succession by Vast-1, a four-person jaunt to the new station that could last up to 30 days. Vast-1 will also launch atop a Falcon 9, and its astronauts will ride on a SpaceX Dragon capsule.

"Vast is thrilled to embark on this journey of launching the world's first commercial space station, Haven-1, and its first crew, Vast-1," Vast CEO Jed McCaleb said in a press release today. "We are grateful to SpaceX for this exciting partnership that represents the first steps in Vast's long-term vision of launching much larger, artificial gravity space stations in Earth orbit and beyond."

Vast is young, founded just two years ago. And it's very hungry, as McCaleb's words suggest.

Eventually, the company aims to operate a "100-meter-long [330 feet] multi-module spinning artificial gravity space station launched by SpaceX's Starship transportation system," Vast representatives wrote in release. (Starship, the most powerful rocket ever built, is still in development; it flew in fully stacked mode for the first time just last month.)

"In support of this, Vast will explore conducting the world's first spinning artificial gravity experiment on a commercial space station with Haven-1," Vast added.

The company is selling up to four seats on Vast-1. (The ticket price has not been publicly released.) SpaceX will provide astronaut training, spacesuits and other such services for the mission, as it did for Ax-1, a private flight to the International Space Station (ISS) operated by Houston-based company Axiom Space in April 2022.

Haven-1 — which will eventually be incorporated as a module into a larger space station, if all goes according to plan — is one of several private outposts currently in the works.

For example, Axiom Space plans to launch several modules to the ISS in the next few years. This complex will then detach and become a free-flying outpost.

And in late 2021, NASA awarded a total of $415 million to three private teams led by Blue Origin, Nanoracks and Northrop Grumman. The space agency wants at least one commercial station to be up and running in low Earth orbit before the ISS retires at the end of 2030.

This snake robot could hunt alien life on icy moons like Saturn's Enceladus

'It needs to go down a 100-foot drop and not fall.'

Forget snakes on a plane; a new project is working on snakes on alien terrain.

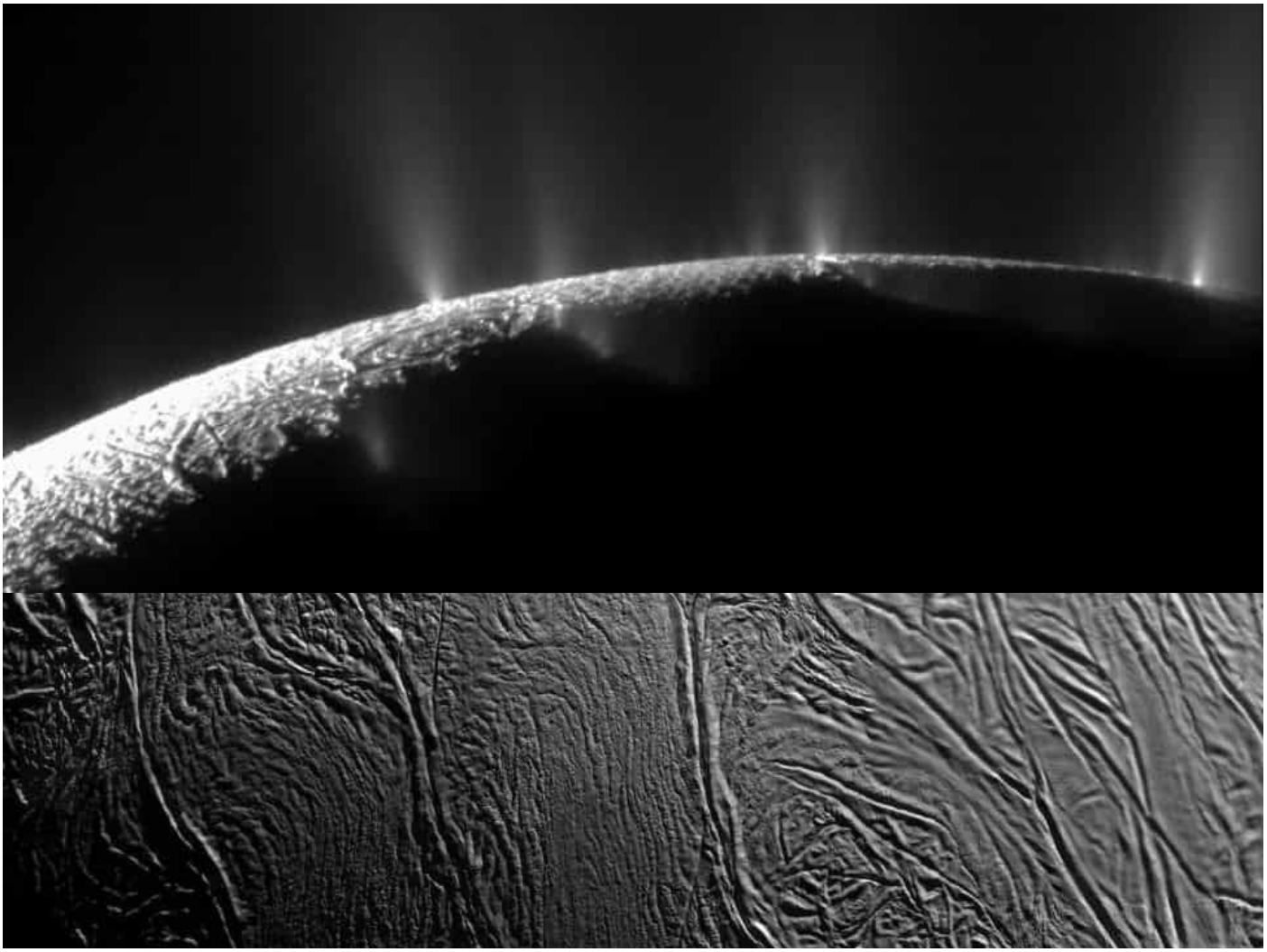
A slithering serpent could explore extreme terrain in icy moons like Enceladus at Saturn, according to team members from NASA's Jet Propulsion Laboratory (JPL) in California. Enceladus is famous for spouting water through its icy crust, and is one of the top spots to search for life in the solar system.

