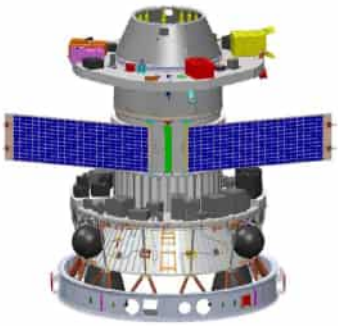
Dr. MGR-ACS Space Technology Centre

SPACE EXPLORER

"An Ingress to Borderless world"

Volume 02/Issue-08 Bimonthly 16-30, April 2023

ISRO's PSLV-C55 lifts off with two Singaporean satellites, 7 Indian 'experiments' in textbook launch



The PSLV-C55 mission launched with two satellites, with the primary one being the TeLEOS-2, a Synthetic Aperture Radar (SAR) payload. The two satellites belong to Singapore and combined weighed 757 kilograms. This was the third big launch of the year for the Indian space agency, which is in the midst of prepping for bigger missions going forward including the Chandrayaan-3 and the maiden solar mission, Aditya L-1. Isro chief S Somnath, declaring the mission successful, said that PSLV placed both satellites in their intended orbit. "In its 57th mission, PSLV has demonstrated its higher reliability, and congratulations to the team and the NSIL for this mission," Somnath added. The PSLV-C55 mission was launched with two satellites, with the primary one being the TeLEOS-2, a Synthetic Aperture Radar (SAR) payload, which will be able to provide all-weather day and night coverage, and capable of imaging at 1m full-polarimetric resolution. Meanwhile, the second payload was developed for the technology demonstration of the High-Performance Space-borne VHF Data Exchange System (VDES). The 16-kilogram LUMELITE-4 is co-developed by the Institute for Infocomm Research (I2R) of A*STAR and the Satellite Technology and Research Centre (STAR) of the National University of Singapore. The third big highlight of the mission is the PSLV Orbital Experimental Module, also called the POEM, which is a repurposed fourth stage of the rocket that normally ends as space debris. Isro has now developed it to be used as an experimental platform to conduct tests with non-separable payloads. The Poem carries seven such experimental payloads from Isro, Bellatrix, Dhruva Space, and the Indian Institute of Astrophysics. The payloads have an operational lifetime of 30 days in space. The mission, which lasted for just about 20 minutes from launch to deployment of the two customer satellites, performed nominally on all stages. The three stages separated with precision and, on time, pushing the two satellites to the required altitude above the planet. The satellites were deployed at an altitude of over 600 kilometers above the planet.

SpaceX's 1st Starship launches on epic test flight, explodes in 'rapid unscheduled disassembly'

Starship packed a lot of action into four minutes of flight. Well, that was an eventful four minutes. SpaceX's huge Starship vehicle launched toward space for the first time ever today (April 20), rising into the sky from the company's Starbase facility in South Texas. Starship didn't make it to the final frontier, however; its mission ended with a bang just under four minutes after liftoff, sending pieces of the stainless-steel craft raining into the Gulf of Mexico. But this was no disaster, SpaceX stressed. The company wasn't expecting full success on the debut space launch, and it cheered the boxes that Starship managed to check. The giant rocket-spaceship combo cleared Starbase's launch tower, for example, and survived Max-Q, the point during launch when the stresses are highest on a vehicle. "Congratulations to the entire SpaceX team on an exciting first integrated flight test of Starship!" the company tweeted shortly after the vehicle's "rapid unscheduled disassembly." "With a test like this, success comes from what we learn, and today's test will help us improve Starship's reliability as SpaceX seeks to make life multi-planetary," it added in another tweet. There's no point in speculating about what caused today's test flight to come to such a dramatic end; SpaceX is analyzing the data and will let us know what the investigation determines. But it is worthwhile to highlight some of the milestones that Starship notched today, as well as the moments that didn't go according to plan.

The biggest success was getting aloft at all. Starship climbed high into the South Texas sky, achieving a maximum altitude of about 24 miles (39 kilometers), according to the data tracker SpaceX provided during its launch webcast.

A failure on the pad today would have been a serious letdown — especially if it resulted in an explosion that destroyed Starbase's gigantic orbital launch tower. That was likely the one outcome SpaceX hoped to avoid, as it would have set back their operations at the South Texas site considerably.

"To get this far is, honestly, amazing," SpaceX's Kate Tice said during the launch webcast today. "Everything after clearing the tower was icing on the cake."

