Dr. MGR-ACS Space Technology Centre

SPACE EXPLORER

"An Ingress to Borderless world"

Volume 02/Issue-14

Bimonthly 16-31, July 2023

ISRO launches PSLV-C56 rocket carrying 7 Singaporean satellites from Sriharikota

The launch of PSLV-C56 carrying DS-SAR satellite, along with 6 co-passengers from the first launch-pad of SDSC-SHAR, Sriharikota was accomplished successfully on July 30, 2023 at 06:30 hrs IST. PSLV-C56 is configured in its core-alone mode, similar to that of C55. It would launched DS-SAR, a 360 kg satellite into a Near-equatorial Orbit (NEO) at 5 degrees inclination and 535 km altitude.

The primary payload of the PSLV-C56 mission was the DS-SAR satellite, a Synthetic-aperture radar (SAR) that creates two-dimensional images or three-dimensional reconstructions of objects. Developed under a partnership between DSTA, representing the Government of Singapore, and ST Engineering, the DS-SAR satellite will cater to the imagery needs of various Singapore government agencies and ST Engineering's commercial customers. The launch was conducted by Isro under a contract with New Space India Limited (NSIL). The Sunday morning launch marked the 431st foreign satellite launch from the country by Isro, and the fourth dedicated PSLV launch for the Singapore government. All seven satellites were successfully deployed into their intended orbit, nearly 20 minutes after launch from Sriharikota.

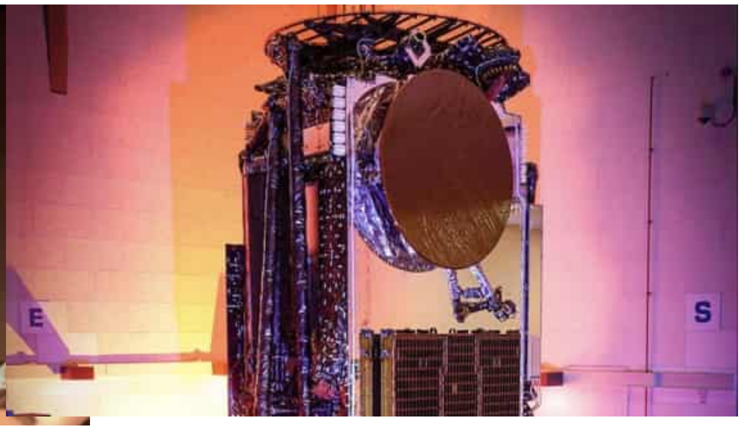
The DS-SAR satellite, weighing 360 kg, was launched into a Near-equatorial Orbit (NEO) at an altitude of 535 km.

It carries a SAR payload developed by Israel Aerospace Industries (IAI), enabling all-weather day and night coverage and capable of imaging at 1m-resolution at full polarimetry.

This high-resolution capability will allow the Singapore government to assess the damage caused by natural disasters, monitor land use, track deforestation, and support security and defense operations. Commercial customers can use the satellite for purposes such as oil and gas exploration, agricultural monitoring, and infrastructure assessment.

Alongside the DS-SAR, six co-passenger satellites were also launched.

SpaceX's Falcon Heavy rocket launches giant satellite, aces double booster landing



SpaceX's brawny Falcon Heavy rocket launched for the seventh time ever on July 28, sending a huge communications satellite skyward.

The Falcon Heavy lifted off at 03:04 GMT on July 29 from Pad 39A at NASA's Kennedy Space Center (KSC) in Florida, carrying the Jupiter 3 satellite skyward.

The launch kicked off a record-breaking mission: Jupiter 3 is the largest commercial communications satellite ever built, according to its operator, Hughes Network Systems.

The Falcon Heavy is the second-most powerful rocket flying today, after NASA's Space Launch System rocket, which debuted in November on the agency's Artemis 1 moon mission. (SpaceX's Starship vehicle is more powerful than the SLS but is not yet operational.)

