

## SpaceX deploys its 1st V2 mini Starlink internet satellites in orbit



The satellites launched on their debut mission at 6:13 p.m. EST (2313 GMT) Monday from Florida's Cape Canaveral Space Force Station. The Falcon 9's first stage came back to Earth atop the SpaceX dronship A Shortfall of Gravitas 8.5 minutes after liftoff, in the Atlantic Ocean off the Florida coast.

These mini-test satellites will be used ahead of deploying full-size Starlink V2s aboard Starship, which can heft bigger ones with a mass of 1.25 tons (1,130 kilograms) to orbit once it is ready to go. A test launch with Starship may happen later this month.

The satellites themselves were deployed about 64.5 minutes after liftoff, SpaceX has said. In the company's new video, a camera mounted on a boom arm folds out away from the satellites as they separate from their Falcon 9 rocket upper stage.

"V2 minis include key technologies — such as more powerful phased array antennas and the use of E-band for backhaul — which will allow Starlink to provide ~4x more

capacity per satellite than earlier iterations," SpaceX said via Twitter on Sunday (Feb. 26).

The V2 minis also have argon Hall thrusters, which are being used for the first time in space. The new thrusters "have 2.4x the thrust and 1.5x the specific impulse of our first gen thrusters," SpaceX said in another Sunday tweet.

SpaceX has more than 4,000 Starlink satellites launched for internet service around worldwide, and has plans to send up many more. SpaceX has regulatory permission to send up 12,000 Starlink craft and asked for approval to deploy nearly 30,000 satellites on top of that.

The company originally planned to have three launches on Monday, but the other two faced delays. Crew-6's planned liftoff that day was scrubbed due to a ground-system issue late in the countdown. The next possible Crew-6 launch opportunity is Thursday (March 2) at 12:34 a.m. EST (0534 GMT).

# Relativity Space sets launch of world's 1st 3D-printed rocket for March 8



The 3D-printed Terran 1 rocket from Relativity Space will fly from Florida's space coast, and will also mark the first natural liquid natural gas booster in space if all goes to plan.

The world's first 3D-printed rocket may soar to space as soon as March.

Relativity Space says it has launch licenses ready for its expendable, 3D-printed Terran 1 rocket to attempt its orbital debut on March 8, no earlier than 1 p.m. EST (1800 GMT).

Company officials confirmed on Twitter Wednesday (Feb. 22) that the launch will proceed from Cape Canaveral Space Force Station on Florida's space coast. The mission is called GLHF (Good Luck, Have Fun) and will assure the readiness of the 110-foot (33-meter) Terran 1 before it flies customer payloads.

The company's rocket, about 85% 3D-printed by mass, has been called "the largest 3D printed object to exist and to attempt orbital flight" by the company. Relativity Space plans to boost 3D-printing on Terran 1 rockets to 95% of its mass.

Additive manufacturing is also used for the nine Aeon engines on the first stage of the rocket, and the Aeon Vac engine on the second. In a nod to environmental

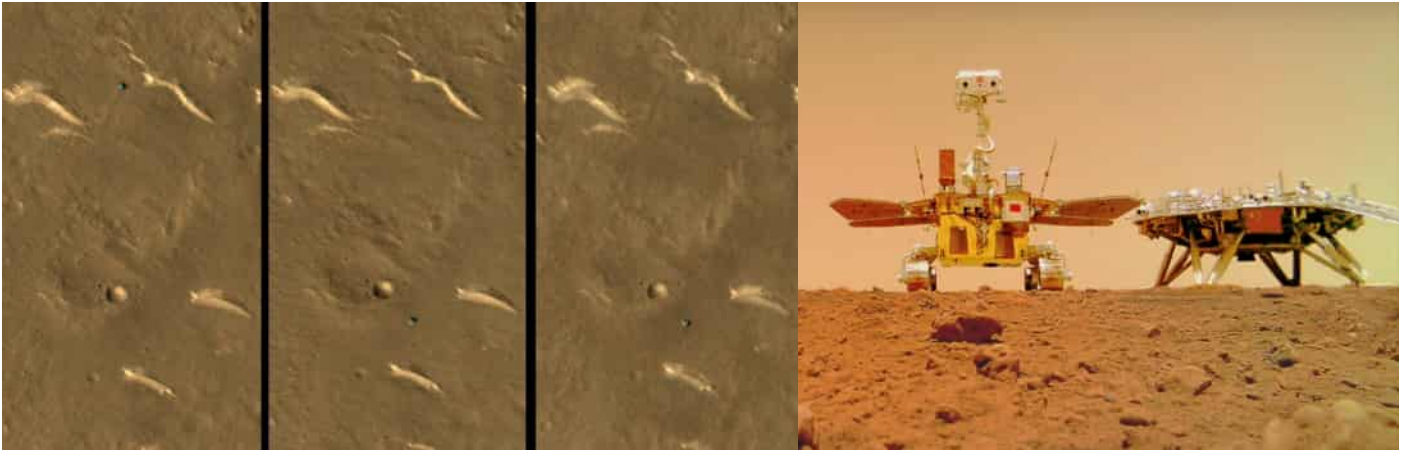
sustainability, Relativity Space also will use liquid oxygen as well as liquid natural gas for Terran 1. If the rocket makes it to space, it will be the first to do so with natural gas fuel and will form a keystone of Relativity's eventual plan to use methane on Mars for its planned Red Planet missions.