And clearing the tower is quite an involved process. Not only do Starship's 33 first-stage Raptor engines — or a high percentage of them, anyway (see below) — have to operate normally, so does all of the tower hardware.

"Everything released," SpaceX's John Insprucker said during the launch webcast. "The hold-downs, the quick-disconnect arms — everything move[d] out of the way" according to plan.

Rocket Lab to fly used engine for 1st time later this year

The company is about to take a big step toward rocket reusability. Rocket Lab is about to take a big step toward reusability. The company announced today (April 19) that it plans to incorporate a used Rutherford engine in one of its Electron rockets, which will launch on a commercial mission later this year. And success on that flight could pave the way for an even bigger milestone. "Rocket Lab will assess the opportunities for flying a complete pre-flown first stage booster following the launch of the pre-flown Rutherford engine in the third quarter this year," company representatives wrote in an update The 59-foot-tall (18 meters) Electron can haul 660 pounds (300 kilograms) of payload to low Earth orbit. The rocket is powered by nine 3D-printed Rutherford engines in its first stage and one in its second stage. (Electron also features an upper "kick stage," which delivers satellites to precise orbits.) Electron has flown more than 30 orbital missions to date, all of them in an expendable configuration. But Rocket Lab wants to make the vehicle's first stage reusable, and it's made strides toward that goal over the past few years. For example, the company has recovered Electron boosters after six different orbital launches, then subjected the hardware to a variety of analyses and tests. This work suggests that reusability is a viable prospect going forward, Rocket Lab has said.

The engine that will make the company's first re-flight originally launched in May 2022, on a mission that Rocket Lab called "There and Back Again." The company managed to catch the falling booster with a helicopter shortly after lift-off on that occasion, though the pilots released it on purpose because they didn't like how the chopper was handling with its new load.

The helicopter snag had been Rocket Lab's go-to method of booster recovery. But analyses have shown that Electron first stages do just fine with parachute-aided ocean splashdowns, so the choppers will now be put on the back burner.

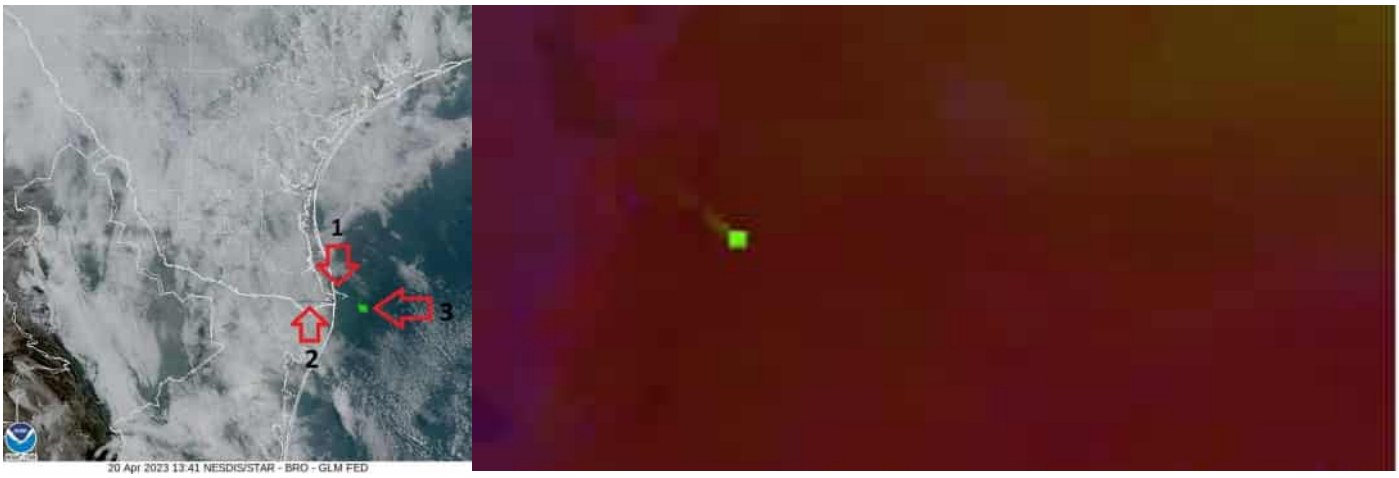
The company "is moving forward with marine operations as the primary method of recovering Electron for re-flight," Rocket Lab wrote

This rocket-reuse update isn't the only news Rocket Lab has made recently. On Monday (April 17), for example, the company unveiled a new suborbital rocket called HASTE (short for "Hypersonic Accelerator Suborbital Test Electron").