The Heavy consists of three strapped-together first stages of the company's workhorse Falcon 9 rocket, with the central booster topped by an upper stage and the payload. These first stages are designed to be reusable, and two of the ones that launched Friday could fly again: SpaceX landed the side boosters about 7.5 minutes after liftoff at Cape Canaveral Space Force Station, which is next door to KSC. The central booster, however, didn't have enough fuel left over for the return trip and ditched into the ocean after launch. That latter detail speaks to the immense size of Jupiter 3 and how far away it's headed — toward geostationary orbit (GEO), which lies about 22,200 miles (35,700 kilometers) above Earth. The satellite, which was built by Maxar Technologies and will service customers in the United States and Latin America, was deployed as planned about 3.5 hours after lift-off, SpaceX confirmed via social media. Jupiter 3 weighs 10.1 tons (9.2 metric tons), making it heavier than any payload ever launched toward GEO. When fully deployed, Jupiter 3 will feature a wingspan similar to that of a commercial airliner, according to Hughes.

The Falcon Heavy launched for the first time in February 2018, sending Elon Musk's red Tesla Roadster aloft on a highly anticipated and very photogenic test flight. It flew again in April 2019 and June 2019 but then endured a 40-month dry spell caused primarily by delays in the development of the satellites it was slated to carry. But the Heavy is now picking up the pace. July 29 liftoff was the rocket's fourth in the past eight months, after launches in November 2022 and January and May of this year. Jupiter 3 was originally supposed to go up on July 26, but SpaceX scrubbed the try with 65 seconds left on the countdown clock "due to a violation of abort criteria." The company nixed another planned try on July 27, citing a desire to "complete vehicle checkouts."

Rocket Lab launches 7 satellites, recovers booster after ocean splashdown

The first stage of Rocket Lab's Electron vehicle came down in a parachute-aided ocean splashdown on July 17. Rocket Lab launched seven satellites to orbit on July 17 and brought the booster back to Earth for a soft ocean splashdown. An Electron rocket carrying seven small satellites lifted off from Rocket Lab's New Zealand site 01:27 GMT on July 18, after being delayed by a few days due to bad weather.

Rocket Lab called the mission, the company's 39th to date, "Baby Come Back." And there's a good reason for that: About 17 minutes after liftoff, the Electron's first stage came back to Earth, making a soft splashdown under parachutes in the Pacific Ocean. Rocket Lab recovered the booster with a ship and will haul it back to land for inspection and analysis. Such work is part of the company's effort to make the first stage of the 59-foot-tall (18 meters) Electron reusable, like that of SpaceX's workhorse Falcon 9 rocket. There are key differences between the two recovery strategies, however. For example, Falcon 9 boosters steer themselves to powered vertical touchdowns; Electron is too small to have enough fuel left over for such maneuvers, which explains the parachutes.

Rocket Lab has recovered boosters on several previous missions, including one earlier this year. (The company originally aimed pluck falling Electron boosters out of the sky with a helicopter, but the chopper component has apparently been shelved.)

Booster recovery was a secondary objective of "Baby Come Back," of course; the main goal was to get the seven satellites to orbit safely. And that was done on schedule, over a nearly hour-long span beginning about 49 minutes after liftoff.

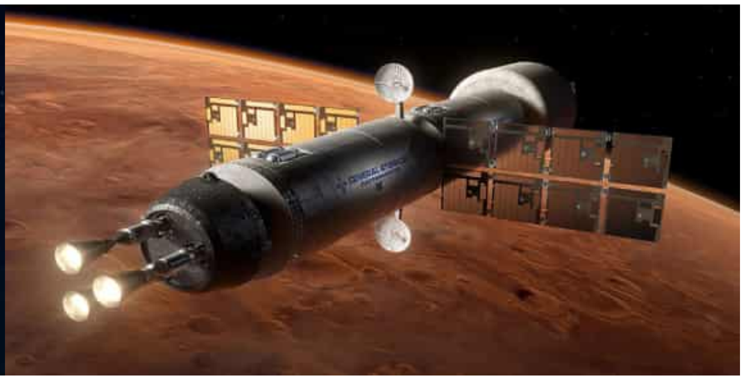
Four of those payloads are tiny cubesats for NASA's Starling mission, which is designed to test tech for future "swarm" missions.

