



May 2021

**Oklahoma Space  
Alliance**

A Chapter of The  
National Space Society

A free email newsletter of the Oklahoma Space Alliance

# NASA's Ingenuity Mars Helicopter Succeeds in Historic First Flight



An image taken by NASA's Ingenuity Mars helicopter during its first flight April 19, looking down at the surface and its shadow. **Credits: NASA/JPL-Caltec**

<https://www.nasa.gov/press-release/nasa-s-ingenuity-mars-helicopter-succeeds-in-historic-first-flight>

**May 2021 OSA  
Meeting**

**Saturday, May 8, 2021**

**Cliff McMurray's home  
2715 Aspen Circle in  
Norman.**

**Non-vaccinated persons  
should wear a mask**

**Zoom link**

<https://us04web.zoom.us/j/79444489279?pwd=R2hLS2R3RnVoUFVMcS9UaDRWMW9sUT09>  
405-821-9077

Program— Space

## Quote of the Month

**"It's amazing what can be accomplished when people come together,". Elon Musk, after making the first US crew splashdown in darkness since the Apollo 8**

## Oklahoma Space Alliance

### Update

April , 2021

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# Ingenuity performs first flight on Mars



WASHINGTON — NASA's Ingenuity helicopter successfully performed the first powered aircraft flight on another planet April 19, briefing hovering above the surface of Mars.

The 1.8-kilogram helicopter performed the flight at 3:34 a.m. Eastern, but data from the flight, relayed through the Perseverance rover and another Mars orbiter, arrived at Earth a little more than three hours later.

The telemetry included one image taken from a camera on Ingenuity, looking down on the surface and capturing its shadow. Perseverance, monitoring the flight from about 65 meters away, also returned a set of images showing the helicopter in flight.

Article: <https://spacenews.com/ingenuity-performs-first-flight-on-mars/>

Video (5:37)

<https://www.youtube.com/watch?v=0gQDnzpy1n4>

Video (0:57) [First Video of NASA's Ingenuity Mars Helicopter in Flight, Includes Takeoff and Landing \(High-Res\) - YouTube](#)

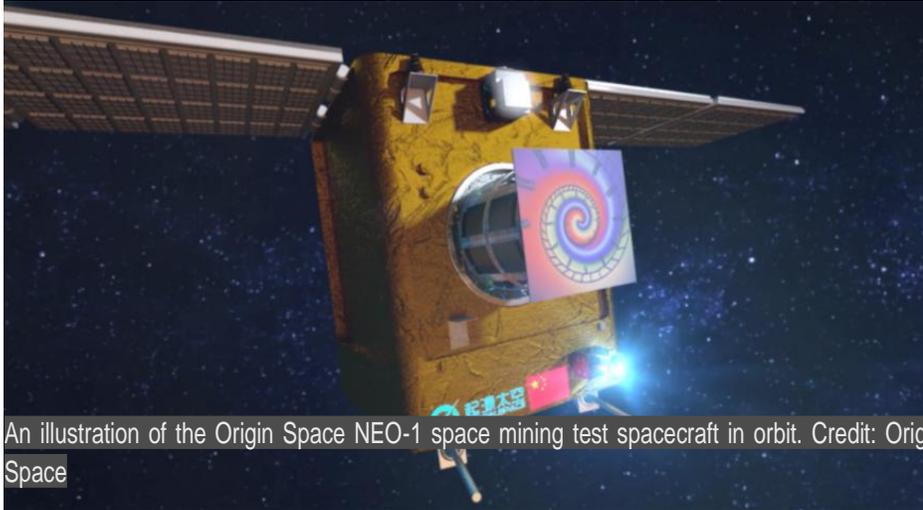
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# China launches space mining test spacecraft on commercial rideshare mission

by [Andrew Jones](#) — April 27, 2021

HELSINKI — China launched a small space mining test spacecraft and eight other commercial satellites into orbit on a Long March 6 rocket late Monday.