As that name suggests, HASTE is derived from the Electron and will be used as a suborbital testbed for hypersonic vehicles.

"HASTE provides reliable, high-cadence flight test opportunities needed to advance hypersonic system technology development, with the inaugural launch scheduled to take place in the first half of 2023 for a confidential customer," Rocket Lab wrote in an update

SpaceX Starship's debut launch attempt seen from space (satellite photos)



The enormous cloud of billowing smoke produced by SpaceX's megarocket during its debut launch attempt was clearly visible as far as 22,000 miles away from Earth.

An American weather satellite witnessed the semi-successful debut launch of SpaceX's Starship megarocket from space.

The GOES-16 satellite operated by the U.S. National Oceanic and Atmospheric Administration (NOAA) observed today's (April 20) Starship launch attempt from its perch in geostationary orbit about 22,000 miles (36,000 kilometers) above Earth. Satellites at this altitude circle our planet at a velocity that matches the speed of the planet's rotation, which means that GOES-16 was able to enjoy the spectacle without haste as it has a constant view of the U.S. East Coast.

The satellite was able to clearly distinguish the enormous cloud of smoke that enshrouded the launchpad in Boca Chica, Texas, as the 33 engines of Starship's Super Heavy first stage ignited. The view from space then shows the smoke dispersing above the Atlantic Ocean.

After successful liftoff, Super Heavy continued to fire for about three minutes. But as the first stage was set to separate from the Starship upper stage, something went wrong and the entire stack began to tumble instead, eventually exploding in a series of fireworks. In the GOES-16 timelapse, a small white spot can be seen separating from the cloud shortly after liftoff and descend toward the blue ocean surface.

"Even though the @SpaceX starship didn't make orbit, it still provided one heck of a fireworks show," British Earth-observation scientist Simon Proud, who shared the images on Twitter, said in a tweet.

The weather forecasting craft also captured an infrared view of the landmark test launch, revealing the temperature signature of the rocket's engines as they fired up.

The U.S. National Weather Service (NWS) posted its own version of the GOES-16 imagery, highlighting where in the image to look for the rocket's condensation trail, the trail's shadow and even the flash of the rocket's "rapid unscheduled disassembly" as SpaceX dubbed the failure.

Other satellites were able to photograph Starship launch preparations as technicians readied the 394-foot-tall (120 meters) rocket for the debut flight. The Pleiades Neo satellite of the European aerospace company Airbus took a series of images zooming onto the launch pad and the rocket towering over it.

Although Starship failed to reach orbit during the debut launch attempt, SpaceX said it considered the flight a success and will have another go in a few months.

Russia agrees to stay aboard International Space Station through 2028

Russia's departure from the International Space Station (ISS) program isn't so imminent after all.

Last year, shortly after Russia invaded Ukraine, Russian space officials said the nation would leave the ISS partnership sometime after 2024, so it could focus on building its own outpost in low Earth orbit.

That vague departure date left open the possibility that Russia would actually stay aboard for a few more years — and that's exactly what's going to happen, we learned today (April 27).

"Russia has confirmed it will support continued station operations through 2028," NASA officials wrote in an update this afternoon.