"Spacecraft swarms refer to multiple spacecraft autonomously coordinating their activities to achieve certain goals," Rocket Lab wrote in a mission description.

"Starling will demonstrate technologies for in-space network communications, onboard relative navigation between spacecraft, autonomous maneuver planning and execution, and distributed spacecraft autonomy — an experiment for small spacecraft to autonomously react to observations, paving the way for future science missions," the company added.

"Baby Come Back" also lofted the LEO 3 demonstration satellite for the Canadian communications company Telesat and two cubesats for Spire Global, a Virginia company whose satellites observe Earth in radio frequencies.

NASA, DARPA to launch nuclear rocket to orbit by early 2026

The DRACO project will test potentially revolutionary propulsion technology. NASA and the U.S. military plan to launch a nuclear-powered spacecraft to Earth orbit in late 2025 or early 2026. The project, known as DRACO ("Demonstration Rocket for Agile Cislunar Operations"), aims to give an in-space test to nuclear thermal propulsion (NTP), potentially revolutionary tech that could help humanity set up shop on Mars and other distant worlds. The DRACO spacecraft will be developed and built by Lockheed Martin, project team members announced (July 26). "We're going to put this together, we're going to fly this demonstration, gather a bunch of great data and really, we believe, usher in a new age for the United States [and] for humankind, to support our space exploration mission," Kirk Shireman, vice president of Lockheed Martin Lunar Exploration Campaigns, said during a press conference.

DRACO isn't new. The U.S. Defense Advanced Research Projects Agency (DARPA) started the program in 2021, and NASA came aboard in early 2023. NASA's involvement shouldn't be surprising; the agency's interest in NTP tech goes way back. For example, NASA aimed to launch a crewed Mars mission aboard a nuclear-powered spacecraft by 1979, via a program called NERVA ("Nuclear Engine for Rocket Vehicle Application"). This didn't happen, of course; NERVA was canceled in 1972.

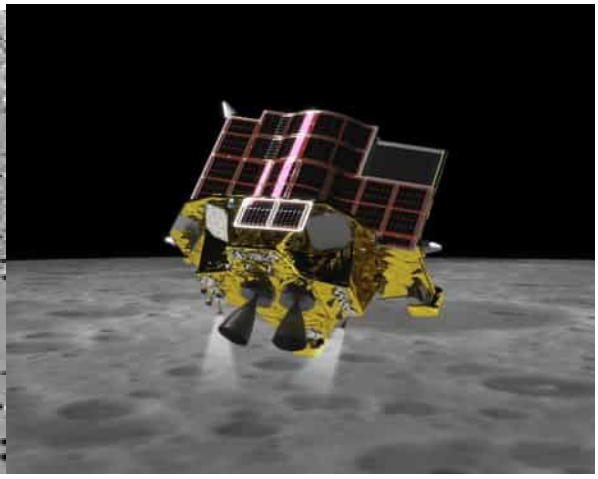
NASA is still shooting for the Red Planet, aiming to get astronauts there by the late 2030s or early 2040s. And it still views nuclear thermal propulsion as a key breakthrough that could make this goal more attainable, by slashing the travel time to and from the Red Planet. Nuclear thermal rockets carry small fission reactors, which release incredible amounts of heat as they split atoms. This heat is then applied to a propellant gas, which expands and is funneled into space through a nozzle to create thrust.

This process is distinct from the one employed by radioisotope thermoelectric generators (RTGs), nuclear tech that has been flying aboard probes since the early days of the space age. RTGs don't provide propulsion; they harness the heat of radioactive decay to generate electricity, which then powers instruments, motors and other spacecraft gear.

