Dr. MGR-ACS Space Technology Centre

SPACE EXPLORER

"An Ingress to Borderless world"

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SpaceX Dragon capsule to be 5-person 'lifeboat' in event of ISS emergency

A SpaceX Dragon capsule is being modified on orbit to carry an extra astronaut home to Earth if need be. On Jan. 18, NASA plans to start moving agency astronaut Frank Rubio's seat liner from a Russian Soyuz spacecraft over to Endurance, the Dragon spacecraft that's flying SpaceX's ongoing Crew-5 mission for NASA. Both vehicles are docked to the International Space Station (ISS). The Soyuz, known as MS-22, lost its coolant last month after suffering an apparent micrometeoroid or debris strike and has been deemed unfit to return astronauts to Earth except in case of emergency. Russia plans to launch an uncrewed Soyuz to the orbiting lab on Feb. 20 to bring the MS-22 crew — Rubio and Russian cosmonauts Sergey Prokopyev and Dmitry Petelin — back down to Earth. MS-22 could still be pressed into service as a lifeboat if something bad happens to the ISS before the next Soyuz's arrival, however. And that's where the seat-liner move comes in: It's safer for MS-22 to carry just two astronauts down instead of three, given its hobbled state.

"The change allows for increased crew protection by reducing the heat load inside the MS-22 spacecraft for cosmonauts Prokopyev and Petelin in the event of an emergency return to Earth," NASA officials wrote in an update Jan. 13. Endurance launched in October 2022 with just four seats installed, because Crew-5 consists of four astronauts — NASA's Nicole Mann and Josh Cassada, Japanese spaceflyer Koichi Wakata and Russia's Anna Kikina. But Dragon capsules are designed to carry up to seven people, so Endurance has the space to accommodate Rubio as well if need be.MS-22 launched to the ISS in September for a planned six-month mission. But Rubio, Prokopyev and Petelin will likely end up staying in orbit for twice that long.

"The plan is for Frank and Dimitri and Sergey to stay on board for several more months until they come home, probably [in] late September," Dina Contella, NASA's ISS operations integration manager, said during a press conference Jan. 17.

SpaceX launches advanced GPS satellite for US Space Force



SpaceX's Falcon 9 rocket lifted off from Cape Canaveral Space Force Station in Florida Jan. 18 at 7:24 a.m. EST (1224 GMT) with a new navigation satellite of the U.S. GPS constellation aboard. The launch of the Global Positioning Satellite used a refurbished Falcon 9 first-stage booster, which previously propelled to the International Space Station Crew 5 astronauts Nicole Mann and Josh Cassada of NASA, Japanese mission specialist Koichi Wakata and Russia's Anna Kikina. The first stage successfully separated from the payload-carrying upper stage about 2 minutes and 40 seconds after clearing the launch pad at Space Launch Complex 40 at Cape, and safely descended back to Earth, landing on SpaceX's drone ship called 'A Shortfall of Gravitas' about 8 minutes and 40 seconds after lift-off. SpaceX said in the launch livestream that the fairing, which protected the payload during the first phase of the rocket's ascend, will be recovered from the Atlantic Ocean for possible future reuse. The GPS III Space Vehicle 06, an advanced satellite, continued to orbit after the first stage and fairing separation atop Falcon 9's upper stage. The upper stage delivered the payload into an altitude of about 2,670 miles (4,300 kilometers) above Earth's surface where it released the satellite about 1 hour and 30 minutes after lift-off. The satellite, named Amelia Earhart after the famous female aviator and first woman to successfully fly across the Atlantic Ocean, will now continue on its own to its operational orbit 12,500 miles (20,200 km) above our planet. Amelia Earhart is the sixth of the GPS III series; the last one, named after Neil Armstrong, launched in June 2021.

The satellite, owned and operated by the U.S. Space Force, is part of a larger push to modernize the nation's GPS fleet. The new satellite has an expected lifetime of 15 years and will eventually form part of a set of 32 next -generation satellites, according to its maker, Lockheed Martin.

The latest generation of GPS spacecraft has up to three times better accuracy, eight times improvement in anti-jamming systems and a new modular design for adaptations "to better address changing mission needs and emerging threats," Lockheed Martin stated. The company says that approximately half the world's population (or four billion users) relies on GPS technology for everything from transportation to precise agriculture monitoring to utility infrastructure (some of which uses GPS in part to pinpoint service areas).