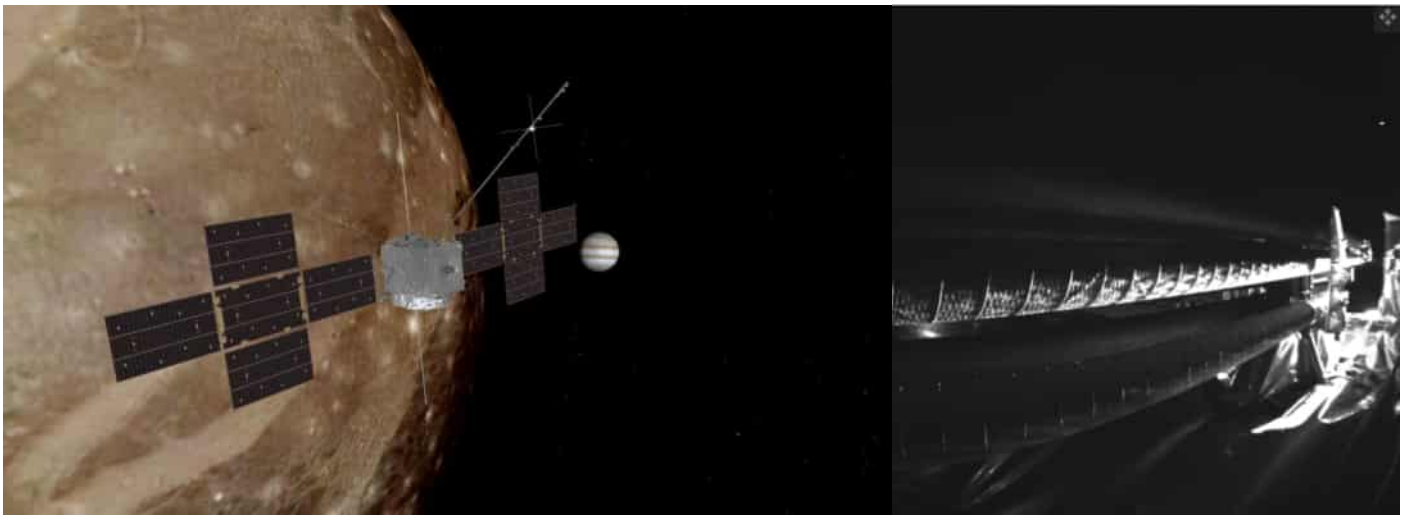
The other major ISS partners — the space agencies of Europe, Canada and Japan — have signed on through 2030, the update added, joining NASA in committing to the orbiting lab through the envisioned end of its operational life.

The ISS partners began building the orbiting lab in 1998, and it has been continuously occupied by rotating astronaut crews since November 2000.

During that time, 266 people from 20 different countries have visited the ISS and conducted more than 3,300 experiments in its unique microgravity conditions, according to NASA officials.

"Now, in its third decade of operations, the station is in the decade of results when the platform can maximize its scientific return," agency officials wrote in today's update. "Results are compounding, new benefits are materializing, and innovative research and technology demonstrations are building on previous work." Though the ISS still has considerable life left in it, NASA is already preparing to pass the baton in low Earth orbit (LEO). The agency is funding the development of multiple private space station concepts, with the hope that at least one of them will be up and running before the ISS meets its end in a fiery (but controlled) reentry to Earth's atmosphere. A sustained crewed presence in LEO over the long haul is key to humanity's quest to extend its footprint to the moon and Mars, NASA officials have said. Commercial LEO outposts will not only allow us to keep learning about how off-Earth life affects the body, they say, but will also help stimulate an orbital economy that can drive expansion out into deep space.

Europe's JUICE Jupiter probe has an antenna glitch in deep space



Engineers "have lots of ideas up their sleeves" to fix the issue, the European Space Agency says.

Europe's flagship Jupiter mission is struggling to unfurl an antenna in deep space.

The Jupiter Icy Moons Explorer or JUICE spacecraft has a stuck antenna on one of its instruments, European Space Agency (ESA) officials reported Friday (April 28). The instrument is designed to penetrate the icy surface of Jupiter moons using radar, to seek signs of habitable conditions for life in the waters beneath.

"A matter of millimeters could make the difference to set the rest of the radar free," ESA officials wrote in an update. Teams working on the partially deployed antenna "have lots of ideas up their sleeves" to free up the jam, they added.

The $1.1 billion (870 million euros) JUICE launched on April 14 for an expected arrival at Jupiter's system in July 2031, where it will spend years flying around the icy Jupiter moons and learning more about their potentially life-friendly environments.

While 10 of the 11 spacecraft instruments are working fine so far, the spacecraft's Radar for Icy Moons Exploration (RIME) antenna is jammed in its mounting bracket. Engineers suspect a tiny stuck pin is holding it in place.