To navigate the crumpled moon's surface, the Exobiology Extant Life Surveyor (EELS) is designed to use several rotating segments connected in a series, to twist and bend itself like a snake across terrain otherwise impassable by rovers and other agile landers.

The JPL EELS team is using a "startup" mentality to move swiftly on the project, which is in early stages and not approved yet for a funded mission. "Build quickly, test often, learn, adjust, repeat," officials said on May 8 post on the JPL website, adding eerie video of the serpentine robot in action.

The rotating segments on EELS are wrapped in screw threads, which it uses to propel itself over a variety of surfaces. EELS' snake-like ability to move those segments independently allows the robot to exert pressure against the confines of tight spaces, to climb or descend areas conventional equipment would be incapable of reaching.

"It has the capability to go to locations where other robots can't go," sid EELS project manager Matthew Robinson in the JPL statement. "Though some robots are better at one particular type of terrain or other, the idea for EELS is the ability to do it all."



EELS has undergone several iterations, with the research team testing which materials and design specifications are best. The current version of the robot consists of 10 rotating segments, propelled by wider, 8-inch (20-centimeter) plastic screws for testing over looser terrain, and sharper metal screws for gaining traction in icy conditions.

So far, the team has tested EELS in several challenging environments: an ice rink, the sandy Mars Yard at JPL used for rover training, and even a "robot playground" setup at a ski resort in southern California.

The robot’s head will feature cameras and lidar to help EELS analyze and traverse different environments, part of which involves creating 3D maps of its surroundings. To test this, EELS researchers lowered a prototype of the snake-robot’s head into a glacial crack not dissimilar to one EELS might encounter on one of its primary targets: Saturn’s moon Enceladus. Enceladus is an icy moon orbiting our solar system's most prominently-ringed planet. Its surface is covered in long cracks known as tiger stripes, which spew jets of water from oceans beneath the miles-thick ice. These jets are expelled with such force that one of Saturn's rings is comprised of the ice particles ejected from Enceladus' orbit.