Relativity was co-founded by Tim Ellis and Jordan Noone in 2015 following work at Blue Origin and SpaceX, respectively. The small-lift rocket can send up to 2,756 pounds (1,250 kilograms) to low-Earth orbit, according to Relativity, and a bigger booster is in production.

Relativity unveiled Terran R in 2021, a much larger booster of 216 feet (66 m) tall by 16 feet (4.9 m) wide that can send nearly 25 times the payload mass of Terran 1 into space. The fully reusable rocket, launching as soon as 2024, can send as much as 44,100 lbs. (20,000 kg) to low Earth orbit.

Terran R's capacity is approaching that of SpaceX's Falcon 9, a competitor that regularly sends large payloads for NASA, the security industry and its own satellite constellation (Starlink) to space for almost 10 years. Falcon 9 is also partially reusable as the first stage can be returned on land or to a drone ship.

# NASA's Mars Reconnaissance Orbiter confirms that China's Zhurong rover has been stationary for months



The rover entered hibernation in May 2022, and there's reason to believe it hasn't woken up. On Feb. 10, China's Tianwen 1 mission — the country's first interplanetary mission — celebrated its second anniversary in Mars orbit. But one major piece of the mission, the Zhurong rover, seems to have stalled, and there's now photo evidence of its stationary state.

Zhurong entered a planned hibernation in May 2022 to ride out the dark and cold Martian winter, as the rover relies on solar energy for power and heat. Its controllers at the China National Space Administration (CNSA) anticipated a wake-up in December as the light returned in Martian spring, but the agency has not yet provided any updates about Zhurong.

New images released Tuesday (Feb. 21) by the University of Arizona, which manages the HiRISE camera on NASA's Mars Reconnaissance Orbiter, show that Zhurong did not move between Sept. 7, 2022, and Feb. 8, 2023, further suggesting that the rover has not yet awoken from hibernation.

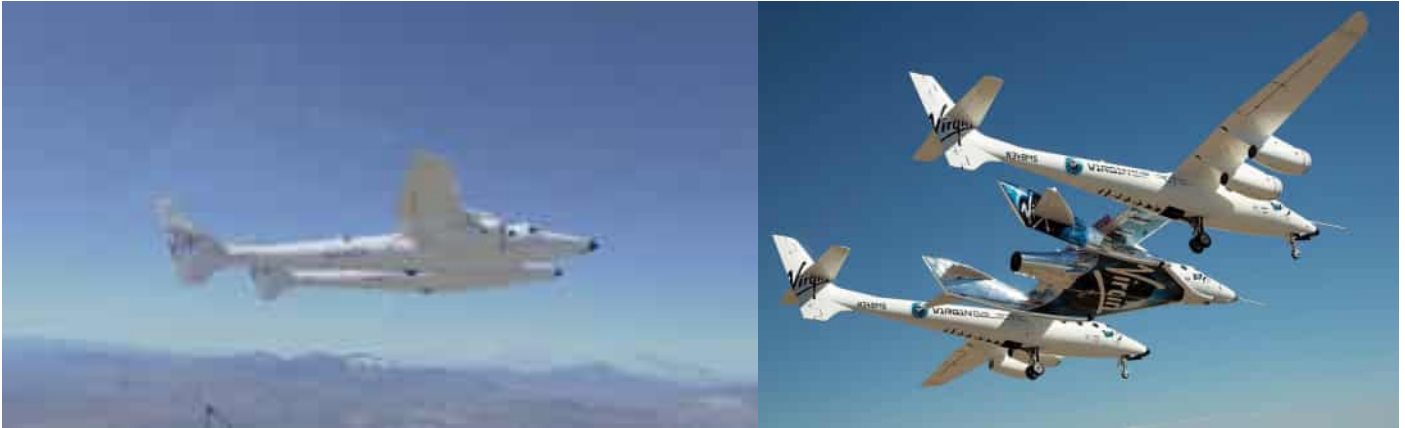
In January, the South China Morning Post reported that the rover had not yet re-established communications with mission control. There are many reasons that the rover