The U.S. GPS network is not the only set of navigation satellites available, however. The European Union has an independent set known as Galileo, Russia has GLONASS, and China has a system called Beidou. Independence of GPS systems is often raised as an important matter of national sovereignty and security, especially in the wake of Russia's invasion of Ukraine in February 2022.

China launches 14 commercial satellites into orbit atop Long March 2D rocket

China has 14 new satellites in orbit following its fifth launch of 2023.

A Long March 2D rocket lifted off from the Taiyuan Satellite Launch Center in northern China on Saturday (Jan. 14) at 10:14 p.m. EST (0314 GMT or 11:14 a.m. Beijing time on Jan. 15). Insulation tiles fell from the rocket as pink and purple exhaust propelled it above the frosty surrounding hills of Taiyuan.

Aboard were 14 satellites for a range of customers. Six of the payloads were Jilin-1 optical and infrared remote sensing satellites for a commercial satellite firm spun off from an institute under the Chinese Academy of Sciences (CAS). Changguang Satellite Technology now has more than 70 satellites in orbit and aims to build a constellation of 300 satellites by 2025.

Also aboard were Qilu-2 and Qilu-3, which Chinese state media described as high-resolution optical and wide-swath optical satellites, respectively.

Three further satellites were Golden Bauhinia Satellite 3, 4 and 6, developed by the Hong Kong Aerospace Science and Technology Group. The first two are optical remote sensing satellites, while the latter is an optical test satellite for a planned constellation for agricultural use.

The final three satellites were Luojia-3 (01), a remote sensing satellite for Wuhan University that was manufactured by state-owned DFH Satellite; the BUPT-1 scientific test satellite for Beijing University of Posts and Telecommunications and developed by the commercial satellite maker Spacety; and the technical test satellite Tianzhi-2D for CAS's Institute of Software, developed by Hunan Hangsheng Satellite Technology.

The Long March rocket for the mission was developed by the China Aerospace Science and Technology Corporation (CASC), a giant state-owned space and defense contractor. CASC says it plans to launch more than 60 times across 2023.

Artemis 1 moon mannequins unpacked from Orion spacecraft



A late lunar holiday shipment is on its way to scientists.

Three mannequins that flew to the moon and back aboard NASA's Orion capsule late last year are now on their way home to their respective labs. The trio participated in the agency's Artemis 1 mission, which launched Nov. 16 atop a powerful Space Launch System rocket and splashed down in the Pacific Ocean on Dec. 11.

Commander Moonikin Campos, named after an Apollo 13 engineer, was stowed in a packing crate at NASA's Kennedy Space Center in Florida on Jan. 10 with his German counterparts, Helga and Zohar, emerging from the spacecraft a day later on Jan. 11.

The next stop for Campos will be NASA's Johnson Space Center in Houston, while the twin German Space Agency (DLR) mannequins will wing their way overseas. Radiation and acceleration data from the mannequins will be scrutinized to see how well the Orion spacecraft will protect humans on future moon missions later in the 2020s.

Investigators wanted to make sure Orion is ready to launch astronauts around the moon, which will happen on the Artemis 2 mission, scheduled to lift off in 2024. So they put three mannequins in Orion for Artemis 1.