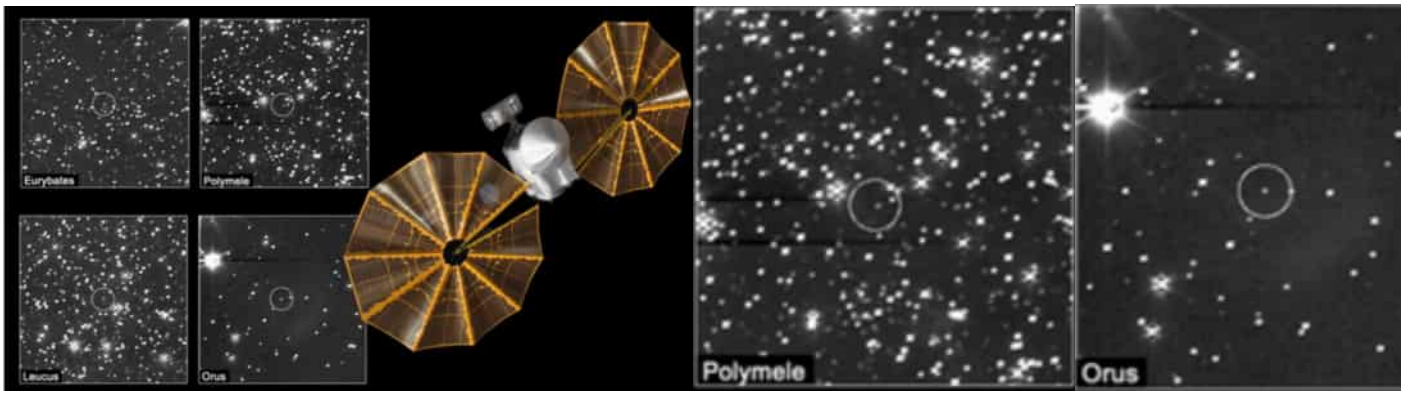
"Various options are still available to nudge the important instrument out of its current position," ESA officials wrote. "The next steps to fully deploy the antenna include an engine burn to shake the spacecraft a little, followed by a series of rotations that will turn JUICE, warming up the mount and radar, which are currently in the cold shadows."

Commissioning, or the first steps of getting a spacecraft ready for its mission, is ongoing for about the next two months. ESA officials emphasized there is "plenty of time for teams to get to the bottom of the RIME deployment issue" in the time remaining.

Assuming the 52-foot (16-meter) antenna unjams, it will allow JUICE to see as far as 20 feet (9 meters) underneath Jupiter moons like Ganymede or Europa. Europa in particular has shown signs of spewing water into space, suggesting the ice has exposure to the outside environment.

This is not the first time a Jovian mission faced antenna issues. NASA's Galileo mission never was able to deploy its high-gain antenna properly ahead of visiting Jupiter and its icy moons between 1995 and 2003. The mission still sent data back home, but at a lower rate than designed for.

NASA's LUCY mission snaps its asteroid targets for the 1st time



The asteroid-hopping spacecraft spotted four of the Jupiter Trojan asteroids that it will visit from 2027 onwards.

NASA's asteroid-hopping mission LUCY has captured the first images of its asteroid targets. The images of the asteroids, some of which are still 330 million miles (530 million kilometers) away from the spacecraft, were captured by LUCY between March 25 and March 27, 2023.

Despite being around three times the average distance between the sun and Earth from the asteroids, and the relatively small size of the space rocks, LUCY was able to catch four of its eight targets, Eurybates, Polymele, Leucus, and Orus. The images were taken with the spacecraft's highest resolution imager, L'LORRI.

LUCY launched on Oct. 16, 2021 on a 12-year mission to become the first spacecraft to study the Jupiter Trojan asteroids, a group of space rocks gravitational bound to the largest planet of the solar system that are orbiting the sun together with the gas giant. The spacecraft will also become the first mission in history to visit so many different destinations in independent orbits around the sun.

LUCY will first make two passages of Earth performing gravity assist flybys that grant it energy and put it on a trajectory to reach six Trojan asteroids between 2027 and 2028, including the 42-mile-wide (68 km) space rock Eurybates and its satellite Queta, 17-mile-wide (27 km) Polymele and its yet-unnamed moon, 25 -mile-wide (40 km) Leucus, and the 33-mile-wide (53 km) Orus.

After this, LUCY will return to Earth in around 2030 for a third gravity boost before heading off to the pair of giant asteroids known as Patroclus -Menoetius, which are each more than 60 miles (100 km) wide. LUCY will reach this double rock at around 2033.

There are over 7,000 Trojan asteroids in two swarms, one leading in front of Jupiter and the other trailing the gas giant. Between 1,800 and 2,000 of these bodies are estimated to have diameters in excess of 10 miles (15 km), which is more than the infamous Chicxulub asteroid that caused the extinction of dinosaurs 65 million years ago. Fortunately, these rocks have been firmly gravitationally bound to Jupiter for billions of years, so are unlikely to veer off and intersect with Earth's orbit.