NASA measurements have detected large amounts of organic material within these plumes, and the space agency has tapped Enceladus as a major contender amongst planetary bodies in our solar system capable of supporting life. NASA will be counting on EELS to wriggle its way through the surface ice of Enceladus to hunt for the proof.

In addition to being highly maneuverable, EELS will also need to be fully autonomous. On average, a radio signal takes about 1.5 hours to traverse the distance between Saturn and Earth.

This time delay means EELS will need to interpret its surroundings, assess possible dangers, discern possible travel routes, differentiate and select targets for gathering data, and even recover from unexpected events — all completely autonomously. The EELS team began monthly hardware and software tests during 2022, largely to improve its independence skills.

"The robot has to figure out what the road is, and try to follow it," said Rohan Thakker, autonomy lead for the EELS project at JPL in the same statement, adding, "then it needs to go down a 100-foot drop and not fall."

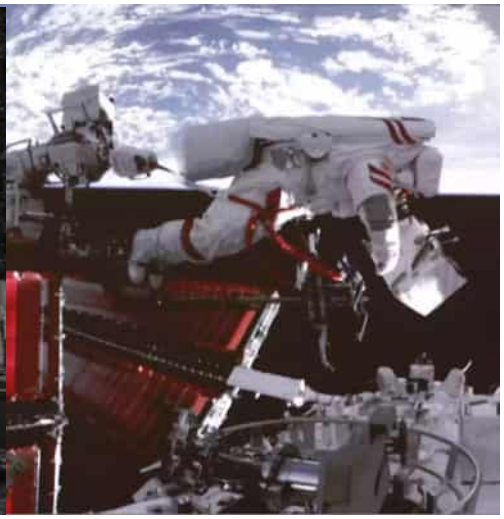
EELS may also have applications much closer to home than Enceladus. The JPL team anticipate EELS' adaptability being useful to researchers on Earth studying environments like glaciers and caves. It could also pivot to explore underground lava tubes and other subsurface geological features on closer worlds, like the moon and Mars.

Beyond its navigational sensors, no additional scientific equipment has been tested using EELS. "Our focus so far has been on autonomous capability and mobility, but eventually we'll look at what science instruments we can integrate with EELS," Robinson said.

Right now, with its 10-segment variant, EELS weighs about 220 pounds (100 kilograms), and measures 13 feet (4 meters) long. In the robot's final design, up to 48 actuators will be used to allow EELS greater flexibility than the current version, with room for research equipment and increasingly complex configurations to navigate unforgiving terrains.

While it's unclear when EELS or similar technology could fly to Enceladus, the most recent decadal survey for planetary science in 2022(opens in new tab) suggested a flagship "orbilander" mission to Enceladus, meaning an orbiter and lander combination. The lander could last up to two years on the surface and would arrive in the 2050s, assuming mission planning begins in earnest in the late 2020s. Uranus and its moons, however, ranked as a higher priority for visitation.

China to land astronauts on the moon by 2030, lunar scientist says



The country is already making progress with needed moon landing hardware.

China will definitely put boots on the moon within the next seven years, according to a leading Chinese lunar scientist.

"By 2030, the Chinese people will definitely be able to set foot on the moon. That's not a problem," Wu Weiren, chief designer of China's lunar exploration program, told Chinese broadcaster CCTV on April 18, ahead of the country's national "space day" on April 24.

China is already working on the necessary hardware for landing astronauts on the moon. The country is developing a next-generation rocket to launch an upgraded crew spacecraft, while work is underway on a lunar lander.

The new rocket is scheduled for a test flight in 2027, while the new spacecraft has already flown an uncrewed mission.

Wu Yansheng, chairman of China Aerospace Science and Technology Corporation (CASC), the country's main space contractor, presented an animated sequence earlier this year giving an impression of what the future Chinese crewed lunar landing might look like.

The mission referred to by Wu Weiren would allow a short-term stay on the lunar surface. But China is also eyeing building a permanent base, known as the International Lunar Research Station, which is planned to be constructed in the 2030s.

The first steps for this ambitious project include robotic missions to the lunar south pole to test using 3D printing technology to create Lego-like bricks from lunar soil.