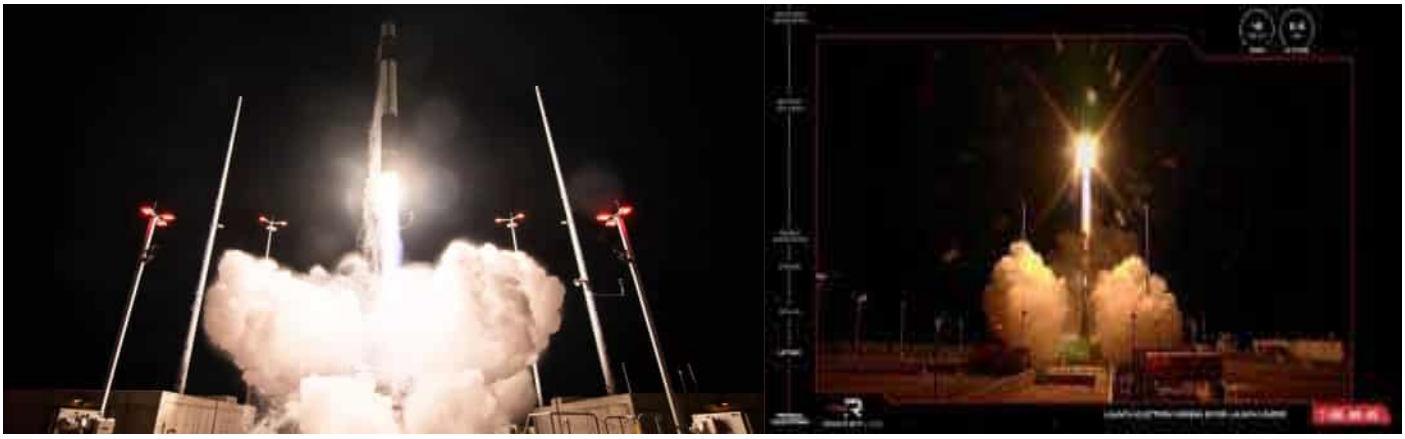
On the recent mission, Orion ventured into a high-radiation zone nearly 270,000 miles (435,000 kilometers) from Earth. That's an environment that only a handful of Apollo astronauts ever encountered, back in the 1960s and 1970s when measuring instruments were not as precise as today's generation.

Indeed, Orion went farther than any human-rated spacecraft ever had before, breaking the distance record set by Apollo 13 in April 1970.To assess radiation and the mitigation efforts that could counter its worst effects, the DLR mannequin Zohar sported a protective vest from Israeli partner StemRad, while Helga flew without one to serve as a control.

Moonikin Campos also sported dual radiation sensors, along with a set of acceleration sensors beneath his seat and headrest. The additional sensors measured the gravity loads of launch, landing and other big mission events for human safety. NASA is expected to name the Artemis 2 crew in early 2023, and at least one will be a foreigner: a Canadian Space Agency astronaut will gain a seat through the Canadarm3 robot arm contribution to NASA's planned moon-orbiting Gateway station.

The Japan Aerospace Exploration Agency is also expected to get several Artemis seats, but how soon is not yet public knowledge. The first landing mission of the program, Artemis 3, is slated to occur no earlier than 2025.

Rocket Lab launches 1st Electron booster from US soil in twilight liftoff



A Rocket Lab Electron booster launched from NASA's Wallops Flight Facility here with three commercial radio frequency satellites for customer HawkEye 360 on board.

Liftoff occurred at 6 p.m. EST (2300 GMT), about 45 minutes after sunset. The rocket lit up the twilight sky over Virginia's Eastern Shore with a rumbling roar, soaring over the stars of the Orion constellation as it arced into orbit.

"Liftoff of Electron from Launch Complex 2, leaving U.S. soil for the first time and on its way to space, up and over the Atlantic Ocean!" Murielle Baker, Rocket Lab's communications manager, said during a webcast of Tuesday's launch.