might remain in hibernation. Dust might have accumulated on Zhurong's solar panels, reducing their efficiency. And data from NASA's Perseverance rover, a nuclear powered spacecraft that can operate through winter, suggests that Mars is still quite cold — potentially below Zhurong's operating levels. Tianwen 1 mission deputy chief designer Jia Yang told reporters in September 2022 that in order for Zhurong to wake up from hibernation, the rover must reach a temperature of 5 degrees Fahrenheit (minus 15 degrees Celsius) and generate at least 140 watts of energy. Both scenarios can be remedied by conditions on Mars — a dust devil or wind storm could clear the solar panels, as happened with NASA's Spirit rover in 2005, and the planet could warm up as the year progresses.

And if Zhurong is in for a permanent sleep, all is not lost: The rover has successfully completed its original mission, which was intended to last just three months on the Martian surface. In total, Zhurong successfully completed a year of operations, which is no small feat. In September 2022, the rover's mission was presented with the International Astronautical Federation's annual space achievement award.



# Virgin Galactic carrier plane flies for 1st time since 2021



Virgin Galactic's carrier plane just took to the skies for the first time in nearly 16 months. The aircraft, known as VMS Eve, conducted a test flight from California's Mojave Air and Space Port on Wednesday (Feb. 15), Virgin Galactic announced in a brief Twitter update. The flight lasted more than 2.5 hours and reached a maximum altitude of about 41,500 feet (12,650 meters), according to Space News, which cited flight tracking data.

It was Eve's first lift-off since late October 2021, when the plane flew to Mojave from Spaceport America in New Mexico to receive a series of modifications and upgrades.

VMS Eve is a key piece of Virgin Galactic's space tourism hardware. During operational flights, the plane carries the company's six-passenger VSS Unity spaceliner to an altitude of about 50,000 feet (15,000 m). The piloted Unity then drops free and fires up its rocket motor, powering its way to suborbital space.

The duo have conducted four such spaceflights to date, most recently in July 2021, when Unity carried four passengers — including Virgin Group founder Richard Branson — to and from the final frontier.

Shortly after that flight, Virgin Galactic announced it was going to upgrade Eve and Unity, taking both vehicles out of operation for a spell. This work included replacing Eve's

center pylon, the point between the plane's twin fuselages where Unity attaches.

Wednesday's flight helped test the new pylon, among other features, even though Eve flew solo, according to Kelly Latimer, Virgin Galactic's senior flight test director.

"One thing we will do is take it out — without any spaceship attached to it — up to high altitude, cold-soak it (make sure everything operates in extremely cold temperature), then we actuate the hooks that would normally attach to the spaceship and collect data on how they performed," Latimer said in a Q&A that the company posted on Wednesday.

VSS Unity is back at Spaceport America, and Eve will likely join the spaceliner there soon, Latimer said.

"After we complete system checks during initial flight test, Eve will fly what we call a ferry flight to New Mexico," she said in the Virgin Galactic Q&A. "The team is excited to see Eve and Unity reunited again, and we have some more testing to do with the mothership and spaceship combined — including more ground testing, glide and powered flight to complete the required validations of the vehicle's modifications."