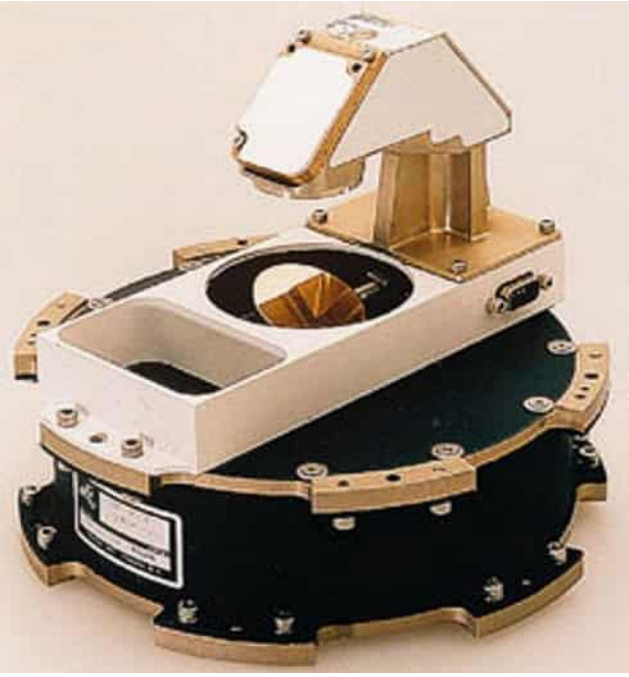
"For questions of whether we can build a house, make bricks and have access to communication services on the moon, they are expected to be verified by Chang'e 8 experiments, which will provide a guarantee for large-scale lunar scientific exploration in future," Wu said, referring to a robotic mission scheduled to launch in 2028.

China is also seeking partners for the venture, just as the United States is drawing support for its Artemis program.

"The International Lunar Research Station built by China is open [to international partners]. We welcome the participation of developed countries such as the United States and European countries. We also hope that BRICS countries and some developing African countries will join us," Wu said. (BRICS is short for Brazil, Russia, India, China and South Africa.)

"We have put forward an initiative for all to sign contracts, deals or strategic agreements of intent."

Reaction Wheels: A Key Technology for Spacecraft Attitude Control



Reaction wheels are a key technology for spacecraft attitude control. They are used to keep spacecraft stable and pointing in the desired direction. Reaction wheels work by storing angular momentum. When a reaction wheel is spun up, it acquires angular momentum. When the wheel is then commanded to stop spinning, it will exert a torque on the spacecraft in the opposite direction, causing the spacecraft to rotate.

Reaction wheels are a very efficient way to control spacecraft attitude. They are also very reliable and have a long life. However, reaction wheels have some limitations. They can only store a limited amount of angular momentum, and they can be damaged if they are spun too fast.

Despite their limitations, reaction wheels are an essential technology for spacecraft attitude control. They are used on a wide variety of spacecraft, including satellites, space telescopes, and space probes.

Here are some of the advantages of using reaction wheels for spacecraft attitude control:

They are very efficient. Reaction wheels do not require any propellant to operate.

They are very reliable. Reaction wheels have a long life and are not susceptible to the same kind of failures as other attitude control systems, such as thrusters.

They are very precise. Reaction wheels can be used to control spacecraft attitude with very high accuracy.