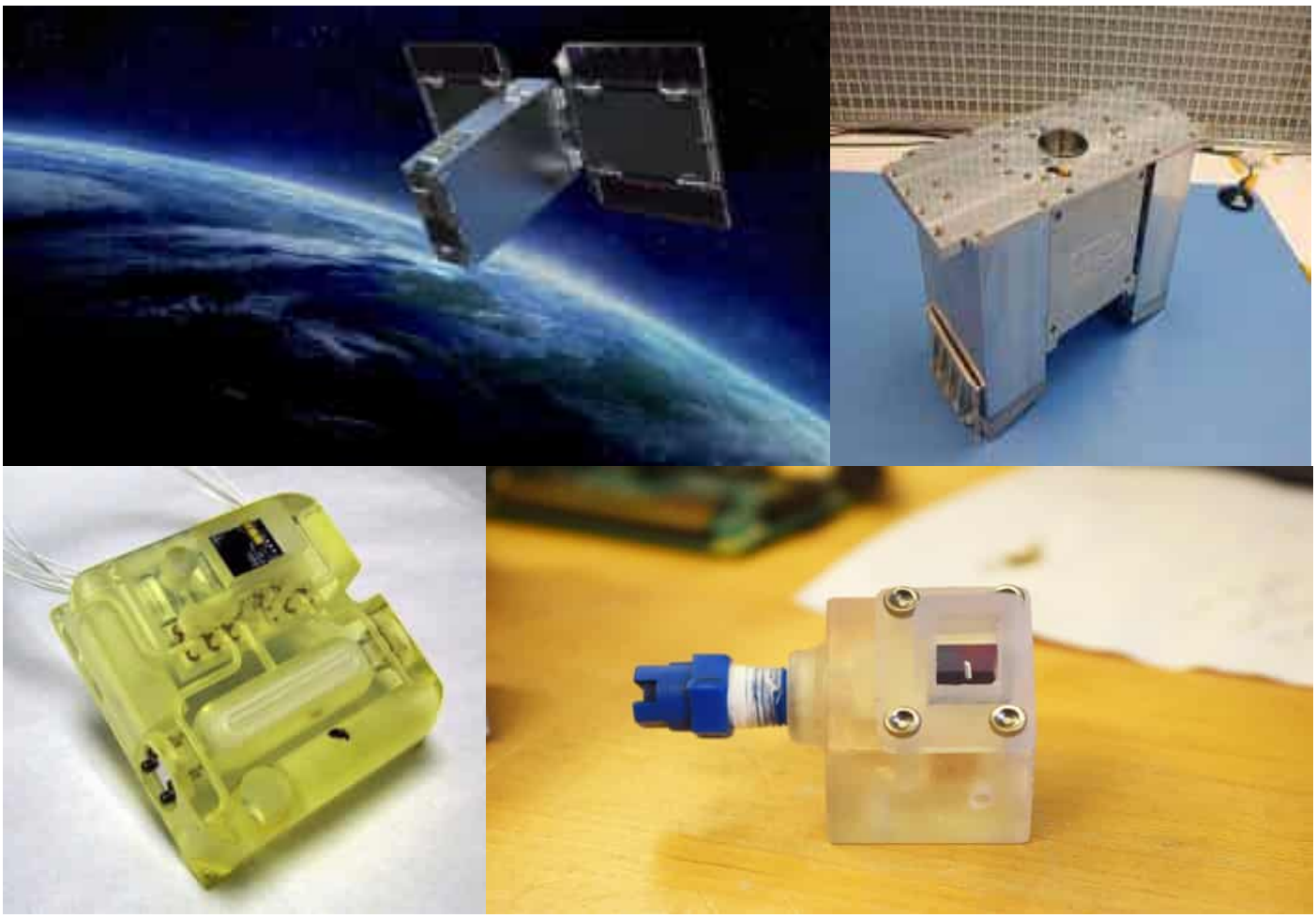
The three satellites were deployed as planned at an altitude of about 340 miles (550 kilometers) just under an hour after liftoff. News of this success was delayed by about 35 minutes, however, because a communications-receiving ground station wasn't functioning properly.

Rocket Lab hoped to begin launches from Wallops in 2020, but delays with a NASA developed autonomous flight termination system that was required for Electron launches from the range added years of delay. The system is automated safety software designed to help rockets self-terminate if they veer off course during flight. Rocket Lab's debut U.S. launch was the first of three planned missions for its Virginia-based customer HawkEye 360, which is building a constellation of small satellites for radio frequency surveillance. The company will fly a total of 15 HawkEye 360 satellites by 2024 under the deal, with Tuesday's launch lofting the firm's fifth batch of satellites overall. "For our fifth cluster of next-generation satellites, we needed optimal orbital flexibility, and Rocket Lab's new Electron launch pad in Wallops, Virginia provides the perfect domestic capability," HawkEye 360 CEO John Serafini said in a different prelaunch statement. "Rocket Lab's inaugural launch facilitates our first mid-latitude satellite cluster, which will strengthen the diversity of our geospatial insights for our government and commercial customers across the globe."

Rocket Lab currently plans to launch roughly one Electron mission a month from the Wallops pad. The company is building a larger reusable rocket called Neutron that will also fly from the Virginia pad. The first flight of the Neutron rocket is expected no earlier than 2024.