DRACO is expected to operate in orbit for a few months. There are no scientific instruments going up; "operation" entails the use of its NTP engine, demonstrating that it can work for long stretches in the space environment.

The contracts awarded to Lockheed and BWX Technologies for their DRACO work have a total value of $499 million, provided all milestones are reached, Dotson said. Half of the money will come from DARPA and half from NASA, she added.

Japan gearing up to launch small moon lander next month

SLIM is scheduled to lift off on Aug. 25 The Japanese Aerospace Exploration Agency (JAXA) is gearing up to send the Smart Lander for Investigating Moon, or SLIM, mission to the moon on an H-2A rocket on Aug. 26 Japan time (00:34 GMT, 9:34 a.m. JST, or 8:34 p.m. EDT on Aug. 25).

SLIM is, as its acronym suggests, a small-scale moon mission, but it has bigger ambitions in mind. The main aim of the lander — which is 7.9 feet (2.4 meters) high, 8.8 feet (2.7 m) wide and 5.6 feet (1.7 m) deep — is to demonstrate accurate lunar landing techniques, which will help make more challenging landing areas more accessible.

SLIM will aim to touch down within 328 feet (100 m) of its target point. This is crucial, as the mission is targeting a landing within Shioli Crater, a relatively fresh, 984-foot-wide (300 m) impact feature within Mare Nectaris, at 13 degrees south latitude and 25 degrees east longitude on the near side of the moon.

The site was chosen using observational data from Japan's SELENE (Kaguya) orbiter, which launched in 2007 and was slammed into the moon in 2009.

JAXA says that precision landings will become vital in the future. As humanity's knowledge of the solar system grows, accessing specific, highly interesting sites will be all the more necessary to advancing our understanding.

The mission is also a test that JAXA hopes will help speed up exploration of the solar system through the use of lighter exploration systems. SLIM architecture could make landing on the moon and planets more economical, save weight (which can instead be used for science payloads) and even lead to small, targeted sample return missions.

SLIM will weigh 1,300 pounds (590 kilograms) at launch, with roughly two-thirds of this mass being fuel. The spacecraft is equipped with a landing radar for its descent onto the lunar surface and will use image matching navigation and obstacle detection. The impact of landing will be absorbed using a crushable aluminum foam base.

Once on the moon, it will employ a multiband camera for assessing the local mineralogical environment, with particular interest in olivine, which may have originated in the moon's mantle. SLIM also carries a small laser retroreflector array. Also joining the lunar ride will be the X-ray Imaging and Spectroscopy Mission, or XRISM, a JAXA-NASA collaborative mission that also involves participation from the European Space Agency.

SLIM will be JAXA's first lunar landing attempt. A private Japanese moon lander, Hakuto-R, reached lunar orbit earlier this year but crashed during its landing attempt.

China has sent more than 100 types of seeds to its Tiangong space station

The research involves exposing seeds to cosmic radiation.

More than 100 kinds of plant material for space breeding were sent to the Tiangong space station aboard the Shenzhou 16 mission, Chinese space officials have revealed.

The 136 seeds and other plant genetic materials delivered to Tiangong in late May come from 53 institutions, according to the China Manned Space Agency (CMSA).

These include 47 crops, consisting of 12 grain crop seeds, 28 cash crop seeds, seven saline-alkali tolerant plants, and 76 species of forest plants, grasses, flowers and medicinal plants.