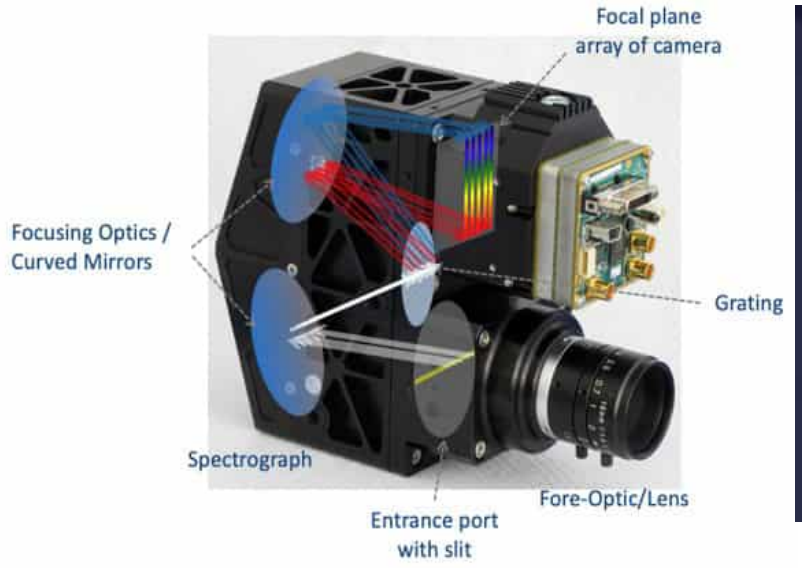
Here are some of the disadvantages of using reaction wheels for spacecraft attitude control:

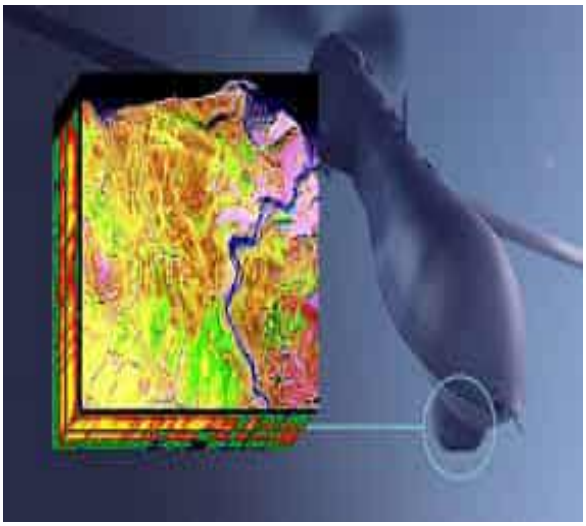
They can only store a limited amount of angular momentum. This means that they can only be used to control spacecraft attitude for a limited period of time.

They can be damaged if they are spun too fast. This is a potential safety hazard.

Overall, reaction wheels are a very important technology for spacecraft attitude control. They offer a number of advantages, such as efficiency, reliability, and precision. However, they also have some limitations, such as a limited capacity for storing angular momentum.

SPACE SENSORS





Hyperspectral cameras are a new technology that is revolutionizing space exploration. These cameras can capture images of objects in space with a much higher level of detail than traditional cameras. This allows scientists to study objects in space in a way that was never before possible.

Hyperspectral cameras work by splitting the light from an object into its component wavelengths. This allows scientists to see the object in a much more detailed way than they could with a traditional camera. For example, hyperspectral cameras can be used to identify different types of rocks on the surface of planets. They can also be used to study the atmospheres of planets and moons.

Hyperspectral cameras have already been used to make a number of important discoveries in space exploration. For example, they were used to help scientists identify water on Mars. They have also been used to study the atmosphere of Venus and to map the surface of the Moon.

Hyperspectral cameras are a powerful new tool for space exploration. They are opening up a whole new world of possibilities for scientists. In the future, hyperspectral cameras are likely to play an even greater role in space exploration.

Some of the advantages of using hyperspectral cameras for space exploration:

They can provide a much higher level of detail than traditional cameras.

They can be used to study a wide variety of objects in space, including planets, moons, asteroids, and comets.

They can be used to study the atmospheres of planets and moons.

They can be used to identify different types of rocks and minerals on the surface of planets.

They can be used to map the surface of planets and moons.

Here are some of the disadvantages of using hyperspectral cameras for space exploration:

They are expensive to develop and build.