Electron has always been an expendable vehicle, but Rocket Lab is working to make its first stage reusable. The company has recovered and analyzed Electron boosters on several orbital missions to date, on one occasion even plucking a falling first stage out of the sky with a helicopter. There was no recovery attempt on "Virginia Is for Launch Lovers," however.

Cubesat that launched on SpaceX Falcon 9 rocket will test water-based propulsion



A Japanese propulsion company developing water-based thrusters is set to test its system on a Sony nanosatellite launched earlier this month.

Pale Blue was chosen by Sony to provide in-orbit propulsion for its Star Sphere project, which will offer still images and 4K video services for artistic and educational use and provide "space perspectives."

Sony's first satellite for the project launched along with 113 other satellites atop a Falcon 9 rocket on SpaceX's Transporter 6 mission on Jan. 3. The 6U cubesat is named Star Sphere-1 and carries a full-frame camera.

The satellite is also equipped with a Pale Blue water vapor propulsion system, which will be used for the company's first in-space demonstration of its water engine at the end of January.

According to Pale Blue, the small thruster will prolong the satellite's lifetime by 2.5 years by helping it maintain its orbit. The company says that water-vapor propellant offers an environmentally friendly solution to the growing demand for small satellites with built-in thrusters.

"I am very pleased that our safe, sustainable and low-cost water thruster can contribute to this project, and we are committed to the development of the space industry," Jun Asakawa, CEO and co-founder of Pale Blue, said in a statement.

Pale Blue was founded in 2020 and is developing a range of water-based propulsion systems building on research carried out by the Japanese space agency JAXA and the University of Tokyo.

Perseverance Mars rover stashes final sample, completing Red Planet depot

NASA's Perseverance Mars rover has finished building its backup sample depot on the Red Planet. The car-sized Perseverance rover just stashed the last of the 10 sample tubes that comprise the depot. Word of the successful drop came in on Jan. 29, about six weeks after the rover deployed the first of the samples.

"It's official: @NASAPersevere has dropped the final tube for the #MarsSampleReturn depot!" officials with NASA's Jet Propulsion Laboratory (JPL) in Southern California, which manages Perseverance's mission, said via Twitter on Jan. 30. "Ten samples have been deposited on the Martian surface and could be returned to Earth for in-depth analysis in the future."

Perseverance landed in February 2021 on the floor of the 28-mile-wide (45 kilometers) Jezero Crater, which harbored a big lake and a river delta billions of years ago.

The six-wheeled robot is hunting for signs of ancient Mars life and collecting dozens of samples, which will be returned to Earth by a joint NASA-European Space Agency (ESA) campaign as early as 2033, if all goes according to plan.

The baseline sample-return architecture calls for Perseverance to deliver several dozen samples to a rocket-equipped NASA lander on the Red Planet. That rocket will then send the samples to Mars orbit, where they'll be snagged and hauled to Earth by an ESA probe.

Perseverance is the only one of these spacecraft that's currently operational; the ESA orbiter and NASA lander are scheduled to launch in 2027 and 2028, respectively.

Perseverance is in good condition now, but a lot can happen in five or six years. So the mission team came up with the depot as a backup plan, in case the rover isn't able to deliver the samples itself. In the backup scenario, two small helicopters will collect the tubes from the depot, which is in a patch of Jezero the team calls Three Forks, and bring them back to the lander one by one.

These helicopters will launch aboard the lander in 2028. They'll be based heavily on Ingenuity, the 4-pound (1.8 kilograms) chopper that launched with Perseverance as a technology demonstration and is still going strong after 40 flights on the Red Planet.

The Three Forks samples, by the way, are doubles; each one has a twin that Perseverance is carrying on its body.

Now that its depot work is done, Perseverance will head up the ancient delta, examining the intriguing rocks as it goes. After the rover passes an outcrop the team calls Rocky Top, it will be in position to begin a new phase of its science mission called the Delta Top Campaign.

Private Peregrine moon lander completes testing ahead of landmark lunar launch

A private U.S. moon lander just cleared a big hurdle on the path toward its debut spaceflight this year.

The Peregrine lunar lander, built by Astrobotic, finished the last of its space qualification tests this month, the Pittsburgh-based company announced on Jan. 25. Now engineers are awaiting approval from United Launch Alliance (ULA) to ship Peregrine from Pittsburgh to Florida for mating to its United Launch Alliance (ULA) Vulcan Centaur rocket.