An illustration of the Origin Space NEO-1 space mining test spacecraft in orbit. Credit: Origin Space

The Long March 6 lifted off from Taiyuan Satellite Launch Center, north China, at 11:20 p.m. Monday Eastern. The China Aerospace Science and Technology Corp. (CASC) [announced](#) launch success within an hour of launch.

The small satellite will test near Earth asteroid observation and prototype technology verification for space resource acquisition in low Earth orbit. The mission will carry out an active debris removal test, releasing a small, square, spiral-patterned target and subsequently attempt capture using a net system. The spacecraft will then lower its orbit using onboard electric propulsion.

“The goal is to verify and demonstrate multiple functions such as spacecraft orbital maneuver, simulated small celestial body capture, intelligent spacecraft identification and control,” Yu Tianhong, an Origin Space co-founder, told [IEEE Spectrum](#) last year. NEO-1 also carries a large field of view camera and other imagers.

Article: <https://spacenews.com/china-launches-space-mining-test-spacecraft-on-commercial-rideshare-mission/>

Launch Video (0:27): <https://www.youtube.com/watch?v=V481t5iLzRU>

# China launches Tianhe space station core module into orbit

by [Andrew Jones](#) — April 29, 2021



Liftoff of the Long March 5B rocket carrying the Tianhe core module for the Chinese Space Station. Credit: CCTV/framegrab

HELSINKI — China successfully launched a 22-metric-ton module April 28, beginning an intense period of missions for constructing the nation's own space station.

A Long March 5B heavy-lift rocket lifted off from the coastal Wenchang spaceport at 11:23 p.m. Eastern. The Tianhe space station core module separated from the first stage after 490 seconds of flight.

Solar array deployment occurred just over an hour after launch. Li Shangfu, chief commander of the China Manned Spaceflight Program, announced launch success shortly after.

Tianhe, or “harmony of the heavens,” is now expected to raise its orbit to around 370 kilometers above the Earth. The uncrewed [Tianzhou-2](#) cargo spacecraft is slated to rendezvous and dock with Tianhe in mid-late May, ahead of the visit of three astronauts aboard Shenzhou-12 in June.

The missions will be the first three of 11 launches scheduled for 2021 and 2022 to build the planned 66-ton, three-module orbital outpost. A Long March 2F rocket and Shenzhou spacecraft will also be on standby at all times at Jiuquan to perform emergency rescue missions to the space station, a senior space official [stated](#) in March.

International science payloads and experiments have also been [selected](#) for a journey to the CSS through cooperation between the United Nations Office for Outer Space Affairs (UNOOSA) and the China Manned Space Agency (CMSA)

China had expressed interest in joining the International Space Station project but membership was effectively denied by U.S. policy towards China's space programs.

The CSS will also be joined in orbit by the [Xuntian optical module](#), a co-orbiting, Hubble-class space telescope. The space telescope will have a 2-meter-aperture comparable to Hubble but feature a field of view 300 times greater, allowing 40 percent of the sky to be surveyed across a decade.

Xuntian will be capable of docking with the CSS for maintenance and repairs. The space station itself could also be expanded from three to six modules, using modules developed as backups.

Article: <https://www.space.com/china-launches-core-module-tianhe-space-station>  
<https://spacenews.com/china-launches-tianhe-space-station-core-module-into-orbit/>

Video of construction animation (1:43)

[https://www.youtube.com/watch?v=sL\\_1TG2ljPo](https://www.youtube.com/watch?v=sL_1TG2ljPo)

Extend summary video (11:05) <https://www.youtube.com/watch?v=o6GUEkc4EEA>

Anton Petrov Additional video on Space Mining (11:09)