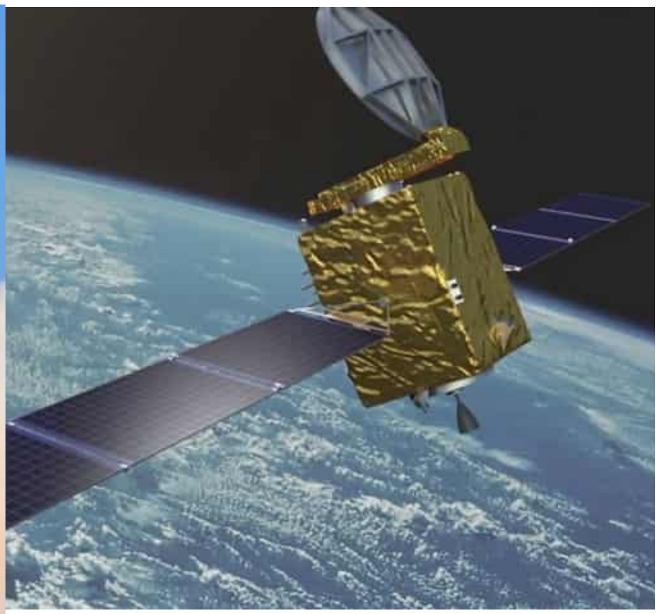
A further 13 microorganisms, including agricultural and industrial microorganisms, edible fungi, algae and mosses, are also part of the cornucopia of genetic material shipped to orbit.

Space breeding involves exposing seeds to cosmic radiation and microgravity in space to generate potentially beneficial genetic mutations. Changes could increase crop yields and make plants more resistant to drought and certain diseases.

China has been engaged in space breeding for decades, starting in the 1980s using recoverable Shijian spacecraft. Similar experiments are being conducted aboard the International Space Station (ISS).

China finished constructing Tiangong in 2022. The current crew, which arrived aboard the Shenzhou 16 spacecraft on May 30, is the fifth astronaut mission to visit the orbital outpost.

China launches 4 commercial weather satellites to orbit

The Tianmu 1 quartet launched July 19 on a light solid rocket. A Chinese solid rocket launched a new batch of commercial satellites from the Gobi Desert on July 19.

A Kuaizhou 1A rocket lifted off from the Jiuquan Satellite Launch Center in northwest China on July 19.

Aboard were four Tianmu 1 satellites, designated numbers 07-10, for collecting weather data. The satellites and rocket upper stage were later detected by space domain awareness tracking in orbits with an altitude of roughly 326 miles (524 kilometers) and an inclination of 97.4 degrees.

The Tianmu 1 constellation is intended to provide global commercial meteorological data services, including numerical weather forecasting, typhoon monitoring and forecasting and climate change research. The satellites were developed by a subsidiary of the state-run China Aerospace Science and Industry Corporation, or CASIC.

The mission follows a similar launch in March of this year, which saw the Tianmu 1 (03-06) satellites reach orbit. Tianmu satellites detect changes to signals transmitted by navigation satellites such as GPS and Beidou as they pass through Earth's atmosphere.

"Some navigation signals are transmitted through different atmospheric layers or different media, and there will be attenuation and differences between these signals. We can obtain valuable information from the medium it penetrates, from its characteristics and density, or other features," Gao Wei, strategic operations director of the Tianmu 1 constellation, told CCTV+.

"By 2025, our Tianmu 1 system will be basically completed and will provide stable service for various user categories. At the same time, through the integrated construction and operation of the constellation, we can better serve the national strategy and improve the national economy and people's livelihoods," Gao said.

The Kuaizhou 1A for the launch was provided by Expace, a rocket-making company spun off from CASIC. It can carry a payload of 440 pounds (200 kilograms) to a 345-mile-high (700 km) sun-synchronous orbit.

The Kuaizhou 1A has now flown 21 times and registered 19 successful launches. The new launch was China's 28th orbital mission of 2023; the country has plans to launch more than 200 spacecraft this year.

China begins trial operations with world's largest solar telescope array

The 1.95-mile-wide (3.14 kilometers) ring of dishes will monitor solar activities.

The world's largest array of sun-monitoring radio telescopes has begun trial operations in southwest China.

The Daocheng Solar Radio Telescope (DSRT) consists of 313 dishes, each with a diameter of 19.7 feet (6 meters), forming a circle with a circumference of 1.95 miles (3.14 kilometers). A 328-feet-high (100 m) calibration tower stands in the center of the ring.