"These tests ultimately proved the quality of Peregrine's design and workmanship," Sharad Bhaskaran, Astrobotic's mission director for Peregrine's debut mission, said in a statement. "Everyone worked diligently, even through holidays, for this incredible achievement."

Peregrine's launch is targeted for the first quarter of 2023 from Cape Canaveral Space Force Station, but like all launch dates, that is subject to change depending on technical matters, weather and numerous other factors. The mission, the first liftoff for the new Vulcan Centaur, represents a new generation of moon efforts by private companies. The Peregrine lander, laden with 11 NASA payloads, was selected for service through the agency's Commercial Lunar Payload Services (CLPS) program. NASA is employing private robotic landers, rovers and other spacecraft to work alongside Artemis program astronauts, who may be landing near the moon's south pole as soon as 2025 on the Artemis 3 mission.

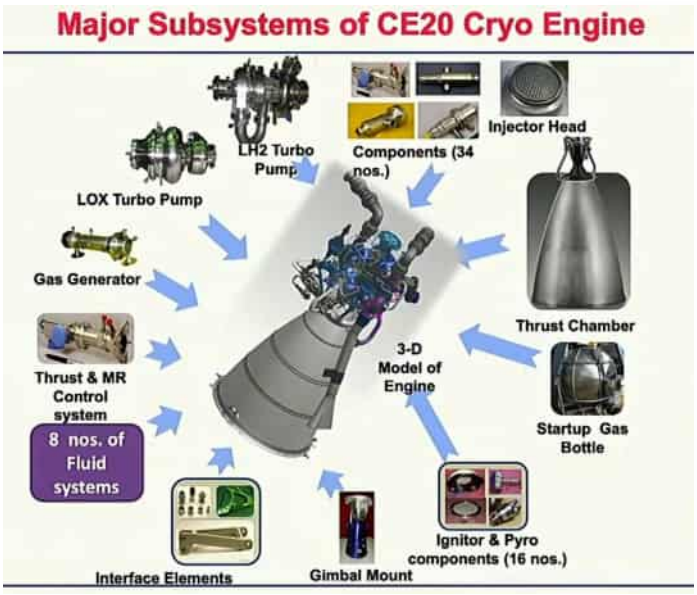
CLPS represents a new form of lunar exploration, as all successful moon landing efforts to date have been led by countries rather than private companies. But that is expected to change in a big way in the 2020s, as numerous missions are in development in the United States and in other countries.

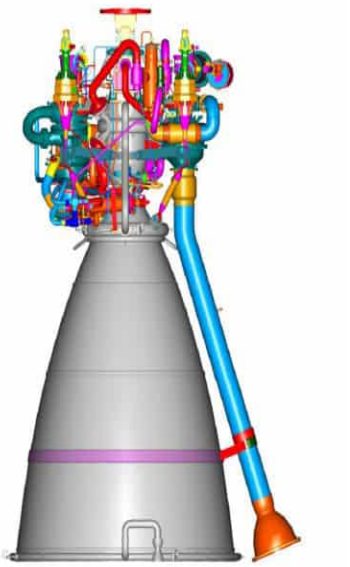
The first few CLPS missions will be survey efforts ahead of landing astronauts, with future ones expected to be located at the lunar south pole as NASA builds up infrastructure for possible permanent settlement there. (The south pole appears to be rich in water ice, presenting an ideal spot for water-hungry machinery and astronauts as they could mine the precious resource locally instead of shipping it all the way from Earth.)

Which CLPS mission will arrive at the moon first isn't yet clear, as numerous efforts are scheduled in the coming months. Besides Peregrine, Intuitive Machines plans to launch its Nova-C lander in the first quarter of 2023, for example.

Meanwhile, another country has a private mission already en route to the moon: The Hakuto-R lander, built by Tokyo-based company ispace, is scheduled to touch down in April. After it lands, Hakuto-R will deploy Rashid, a small rover provided by the United Arab Emirates' space agency.