<https://www.youtube.com/watch?v=cU8rfmjqiCc>

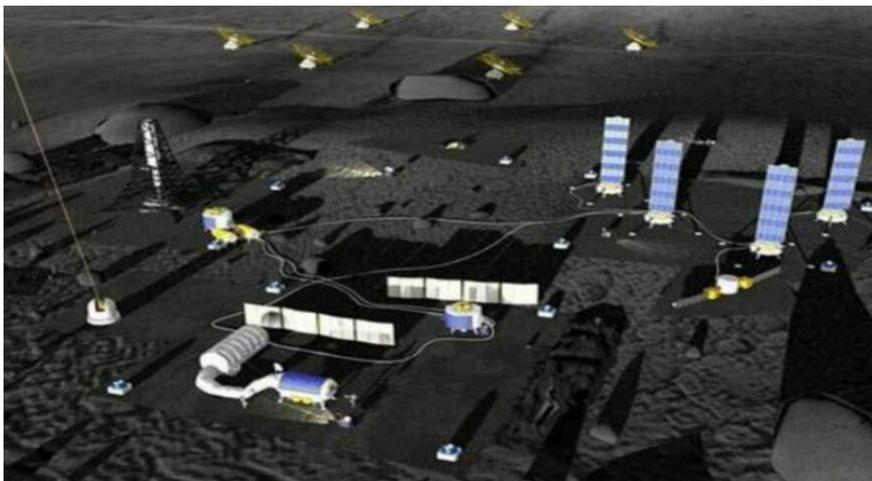
## China, Russia open moon base project to international partners, early details emerge

by [Andrew Jones](#) — April 26, 2021

China also reveals early outline and objectives for lunar research station.

HELSINKI — Russia and China have formally invited countries and international organizations to join the International Lunar Research Station (ILRS) project being developed by the two nations.

China National Space Administration (CNSA) and Russia's Roscosmos said the ILRS project would be open to participation at all stages and levels. This includes planning, design, research, development, implementation and operations.



*An artist's conception of the International Lunar Research Station (ILRS), post-2030 Credit: CNSA/CLEP*

CNSA and Roscosmos will promote extensive cooperation for the development of human space science and technology and socio-economic progress, said CNSA deputy director Wu Yanhua.

The announcement was made at a sideline event of the 58th session of the Scientific and Technical Subcommittee of the United Nations' Committee on the Peaceful Uses of Outer Space (COPUOS)

April 23.

Russia and China signed a memorandum of understanding on the ILRS in [March](#).

### Early ILRS outline

The China Lunar Exploration Project under the CNSA presented early details of the ILRS project—first proposed by China as an evolutionary, expanded stage of lunar exploration following the success of a series of missions launched since 2007—at the sixth annual China Space Day in Nanjing, east China, April 24, . Slides [detailing](#) the project appeared on social media.

The first phase involves using data returned by missions sent to launch by 2025. These will determine the location for a lunar surface base in the vicinity of the lunar south pole. Missions include China's Chang'e-6 and [Chang'e-7](#) and Russia's Luna 25, 26 and 27 missions.

The second phase will run from 2026-2030. It will see Chang'e-8 and Luna 28 set down at the chosen site and mark the beginning of construction.

The third phase will consist of multiple missions across 2030-2035. By this time China hopes to test launch its [Long March 9](#) super heavy-lift launcher.

Earlier [Chinese visions](#) of the ILRS outlined long-term robotic and potentially short-term crewed missions for this timeframe. A long-term human presence at the lunar south pole is the goal for 2036-2045.

The ILRS will focus on water and mineral resources, in-situ resource utilization and manufacturing on the moon, require developing wireless energy transmission and nuclear power for space, and trialing effects of low gravity on biology, according to the China Space Day presentation

Areas of particular scientific interest include lunar geology and chemistry, the lunar space environment, moon-based astronomy, biomedicine and utilization of resources.

### **Upcoming missions**

Chang'e-6 is a 2024 former backup to Chang'e-5 which visited Oceanus Procellarum on the near side. The new mission would target the ancient and massive South Pole-Aitken basin on the far side of the moon. The spacecraft will also carry payloads from France, Sweden, Russia and Italy.

Chang'e-7 will consist of an orbiter and a lander and deploy both a rover and a mini-flying probe. It will be supported by a relay satellite and the various spacecraft will carry a total of 23 science payloads. Objectives include a detailed survey of the environment and resources in the lunar south polar region. The mini-flying probe will make in-situ observations of a permanently shadowed crater.