This won't be the last time LUCY beams back images of the Trojan asteroids. Further investigations will measure how these objects reflect light at high angles that can't be seen from Earth.

Currently, the asteroids LUCY will study appear as mere single specks of light against a background of distant stars, but the data the craft currently collects will help its operating team choose the exposure times LUCY uses during its close-up observations from 2027 onwards.

North Korea readying launch of nation's 1st spy satellite: report

The announcement by North Korean state media follows a flurry of rocket and missile testing in recent months.

North Korea's space program appears to be moving forward.

North Korean state media announced Wednesday (April 19) that the country has built its first spy satellite and is preparing it for launch. According to a report by the Associated Press, North Korean leader Kim Jong Un hailed the development as an important milestone for the country's nuclear missile program.

Kim added that North Korea would require multiple spy satellites to bolster the nation's intelligence capabilities, claiming the satellites would enable the nation to "use preemptive military force when the situation demands," according to the report.

North Korea has already launched two Earth observation satellites into orbit, one in 2012 and another in 2016, but there were doubts as to how well they operated once in space.

On Dec. 19, 2022, North Korea conducted a test flight of a rocket that state media reported would "finish the preparations for the first military reconnaissance satellite by April 2023." That launch sent a test vehicle in a near-vertical trajectory to an altitude of up to 340 miles (550 km) before it splashed into the Sea of Japan.

North Korea also claimed to have conducted the first test of a solid-fuel intercontinental ballistic missile on April 14, 2023, according to the Associated Press. If that capability is in fact confirmed, it would greatly increase the nation's ability to strike long-distance targets, including those inside the continental United States.

As North Korea continues to make advances in its space ambitions, the United States is stepping up its space-focused military presence in the region. Just days prior to the launch of North Korea's test rocket in December 2022, the U.S. Space Force announced it was activating U.S. Space Forces Korea.

The new U.S. command aims to provide space-based services, such as missile warning and satellite communications, throughout the Korean peninsula and surrounding area.

Artificial Gravity Space Stations: The Future of Human Space Exploration?

For decades, humans have dreamed of exploring space. We have sent probes and rovers to other planets, and we have even landed humans on the moon. But there is still so much that we do not know about space, and there are many places that we have yet to visit.

One of the biggest challenges of human space exploration is the lack of gravity. On Earth, gravity is what keeps us grounded and allows us to move around. Without gravity, astronauts can experience a variety of health problems, including muscle atrophy, bone loss, and cardiovascular problems.

One way to address the problem of gravity in space is to create artificial gravity. Artificial gravity can be created by rotating a space station. As the space station rotates, it creates a centrifugal force that mimics the force of gravity.

There are several advantages to artificial gravity. First, it can help to prevent the health problems that astronauts experience in space. Second, it can make it easier for astronauts to move around and perform tasks. Third, it can create a more comfortable environment for astronauts to live and work in.

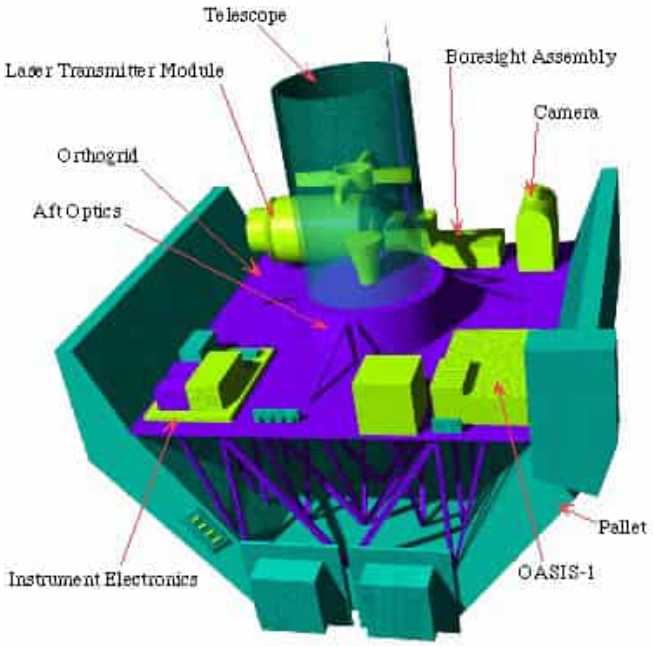
There are also some challenges to artificial gravity. One challenge is that it can be expensive to build and operate a rotating space station. Another challenge is that the centrifugal force can create nausea and dizziness in some people.