The array has undergone half a year of debugging and testing, demonstrating the capability to consistently and reliably monitor solar activity with high precision. Trial operations officially started July 14, according to CCTV News.

Scientists simulate the effect of a much larger telescope and gain much higher resolution and sensitivity by collecting electromagnetic radiation from the sun with the multitude of dishes. The signals are combined, and then sophisticated mathematical algorithms are then used to reconstruct images.

DSRT is situated in Daocheng County, on a plateau in Sichuan province in southwest China. Its main task is continuous monitoring of the sun and observing solar flares and coronal mass ejections (CMEs). It will also aid research into monitoring and early warning methods for pulsars, fast radio bursts and asteroids.

DSRT was developed by the National Space Science Center under the Chinese Academy of Sciences (CAS). The array is part of the Meridian Project on space weather monitoring, a major China national science and technology infrastructure.

3D-printed hearts on ISS could help astronauts travel to deep space

Scientists are developing 3D-printed hearts that they plan to launch to the International Space Station in 2027. The goal is to see how these artificial organs fare when exposed to harsh space radiation. This research could help pave the way for long-term space exploration and could also have benefits for Earth-based medicine.

The PULSE project is funded by the European Innovation Council and is led by researchers at the University of Maastricht in the Netherlands. The team plans to use a technique called magnetic levitation to build the 3D-printed hearts. This will allow them to perfectly manipulate the cells and hydrogels used to create the organs, so that they closely replicate the complexity of human hearts.

The PULSE project is not the first time that scientists have exposed heart cells to spaceborne conditions. In the past, researchers have sent cardiac tissue specimens to the ISS to see how they contract in microgravity.

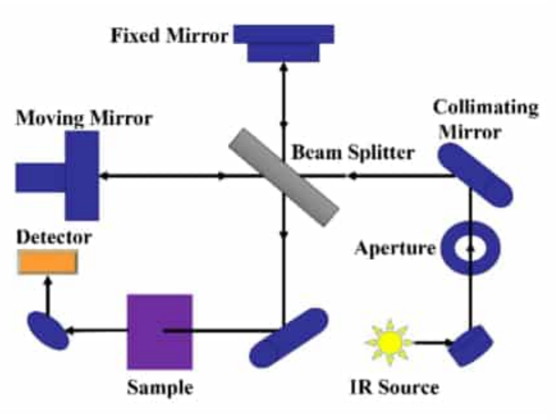
However, the PULSE project will be the first time that a fully 3D-printed heart is sent to the space station.

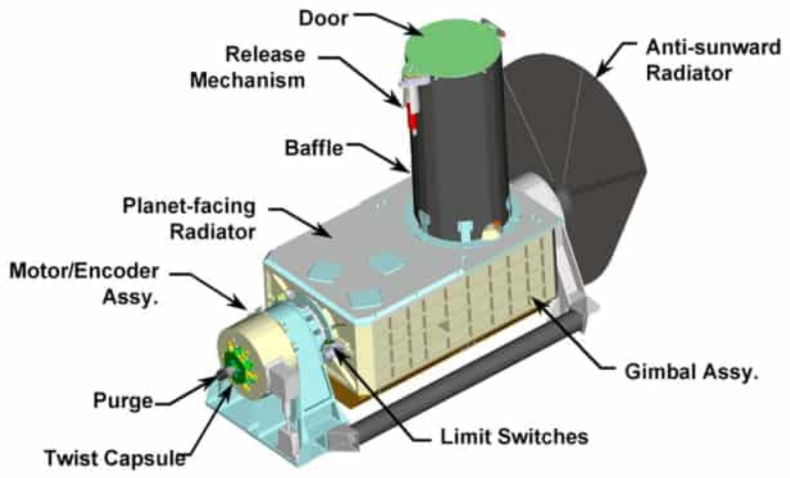
The results of the PULSE project could have major implications for both space exploration and Earth-based medicine.