Luna 25 is a Russian lander targeting a launch in October this year and landing near the lunar south pole. The mission follows 45 years after the Soviet Luna-24 mission.

China has launched two lunar orbiters, a pair of lander and rover missions and, in late 2020, the complex [Chang'e-5](#) lunar sample return mission. It is also [developing](#) spacecraft and launch vehicles to allow crewed visits to the moon.

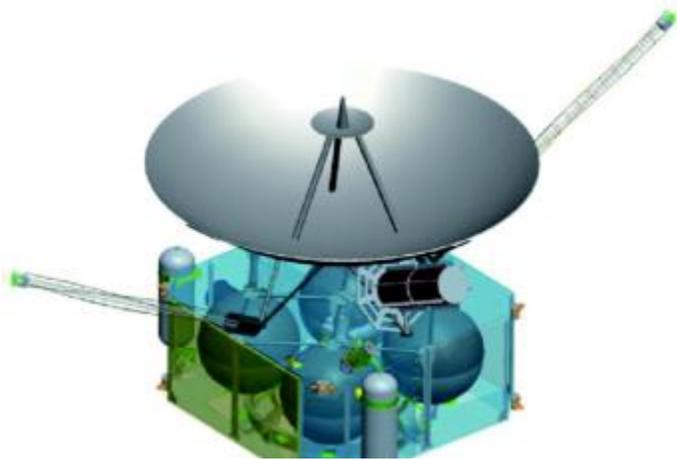
## **China to launch a pair of spacecraft towards the edge of the solar system**

by [Andrew Jones](#) — April 16, 2021

Chinese Voyager-like missions could launch in 2024, making planetary flybys before focusing on heliosphere science.

HELSINKI — China is developing a mission to send a pair of spacecraft to study the far reaches of the solar system and reach interstellar space by mid-century.

The project aims to send separate spacecraft to the nose and tail of the heliosphere, a region of space dominated by solar wind created by our Sun, to study distinct areas of this bubble and how it interacts with the interstellar medium.



Schematic diagram of an RTG-based Chinese heliosphere spacecraft. Credit: Scientia Sinica

Wu Weiren, a senior figure in China’s lunar exploration project, **told** official industry newspaper China Space News Friday that scientists are working on an implementation plan for the mission.

Wu says the mission aims to reach 100 astronomical units—one AU is equivalent to one Sun-Earth distance, or 150 million kilometers—from Earth by 2049, when the People’s Republic of China celebrates the centenary of its founding.

No launch date was provided by Wu. However an overview of the proposed mission **presented** to the European Planetary Science Congress in

2019 indicates the Chinese heliosphere probes would launch in 2024. The first would make a flyby of Jupiter in 2029 before heading to the nose of the heliosphere.

Full Article: <https://spacenews.com/china-to-launch-a-pair-of-spacecraft-towards-the-edge-of-the-solar-system/>

## NASA’s Perseverance Mars Rover Extracts First Oxygen from Red Planet

Apr 21, 2021 The growing list of “firsts” for Perseverance, NASA’s newest six-wheeled robot on the Martian surface, includes converting some of the Red Planet’s thin, carbon dioxide-rich atmosphere into oxygen. A toaster-size, experimental instrument aboard Perseverance called the Mars Oxygen In-Situ Resource Utilization Experiment (**MOXIE**) accomplished the task. The test took place April 20, the 60th Martian day, or sol, since the mission landed Feb. 18.

While the technology demonstration is just getting started, it could pave the way for science fiction to become science fact – isolating and storing oxygen on Mars to help power rockets that could lift astronauts off the planet’s surface. Such devices also might one day provide breathable air for astronauts themselves. MOXIE is an exploration technology investigation – as is the Mars Environmental Dynamics Analyzer (**MEDA**) weather station – and is sponsored by NASA’s Space Technology Mission Directorate (STMD) and Human Exploration and Operations Mission Directorate.