When those checkouts are done, Virgin Galactic will presumably be ready to resume crewed spaceflights. The first of those, a research mission for the Italian Air Force, is on target to lift off sometime this spring, Virgin Galactic representatives have said.

# Amazon gets a green light to launch 3,000-satellite Kuiper constellation



Amazon has received the go-ahead to construct a constellation of 3,236 satellites after gaining approval for an updated orbital debris mitigation plan.

The Federal Communications Commission (FCC), the U.S. main telecommunications services regulator, approved Amazon's Project Kuiper plan in an authorization adopted and released on Feb. 8.

"Our action will allow Kuiper to begin deployment of its constellation in order to bring high-speed broadband connectivity to customers around the world," the FCC document read.

Amazon previously received conditional approval from the FCC for its Project Kuiper plan back in 2020. The company has now satisfied conditions including a plan to address issues of collision risk, post-mission disposal reliability, completion of satellite design, and orbital separation.

The plan addressed concerns from other satellite operators and organizations including Viasat and SpaceX, Via Satellite reported. Amazon will also need to provide semi-annual conjunction and space debris reports.

The 3,236 Kuiper satellites will have a seven

year operational lifetime and orbit at altitudes of roughly 365 miles, 380 miles and 390 miles (590 kilometers, 610 km and 630 km respectively) and operate in Ka-band radio frequencies.

The post-mission disposal plan involves lowering the perigee of the satellite to about 220 miles (350 km), an altitude at which Earth's atmosphere would result in drag that would see the satellite's orbit decay within a year, SpaceNews reports.

The decision clears the way for what will be intense work to get the constellation deployed and operational. The FCC approval stipulates that 50% of the satellites must be launched by the end of July 2026, and the rest of the constellation by mid 2029.

Last August Amazon booked up to 83 launches to carry Kuiper satellites into orbit. Up to 37 of these will fly on the New Glenn rocket developed by Blue Origin, a company which, like Amazon, was founded by Jeff Bezos, with another 38 flights using United Launch Alliance's (ULA) Vulcan Centaur rocket, which uses Blue Origin's BE-4 engine. A further 18 launches will be conducted by Arianespace's Ariane 6.

# China launches secretive Horus 1 remote sensing satellite



The Horus 1 mission is a collaboration between China and Egypt.

China sent a secretive remote-sensing satellite named Horus 1 to orbit on Friday night (Feb. 23) as the country begins to ramp up its launch activity.

A Long March 2C rocket lifted off from Jiuquan Satellite Launch Center in the Gobi Desert at 11:01 p.m. on Friday (0401 GMT; 12:01 p.m. Beijing time on Feb. 24). Insulation tiles fell away from the rocket as it rose into the sky before carrying Horus 1 into orbit.

China's main space contractor CASC announced launch success within an hour of liftoff. The Horus 1 satellite is designed for remote sensing and was produced by CASC's China Academy of Space Technology. No further details were provided by CASC or Chinese state media.

A Jiuquan mission control screen announcing mission success, however, gave a first hint that the satellite may have been launched for Egypt. Egyptian media confirmed this a day later, with quotes from the head of the Egyptian space agency.

Astronomer and space launch observer Jonathan McDowell noted that Egypt has previously contracted CASC to build remote-sensing satellites. The two countries have

recently deepened their space-related cooperation, according to a 2022 report from Space in Africa.

U.S. Space Force space domain awareness teams later tracked the satellite in a roughly 308-mile-high (496 kilometers) sun-synchronous orbit.

Less than a day earlier, China launched the Zhongxing 26 (ChinaSat 26) communications satellite toward geostationary orbit. A Long March 3B lifted off from Xichang in southwest China at 6:49 a.m. EST (1149 GMT or 7:49 p.m. Beijing time) on Feb. 23.

Zhongxing 26 is China's first communications satellite with a communications capacity of more than 100 gigabits per second (Gbps), according to Chinese state media. The satellite will provide high-speed private network communications and satellite internet services to China and the Asia-Pacific region in concert with the earlier Zhongxing 16 and 19 spacecraft.

Zhongxing 26 was China's first launch for more than a month, following a pause in activity as the country marked the New Year according to the traditional Chinese calendar. China aims to launch at least 200 spacecraft on more than 60 planned launches in 2023.