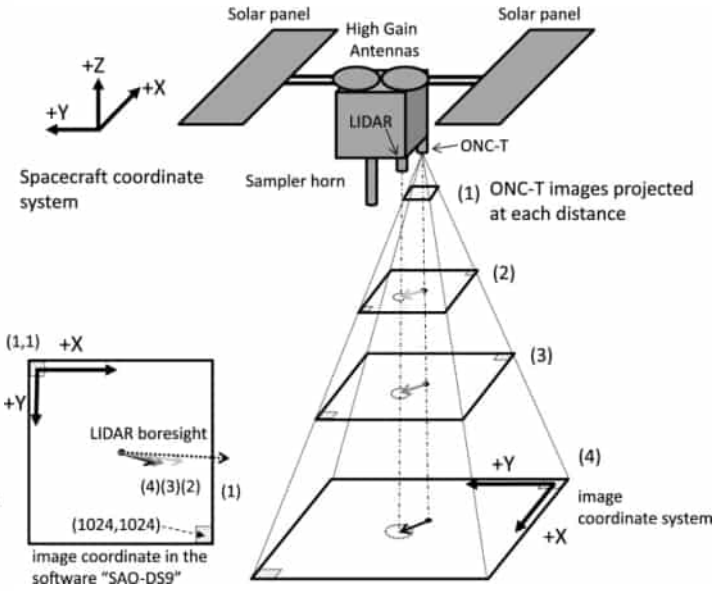
Despite the challenges, artificial gravity is a promising technology that could revolutionize human space exploration. By creating artificial gravity, we can make it possible for humans to live and work in space for extended periods of time. This would open up a whole new world of possibilities for human exploration and discovery.

In the near future, we may see the first artificial gravity space stations being built. These stations could be used to conduct research on the effects of artificial gravity on human health. They could also be used as bases for long-duration space missions, such as missions to Mars.

Artificial gravity space stations represent a major step forward in human space exploration. With artificial gravity, we can overcome the challenges of living and working in space and open up a whole new world of possibilities for human exploration.

SPACE SENSORS





LIDAR, or Light Detection and Ranging, is a remote sensing technology that uses light to measure the distance to an object. It is used to map the surface of planets and to study the atmosphere of other planets.

LIDAR works by sending a laser pulse towards an object and measuring the time it takes for the pulse to return. The distance to the object can then be calculated using the speed of light.

LIDAR has been used on space crafts to map the surface of planets, including Mars, the Moon, and Venus. It has also been used to study the atmosphere of other planets, such as Earth and Mars.

LIDAR is a powerful tool for mapping the un-known. It can be used to map surfaces that are too dangerous or difficult to reach by other means. LIDAR can also be used to study objects that are too small or too far away to be seen with the naked eye.

In the future, LIDAR is likely to play an even greater role in space exploration. It is a promising technology that has the potential to revolutionize our understanding of the universe.

Some of the benefits of using LIDAR in space include:

High resolution: LIDAR can produce high-resolution maps of the surface of planets and other objects in space. This allows scientists to study the details of the surface, such as mountains, valleys, and craters.

3D data: LIDAR can produce 3D data of the surface of planets and other objects in space. This allows scientists to study the shape of the surface and to identify features that would not be visible in 2D maps.

Non-destructive: LIDAR is a non-destructive remote sensing technology. This means that it does not damage the surface of the object being studied. This is important for studying objects that are rare or valuable.

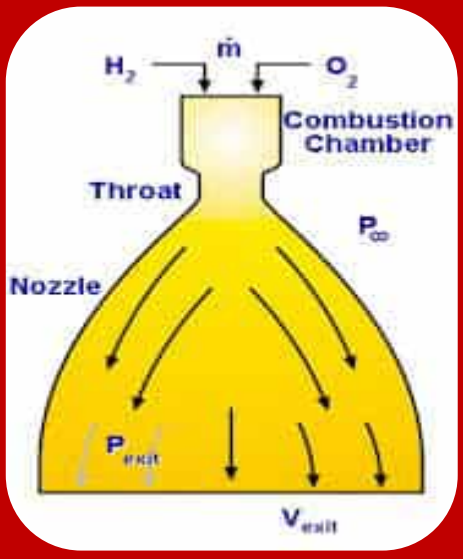
Wide range of applications: LIDAR can be used for a wide range of applications in space, including mapping the surface of planets, studying the atmosphere of other planets, and detecting asteroids and comets.