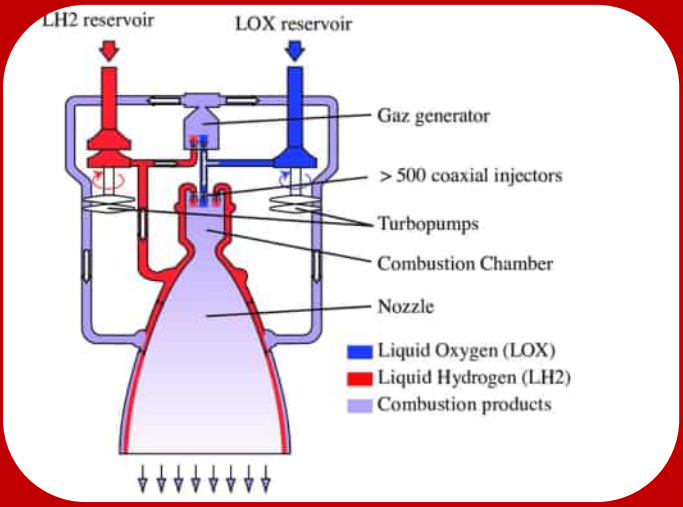
They are complex to operate.

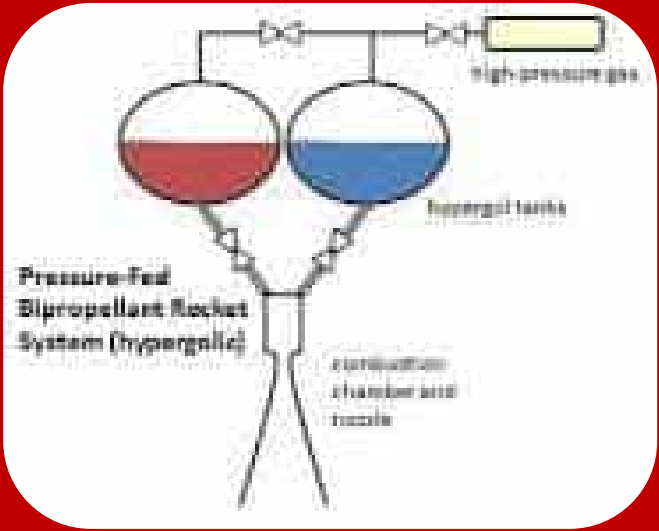
They can only be used on spacecraft that are equipped with the necessary sensors and equipment. Overall, hyperspectral cameras are a powerful new tool for space exploration. They offer a number of advantages, such as a high level of detail, a wide range of applications, and the ability to identify different types of objects in space. However, they also have some disadvantages, such as their high cost and complexity.

Space Terms to know about

Liquid Rocket Engine (LRE) :

A rocket engine that uses liquid propellants. The fuel and oxidizer are stored separately and combined in the combustion chamber before ignition.



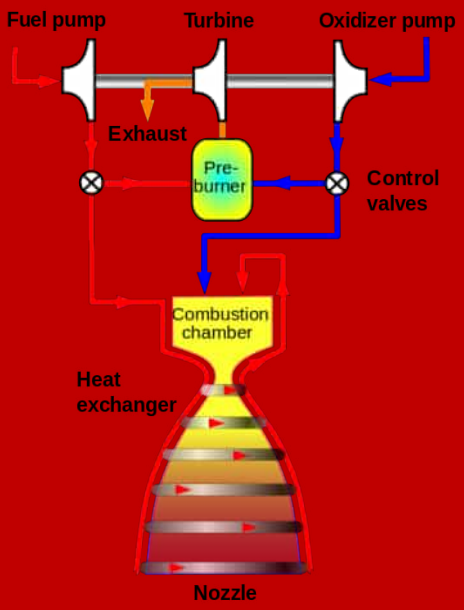


Hypergolic Propellant :

A type of liquid propellant combination that ignites spontaneously upon contact. Hypergolic propellants eliminate the need for an ignition system, simplifying engine design.

Gas Generator Cycle :

A propulsion cycle commonly used in liquid rocket engines. It involves diverting a small portion of the propellant flow to generate high-pressure gas, which drives the turbine to power the propellant pumps.



Space-Tech Company

AGILE SPACE INDUSTRIES

Agile Space Industries is an aerospace company that develops and manufactures in-space propulsion products. The company was founded in 2015 and is headquartered in Durango, Colorado. Agile Space Industries' products are used in a variety of applications, including satellite attitude control, spacecraft maneuvering, and launch vehicle upper stages. The company is committed to providing high-quality, reliable in-space propulsion products that meet the needs of its customers.