# SpaceX scrubs Crew-6 astronaut launch due to ignition-fluid issue



The next launch opportunity is Thursday, March 2 at 12:34 a.m. EST (0554 GMT).

SpaceX's next astronaut mission will be groundbound for at least one extra day.

A SpaceX Falcon 9 rocket was scheduled to launch the Crew-6 mission to the International Space Station (ISS) for NASA early Monday morning (Feb. 27) from Kennedy Space Center in Florida. But the launch team called the effort off less than 2.5 minutes before T-0, citing a ground-system issue.

"Teams were tracking a ground issue with TEA-TEB — that's the ignition fluid that actually sparks with the oxidizer and allows the engines to fire," NASA commentator Gary Jordan said during the agency's webcast of Monday's launch attempt.

That issue could not be resolved in time ahead of the instantaneous launch window at 1:45 a.m. EST (0645 GMT), leading to Monday morning's scrub. The next launch opportunity comes on Thursday (March 2) at 12:34 a.m. EST (0534 GMT); weather on Tuesday (Feb. 28), the first possible opportunity before that, is not favorable for launch, according to NASA and SpaceX. Officials with both entities will hold a press conference at some point, although NASA did not release timing in a blog post.

Crew-6 will send NASA astronauts Stephen Bowen and Woody Hoburg, the United Arab Emirates' (UAE) Sultan Al Neyadi and Russian cosmonaut Andrey Fedyaev toward the ISS aboard the Dragon capsule Endeavour.

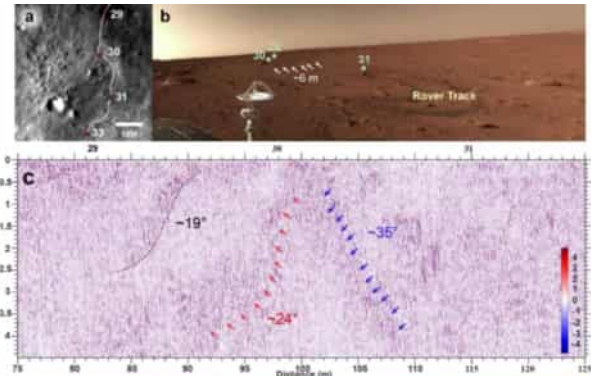
It's a historic mission; Al Neyadi will become the first person from the UAE to spend a long duration mission aboard the ISS. His countryman Hazzaa Ali Almansoori traveled to the orbiting lab in 2019 but spent just eight days off Earth.

Crew-6 will be the sixth operational astronaut mission that SpaceX flies for NASA's Commercial Crew Program and the company's ninth crewed flight overall. It will be the fourth crewed mission to the ISS for the capsule Endeavour, which also flew the Demo-2 test flight in 2020, Crew-2 in 2021 and the all-private Ax-1 mission in April 2022.

The next day or so is shaping up to be very busy for SpaceX. The company plans to launch two batches of its Starlink internet satellites less than an hour apart on Monday, one from Cape Canaveral Space Force Station in Florida at 1:38 p.m. EST (1838 GMT) and the other from Vandenberg Space Force Base in California at 2:31 p.m. EST (1931 GMT).

Should the launch go on Thursday, docking with the ISS is scheduled for Friday, March 3 at 1:11 a.m. EST (0611 GMT), according to the NASA Television schedule.

# China's Zhurong rover reveals complex layers beneath the surface of Mars



China's Zhurong rover has provided one of the few peeks into what lies below the surface of Mars. Data returned by Zhurong's ground penetrating radar instrument reveals evidence of craters buried just under the surface of Mars and other, sloping features with less certain origins, according to a new paper. This view of the Martian surface, which shows several clear features, contrasts starkly with the shallow subsurface structure of Earth's moon, also revealed by ground-penetrating radars. The moon's uppermost 33 feet (10 meters) consists of fine layers that have been ground up by a bombardment of micrometeorite strikes. The difference may be explained by Mars' thin atmosphere, which offers protection against micrometeorites and also has weathering effects on the surface.

"We found a lot of dunes on the surface at the landing site, so maybe this crater was quickly buried by the sand and then this cover reduced space weathering, so we can see the full shape of these craters' walls," Yi Xu, the lead author on the study, said in a statement.