If the 3D-printed hearts are able to withstand the harsh conditions of space, it could mean that astronauts could one day carry artificial hearts with them on long-duration space missions. The research could also lead to new treatments for heart disease on Earth.

The PULSE project is still in its early stages, but it has the potential to revolutionize both space exploration and medicine. The results of the project could help us to better understand how the human body reacts to space radiation and could lead to new ways to treat heart disease.

SPACE SENSORS





Infrared spectrometers are used in space to study the composition and temperature of objects in our solar system and beyond. They work by splitting light into its component wavelengths, or colors, and then measuring the strength of the light at each wavelength. This information can be used to identify the molecules that are present in an object, as well as to determine the temperature of the object.

Infrared spectrometers are used on a variety of space missions, including the Cassini spacecraft, which orbited Saturn from 2004 to 2017. The Cassini spacecraft's Composite Infrared Spectrometer (CIRS) was used to study the atmospheres of Saturn, Titan, and other moons. CIRS also helped to map the surface of Titan, and to identify the presence of liquid methane lakes on the moon.

Another example of an infrared spectrometer used in space is the Infrared Array Camera (IRAC) on the Spitzer Space Telescope. IRAC was used to study the formation of stars and galaxies, as well as to map the distribution of dust and gas in the Milky Way galaxy. IRAC's sensitivity to infrared light allowed it to see objects that would be invisible to visible light telescopes.

Infrared spectrometers are a powerful tool for studying the universe. They can be used to learn about the composition, temperature, and structure of objects in space. As new space missions are launched, infrared spectrometers will continue to play an important role in our understanding of the cosmos.

The benefits of using infrared spectrometers in space:

They can be used to study objects that are too cold or too faint to be seen in visible light.

They can be used to identify molecules that are not visible in visible light.

They can be used to measure the temperature of objects in space.

The challenges of using infrared spectrometers in space:

The Earth's atmosphere blocks out most infrared wavelengths.

Infrared spectrometers must be cooled to very low temperatures in order to operate properly.

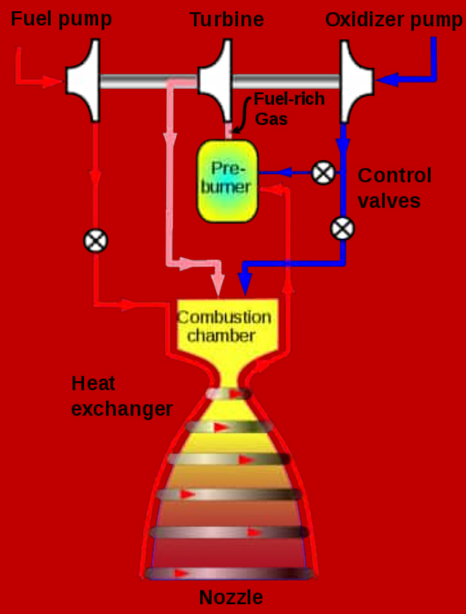
The sensitivity of infrared spectrometers is limited by the amount of light that they can collect.

Despite these challenges, infrared spectrometers are a valuable tool for studying the universe. They have helped us to learn about the composition, temperature, and structure of objects in space, and they will continue to play an important role in our understanding of the cosmos.

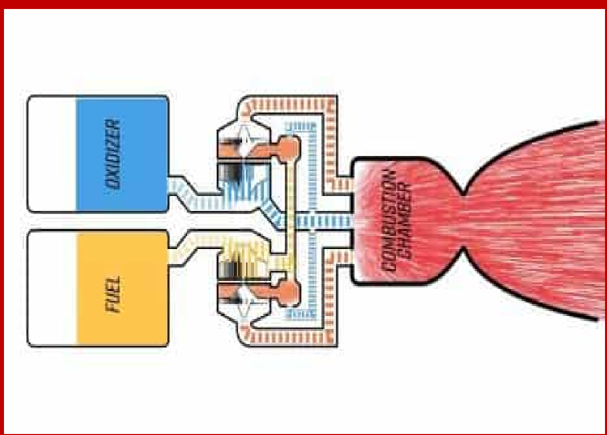
Space Terms to know about

Staged Combustion Engine:

Staged combustion rocket engines are a type of rocket engine that uses the hot exhaust gases from the combustion chamber to drive the turbines that power the propellant pumps. This allows the engine to achieve higher chamber pressures and specific impulses than other types of rocket engines, such as gas-generator engines.