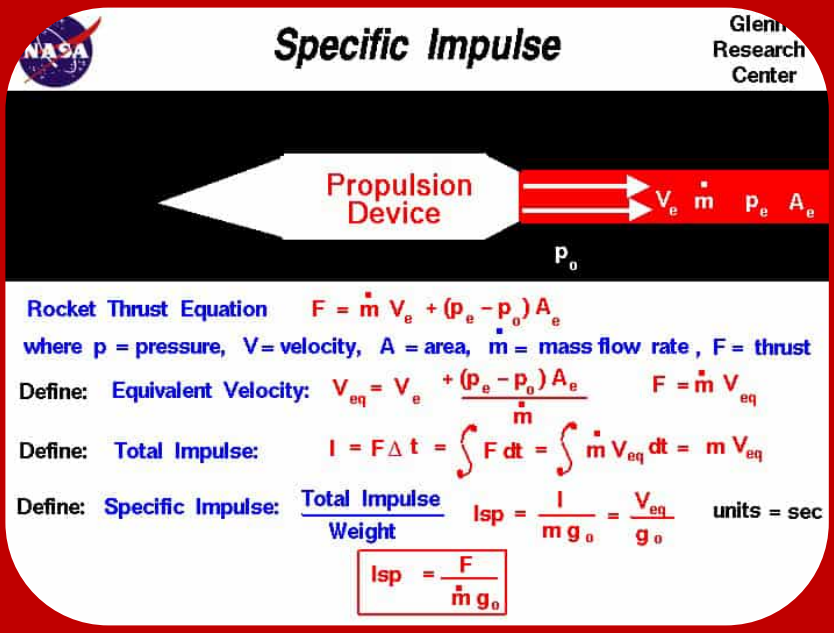
LIDAR is a powerful tool for space exploration. It has the potential to revolutionize our understanding of the universe and to help us to explore new worlds.

Space Terms to know about

Nozzle :

The exhaust nozzle is the outlet of a rocket engine where the high-pressure gases escape, creating thrust. It is designed to accelerate and direct the exhaust gases to maximize thrust efficiency.



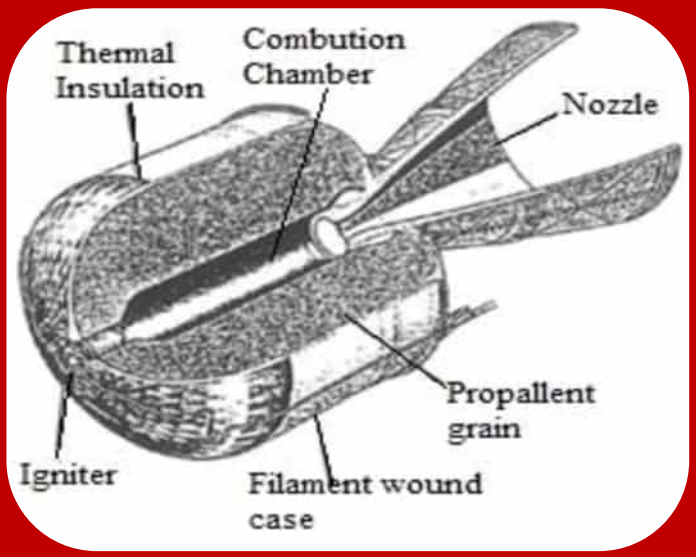


Specific Impulse (Isp):

A measure of the efficiency of a rocket engine. It represents the amount of thrust produced per unit of propellant consumed and is usually expressed in seconds. Higher specific impulse values indicate more efficient engines.

Solid Rocket Motor (SRM):

A type of rocket engine that uses a solid propellant. The propellant mixture is cast into a solid form, and once ignited, it burns at a controlled rate until exhausted.



Space-Tech Company

VAST SPACE LLC

Vast Aerospace is a privately held American aerospace company headquartered in Long Beach, California. It was founded in 2021 by entrepreneur Jed McCaleb with the goal of developing artificial gravity space stations. Vast's first project is Haven-1, a commercial space station that is scheduled to be launched into low Earth orbit in 2025. Vast is also developing a line of smaller, more affordable space stations for private individuals and space agencies. With its experienced team and innovative technology, Vast is well-positioned to lead the way in the commercialization of space.