Zhurong launched in July 2020 along with the Tianwen 1 mission orbiter and landed in the large plain of Utopia Planitia in May 2021. The rover traveled 6,302 feet (1,921 meters) south from its landing site over the following Earth year.

The landing site was selected for engineering and science criteria, with the area thought to host shorelines of a possible ancient ocean.

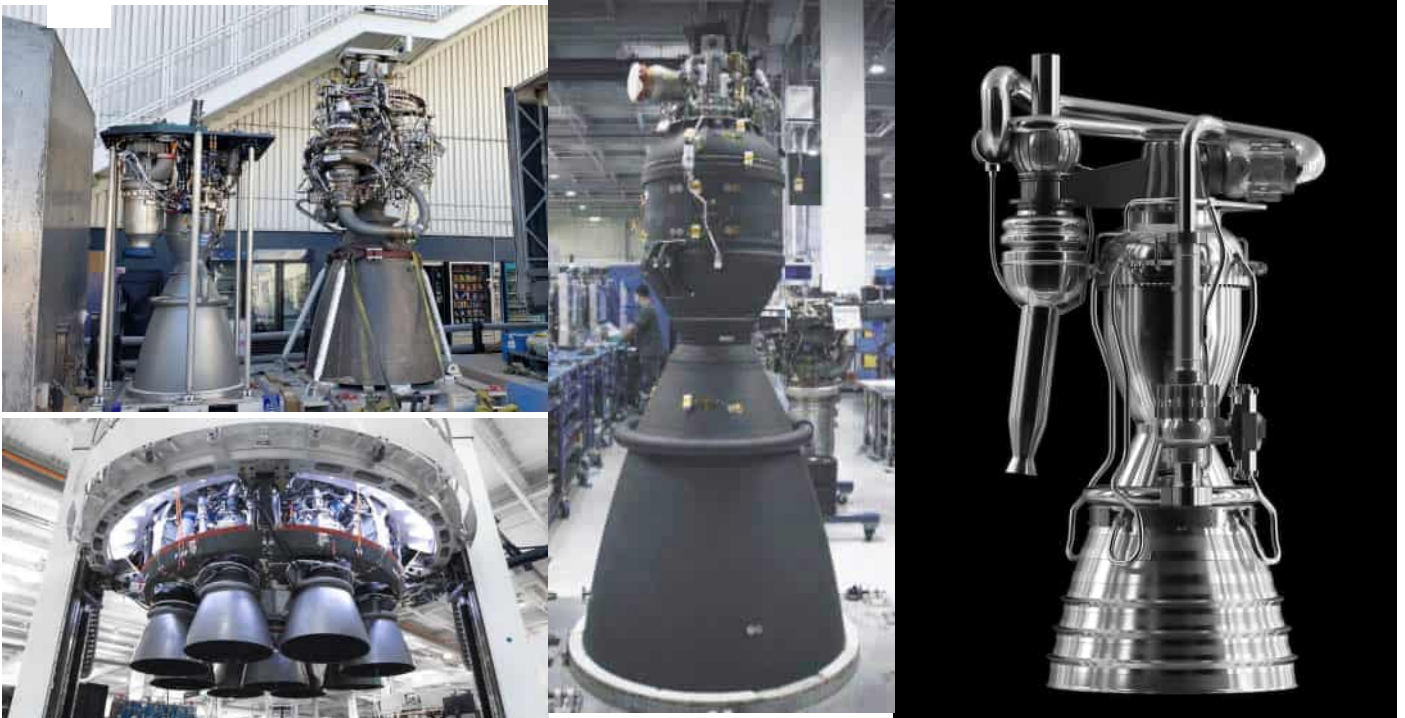
One objective for Zhurong's ground-penetrating radar — which pings electromagnetic signals off subsurface rocks and collects their reflections — was seeking evidence of water or ice trapped below the surface. It uses two different frequency ranges, with the frequency used for this study providing fine detail but only to a depth of around 15 feet (4.5 m). No water was found in this study, but the other radar frequency reaches down to around 260 feet (80 m). Researchers hope that opening this window onto the subsurface of Mars will provide insight into Mars's geological development, clues about earlier climate conditions and possibly evidence of the presence of water or ice.