The CE-20 Engine: ISRO's Indigenous Cryogenic Triumph





The Indian Space Research Organisation's (ISRO) CE-20 engine is an indigenous cryogenic engine that has propelled India's space program to new heights. This liquid-fueled rocket engine uses a mixture of liquid hydrogen and liquid oxygen as propellants, providing high thrust and excellent efficiency. With a thrust capability of 20 tonnes, the engine is designed to be used in the upper stages of the GSLV Mk-III rocket.

The CE-20 engine is a critical component of ISRO's space program, enabling the organization to launch heavy payloads into space, including communication and remote sensing satellites and interplanetary missions. The engine's success has established India as a leading player in the global space race and has provided a significant boost to the country's scientific and technical capabilities.

One of the significant advantages of the CE-20 engine is its use of liquid hydrogen as fuel. This fuel source has a very high specific impulse, providing a lot of thrust per unit of fuel consumed. Additionally, the use of liquid hydrogen as fuel has significant environmental benefits, as it only produces water vapor when burned, making it a clean and sustainable option for space exploration.

The development of the CE-20 engine was not without its challenges. Developing a cryogenic engine requires a high level of technical expertise, and there have been several setbacks along the way. However, ISRO has persevered, and the successful deployment of the engine has been a significant achievement for the organization.

In conclusion, the CE-20 engine is a remarkable piece of technology that has propelled India's space program to new heights. The engine's high thrust capability, excellent efficiency, and use of clean and sustainable fuel have significant advantages for space exploration. The successful development and deployment of the CE-20 engine have established ISRO as a leading player in the global space race and a testament to India's scientific and technical capabilities.

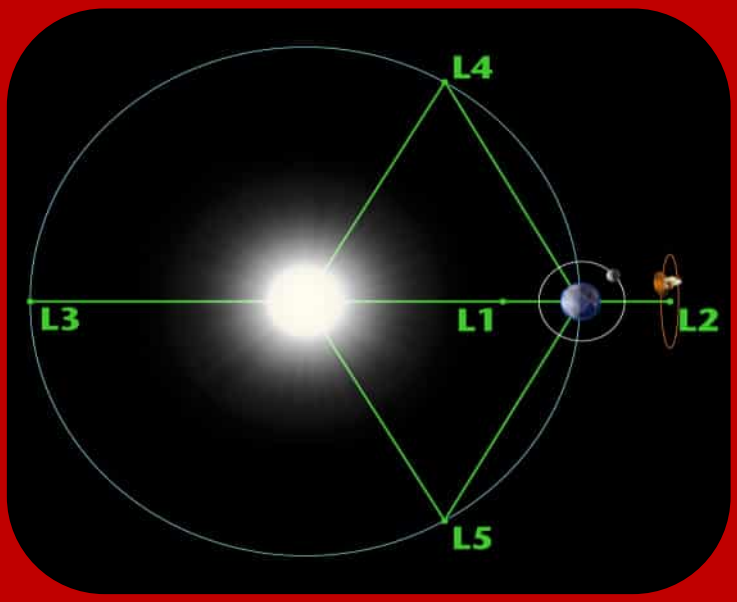
SPACE SENSORS

The use of pressure sensors in space technology is essential for monitoring the atmospheric and fluid pressure of spacecraft, satellites, and other space equipment. These sensors are designed to withstand the harsh conditions of space, including extreme temperature fluctuations, radiation, and the vacuum environment. Pressure sensors must also be highly accurate, reliable, and capable of transmitting data over long distances with minimal power consumption. One type of pressure sensor used in space technology is the piezoresistive pressure sensor. This type of sensor is made up of a thin diaphragm that deforms as pressure is applied, causing a change in resistance. The change in resistance is then measured, providing a reading of the pressure. The piezoresistive pressure sensor is commonly used in spacecraft, satellites, and rovers for measuring the pressure of gases and fluids. Another type of pressure sensor used in space is the capacitive pressure sensor. This sensor operates by measuring the changes in capacitance as pressure is applied to a diaphragm. The capacitive pressure sensor is used for measuring the pressure of fluids in space applications, including fuel and hydraulic systems. Pressure sensors are used in many different space applications, including the Mars Environmental Dynamics Analyzer (MEDA) instrument on the Mars Perseverance rover. The MEDA instrument includes several types of pressure sensors, including the piezoresistive pressure sensor and capacitive pressure sensor. These sensors are used to measure atmospheric pressure and provide critical information about the Martian environment and potential habitability. The High Accuracy Absolute Pressure Sensor (HAAPS) developed by the European Space Agency (ESA) is another example of a pressure sensor used in space technology. The HAAPS sensor is highly accurate and reliable, with a measurement range of 0-10 kPa, and is used to monitor the pressure of air and other gases inside the International Space Station (ISS). Pressure sensors used in space technology must be designed to withstand extreme conditions and be highly reliable to ensure the safety and success of space missions. They must also be capable of transmitting data over long distances with minimal power consumption. With the advancement of space technology, the development of even more advanced and reliable pressure sensors will be critical to pushing the boundaries of human knowledge and exploration. In conclusion, pressure sensors are a vital component of space technology, providing critical information about the atmospheric and fluid pressure of spacecraft, satellites, and other space equipment. These sensors must be highly accurate, reliable, and capable of transmitting data over long distances with minimal power consumption. With the continued advancement of space technology, the development of even more advanced pressure sensors will be critical to future space exploration and discovery.