“This is a critical first step at converting carbon dioxide to oxygen on Mars,” said Jim Reuter, associate administrator for STMD. “MOXIE has more work to do, but the results from this technology demonstration are full of promise as we move toward our goal of one day seeing humans on Mars. Oxygen isn’t just the stuff we breathe. Rocket propellant depends on oxygen, and future explorers will depend on producing propellant on Mars to make the trip home.”

Full Article: <https://www.nasa.gov/press-release/nasa-s-perseverance-mars-rover-extracts-first-oxygen-from-red-planet>

Video (3:11) <https://mars.nasa.gov/resources/22532/crazy-engineering-making-oxygen-on-mars-with-moxie/>

## Ingenuity shifts from technology to operations demo after successful fourth flight

by Jeff Foust — April 30, 2021



A hazard camera on the Perseverance Mars rover captured an image of the Ingenuity helicopter during its fourth flight April 30. Credit: NASA/JPL-Caltech

WASHINGTON — With four flights now complete, NASA’s Ingenuity Mars helicopter will transition from being strictly a technology demonstration to a test of its ability to work in cooperation with the Perseverance rover.

Ingenuity performed its fourth flight April 30, staying aloft for 117

seconds. The helicopter flew to an altitude of 5

meters, then went 133 meters downrange and back before landing. The flight set records for duration in the air and distance traveled.

The flight was scheduled for April 29, but telemetry returned later that day showed that the helicopter never took off. Project engineers believe that a timer issue, similar to one discovered during a preflight test in early April, kept the helicopter grounded. They developed a way to get around the timer glitch without updating the helicopter’s software, a method they previously said should work 85% of time the time.

“There is a bug, and this is a workaround for the bug,” Bob Balaram, Ingenuity chief engineer at the Jet Propulsion Laboratory, said during an April 30 press conference about the helicopter

shortly before data confirming the successful flight arrived on Earth. “It worked out perfectly well three times and yesterday it didn’t quite work.”

The successful fourth flight now allows Ingenuity to move into a new phase of its mission. NASA originally planned to conduct up to five test flights over a campaign lasting 30 sols, or Martian days, after which the project would end, no matter the state of the helicopter. That would allow the Perseverance rover, supporting the helicopter flights, to move on to its primary science mission

## SpaceX launches 4 astronauts to space station, nails rocket landing

By [Amy Thompson](#) April 23, 2021



CAPE CANAVERAL, Fla. — [SpaceX](#) just launched its third astronaut mission in less than a year.

A slightly sooty Falcon 9 rocket topped with a [Crew Dragon capsule](#) took to the skies above NASA's Kennedy Space Center here at 5:49 a.m. EDT (0949 GMT) today (April 23), lighting up the predawn sky as it lifted off

from the historic Pad 39A.

The launch kicked off SpaceX's Crew-2 mission, which will carry four astronauts — NASA's Shane Kimbrough and Megan McArthur, French astronaut Thomas Pesquet and Japanese spaceflyer Akihiko Hoshide — on a 24-hour flight to the [International Space Station](#) (ISS).

Full Article: <https://www.space.com/spacex-crew-2-astronaut-launch-rocket-landing-success>

Video ( 1:18) <https://www.youtube.com/watch?v=kxBqEKKsELo>

## SpaceX Astronauts Return to Earth in 1st Splashdown Landing in the Dark Since Apollo 8

Video (2:12) <https://www.youtube.com/watch?v=10-Zbu9lxJc>

# Michael Collins, Apollo 11 astronaut who orbited moon, dies at 90



Gemini and Apollo astronaut Michael Collins, who orbited the moon during the world's first lunar landing mission, has died at the age of 90.

[Collins' death on Wednesday](#) (April 28) was made known his family and NASA.