NASA's Perseverance also carries a ground-penetrating radar instrument, providing new insights into its environs, the floor of Mars' Jezero Crater. The research article was published on Feb. 9 in the journal *Geology* of the Geological Society of America. Meanwhile, the fate of the Zhurong rover itself is currently unknown. The solar-powered rover entered hibernation in May 2022 due to the approaching winter in Mars' northern hemisphere. It was expected to resume activities autonomously in December, but Chinese space authorities have not commented on the rover's apparent silence.

NASA's Mars Reconnaissance Orbiter recently imaged Zhurong from orbit, showing that the rover has not moved since its hibernation period began. The rover could awaken as heat and light conditions improve in Utopia Planitia.



# The Marlin Engine: A New Era in Sustainable Transportation



The Marlin engine is a revolutionary technology that promises to revolutionize the world of transportation. Developed by a team of experts at Marlin Motors, this cutting-edge engine is designed to be lightweight, compact, and incredibly efficient. Here's everything you need to know about the Marlin engine.

The Marlin engine is a four-stroke internal combustion engine that operates on the Otto cycle. What sets it apart from traditional engines is its unique design. The Marlin engine is made up of two opposing cylinders that move in opposite directions. This creates a balanced, vibration-free engine that runs smoothly and efficiently.

One of the most significant advantages of the Marlin engine is its lightweight design. Thanks to its compact size and simplified construction, the Marlin engine weighs up to 30% less than traditional engines of similar power output. This means that it can be used in a variety of applications, from small cars to airplanes, without adding significant weight to the vehicle.

Another key feature of the Marlin engine is its impressive fuel efficiency. The engine has been designed to operate on a variety of fuels, including gasoline, diesel, and biofuels. With its advanced combustion technology and efficient design, the Marlin engine can achieve fuel efficiency ratings that are up to 30% better than traditional engines.

In addition to its impressive performance characteristics, the Marlin engine is also designed to be environmentally friendly. Thanks to its efficient combustion technology, the engine produces fewer emissions than traditional engines. This makes it an ideal choice for companies and individuals who are committed to reducing their carbon footprint.

Despite its many advantages, the Marlin engine is still in the early stages of development. The team at Marlin Motors is currently working to refine the engine's design and optimize its performance. However, with its impressive performance and cutting-edge technology, the Marlin engine has the potential to revolutionize the world of transportation in the years to come.

# SPACE SENSORS



In space, one of the most crucial tools for satellite navigation is the star tracker. This device allows satellites to determine their precise orientation and location in space by observing the positions of stars. The technology behind star trackers is impressive, and their accuracy is unmatched by any other navigation system.

A star tracker works by capturing images of the stars surrounding the satellite and comparing them to a catalog of known star positions. By identifying specific star patterns, the star tracker can determine the satellite's orientation, which is critical for tasks such as aligning solar panels, antennas, or instruments.

Star trackers are essential for satellites that require extremely precise pointing, such as telescopes and communication satellites. For example, the Hubble Space Telescope uses two Fine Guidance Sensors, each equipped with a star tracker, to keep the telescope pointed at specific targets with an accuracy of 0.007 arcseconds, which is equivalent to aiming at a dime from 200 miles away.

Another important application of star trackers is in Earth observation satellites. These

satellites use star trackers to determine their position and orientation accurately, allowing them to capture high-resolution images of the Earth's surface. The star tracker provides the satellite with the necessary information to compensate for any movement caused by the satellite's orbit or other factors, ensuring that the images captured are of the highest quality.