Space Terms to know about

Lagrange Points :

Points in space where the gravitational forces of two large bodies, such as the Earth and the Moon, balance out, allowing for stable orbits for smaller objects.

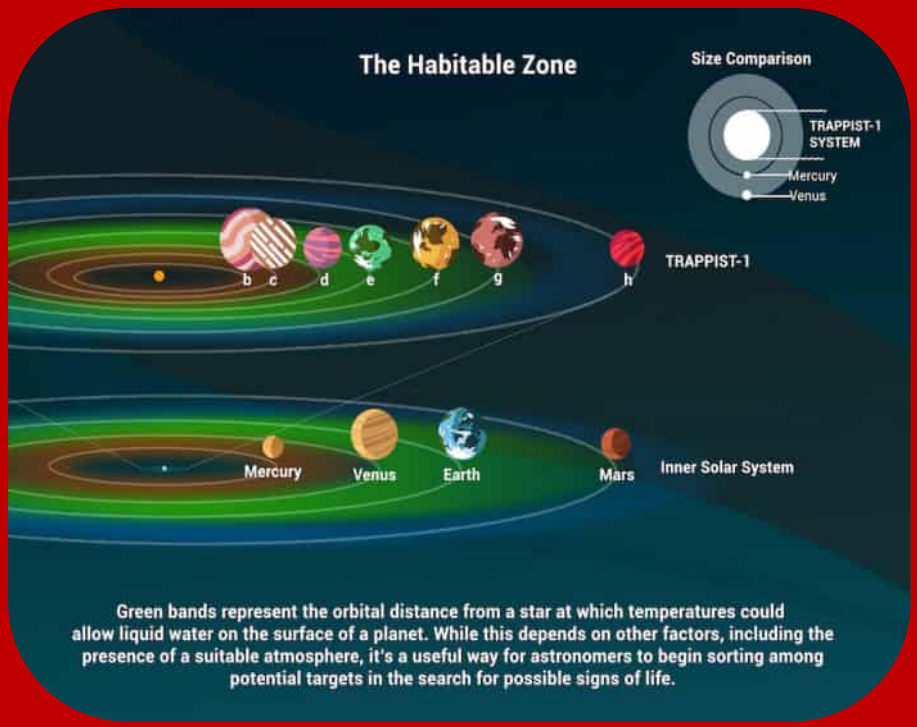


Planetary Alignment :

When two or more planets appear to line up in the sky as seen from Earth, due to their positions in their orbits.

Habitable Zone :

the distance from a star at which liquid water could exist on orbiting planets' surfaces. Habitable zones are also known as Goldilocks' zones, where conditions might be just right – neither too hot nor too cold – for life.



Space-Tech Company

Astra

Image Credit: *Astra*

Astra is a California-based space transportation company that aims to make space more accessible to everyone. The company was founded in 2016 by a team of experienced engineers and entrepreneurs, and it has quickly gained a reputation for its innovative approach to space travel. Astra's rockets are designed to be cost-effective, reliable, and easy to operate, making it possible for small satellite operators to launch payloads into space quickly and efficiently. Astra has already achieved several successful launches and is continuing to work on improving its technology to make space more accessible and affordable for everyone.