Closed Cycle Engine:

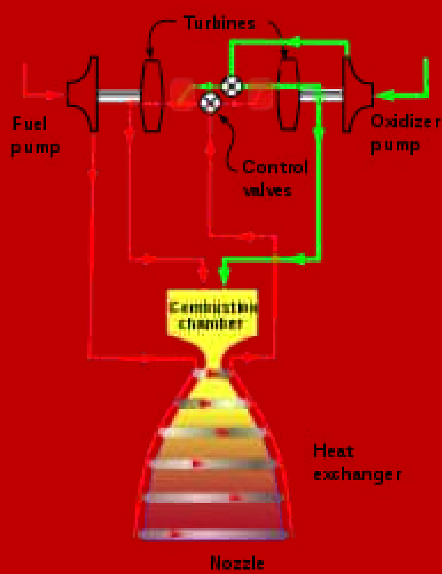


An electricClosed cycle engines are a type of rocket engine that uses the hot exhaust gases from the combustion chamber to drive the turbines that power the propellant pumps. The exhaust gases are then routed back into the combustion chamber, where they are burned again. This process is repeated, resulting in a closed cycle of combustion and gas expansion.

Methalox Engine:

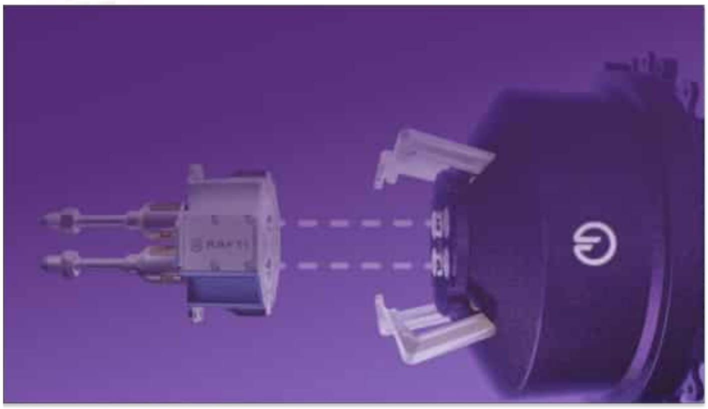
A typMethalox engines are rocket engines that use methane and liquid oxygen as propellants. They are a type of liquid-fueled rocket engine.

Methane is a relatively clean-burning fuel, and liquid oxygen is a very efficient oxidizer. This makes methalox engines a promising option for future space exploration.



Space-Tech Company

ORBIT FAB



Orbit Fab is an American startup company based in Lafayette, Colorado, United States, that develops in-space refueling systems for satellites. The company was founded in 2018 by Daniel Faber and Jeremy Schiel.

Orbit Fab's mission is to eliminate the single-use spacecraft paradigm with in-space refueling. Spacecraft are still limited to the amount of fuel they are launched with, which limits flexibility and poses long-term risks to the space environment. Orbit Fab's refueling systems will allow satellites to be refueled in orbit, extending their lifespans and increasing their capabilities.

Orbit Fab has developed a refueling interface called RAFTI™ (Rapidly Attachable Fluid Transfer Interface). RAFTI™ is a standardized interface that allows satellites to be refueled with a variety of propellants. The company has also developed a fleet of refueling spacecraft called the Tankers. The Tankers are designed to deliver fuel to satellites in orbit