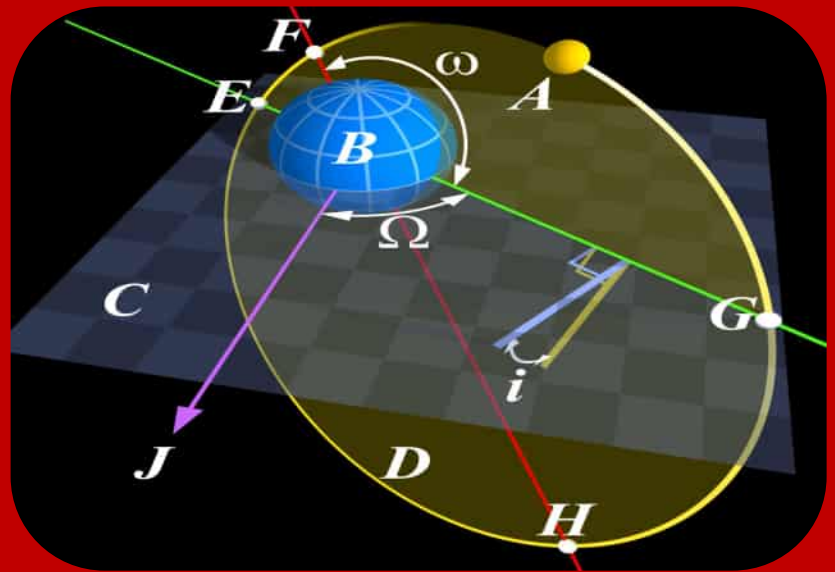
The development of star tracker technology has come a long way since the first star tracker was launched in 1967. Today, modern star trackers can detect stars as faint as magnitude 6.5, which is 500 times fainter than what is visible to the naked eye. They are also capable of operating in various conditions, such as during eclipses, when the satellite's solar panels are not receiving sunlight.

In conclusion, star trackers are a vital component of space navigation and Earth observation. They provide satellites with accurate and reliable information about their position and orientation, allowing them to perform critical tasks and collect valuable data. As space technology continues to advance, we can expect to see further improvements in star tracker technology, enabling even more precise and sophisticated satellite operations.

# Space Terms to know about

## Orbital Period :

*The time it takes for a planet or other celestial body to complete one orbit around its star or another object.*

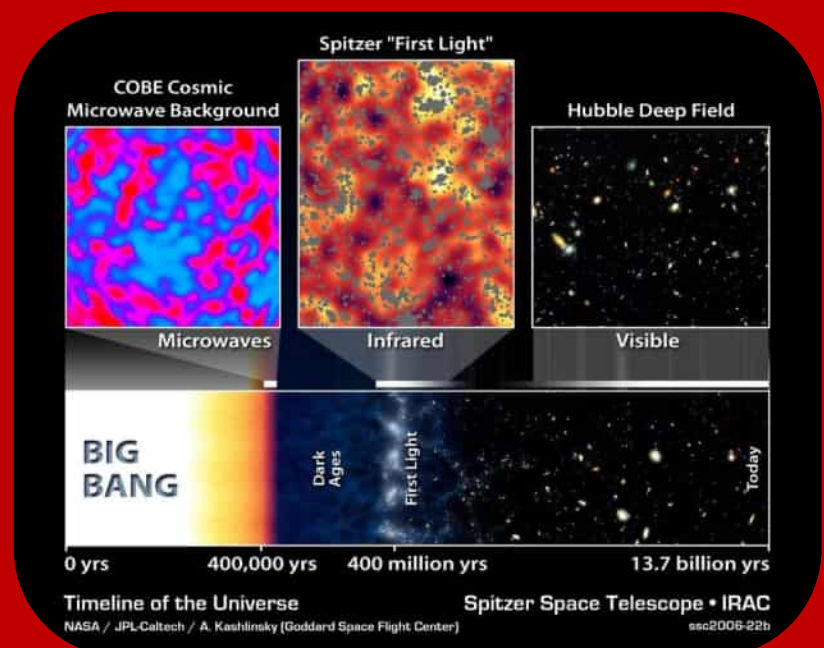


## Terraforming :

*The process of transforming a planet or other celestial body to make it habitable for humans, by altering its atmosphere, temperature, and other conditions.*

## Cosmic Microwave Background :

*A faint glow of radiation that is present throughout the universe, thought to be the afterglow of the Big Bang.*





# Space-Tech Company

Firefly Aerospace



*Image Credit: Firefly Aerospace*

Firefly Aerospace is a private American space launch services company based in Cedar Park, Texas. Founded in 2014, the company's goal is to provide reliable, low-cost access to space for small and medium-sized payloads. Firefly's Alpha rocket is designed to deliver payloads of up to 1,000 kg to low Earth orbit and beyond. The company also offers mission management services and ground support equipment. Firefly has already completed several successful test launches and has contracts with multiple customers, including NASA and private satellite companies. With a focus on affordability and innovation, Firefly Aerospace aims to become a major player in the commercial space industry.

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