"We regret to share that our beloved father and grandfather passed away today, after a valiant battle with cancer. He spent his final days peacefully, with his family by his side,"

Collins' family said in a statement. "Mike always faced the challenges of life with grace and humility, and faced this, his final challenge, in the same way. We will miss him terribly. Yet we also know how lucky Mike felt to have lived the life he did. We will honor his wish for us to celebrate, not mourn, that life."

"Please join us in fondly and joyfully remembering his sharp wit, his quiet sense of purpose and his wise perspective, gained both from looking back at Earth from the vantage of space and gazing across calm waters from the deck of his fishing boat," his family said.

NASA responded with a statement by acting administrator Steve Jurczyk.

"NASA mourns the loss of this accomplished pilot and astronaut, a friend of all who seek to push the envelope of human potential. Whether his work was behind the scenes or on full view, his legacy will always be as one of the leaders who took America's first steps into the cosmos. And his spirit will go with us as we venture toward farther horizons," said Jurczyk.

As the command module pilot on NASA's [Apollo 11](#) mission, Collins circled the moon while Neil Armstrong and Buzz Aldrin touched down at Tranquility Base on July 20, 1969. When his two crewmates returned from the surface, Collins was in the unique position to capture a photo of all of humanity — his fellow astronauts on board the lunar module and everyone else on Earth off in the distance.

Full Article: <https://www.space.com/michael-collins-apollo-11-astronaut-dies-at-90>

# Harris to place “personal stamp” on National Space Council

by [Jeff Foust](#) — May 1, 2021



WASHINGTON — Vice President Kamala Harris will put her “personal stamp” on the National Space Council as it takes on both existing and new priorities under the Biden administration.

Senior administration officials, speaking on background in a call with reporters May 1, confirmed that the administration will retain the National Space Council, an interagency body used to coordinate space policy across

the federal government. The vice president chairs the council by statute.

The White House announced March 29 that the council, revived by the Trump administration in 2017 after a hiatus of almost a quarter-century, [would continue under the new administration](#). At the time, though, they offered few details about how it would operate.

In the call, officials said they are in the process of hiring a new executive secretary who handles the day-to-day operations of the council. The hiring process is “well underway,” said one senior administration official, but didn’t estimate when that person would be hired.

Also unclear is when the first formal meeting of the council will take place. “The vice president will be engaging stakeholders, engaging members of that council, all along the way,” an official said. “And then when we think it is useful to have the first full meeting we’ll have the first full meeting.”

The council will be structured similarly to past administrations, and will also retain the Users’ Advisory Group created by the Trump administration to advise the council as it works on a range of policy issues.

## NASA selects SpaceX to develop crewed lunar lander

by [Jeff Foust](#) — April 16, 2021

WASHINGTON — NASA has selected SpaceX as the sole company to win a contract to develop and demonstrate a crewed lunar lander, while keeping the door open for others to compete for future missions.

NASA announced April 16 that it awarded a contract to SpaceX for Option A of the Human Landing System (HLS) program, which covers development of a crewed lunar lander and a demonstration mission. The fixed-price, milestone-based contract has a total value of \$2.89 billion.

SpaceX was one of three companies that received initial HLS contracts nearly one year ago for early design work on their lander concepts. SpaceX offered a version of its Starship vehicle, launched on its Super Heavy booster and refueled in low Earth orbit before going to the moon.



NASA selected SpaceX for a \$2.89 billion contract to develop a lunar lander version of its Starship vehicle and fly a demonstration mission to the surface of the moon. Credit: SpaceX

NASA officials previously stated they would attempt to make more than one Option A award in order to preserve competition in the program.

“Competition — having multiple suppliers for us — is an extremely important principle. It’s on our minds,” Mark Kirasich, director of the advanced exploration systems division at NASA, said in February.

However, in a hastily arranged call with reporters to announce the selection of only SpaceX, officials acknowledged that limited budgets forced them to select only SpaceX. The agency received \$850 million for the HLS program in

fiscal year 2021, about one-fourth its original request.

Full Article: <https://spacenews.com/nasa-selects-spacex-to-develop-crewed-lunar-lander/>

# That's All Folks

