China Launches Probe On Mission to Explore Far Side of the Moon

By KATRINA MILLER

On Friday, China launched a second lander to the lunar far side. If the mission is successful, it will be the first in history to bring back a sample from the part of the moon that Earth never sees.

The mission is called Chang'e-6, named after the Chinese moon goddess and pronounced "chong-uh." It lifted off on time at 5:27 p.m. local time under gloomy skies from the Wenchang space site on Hainan Island in southern China, carried to space by a Long March 5 rocket. About 32 minutes after the launch, the spacecraft separated from the rocket and the mission proceeded on a 5-day journey to the moon.

Why the far side of the moon?

Unlike Earth, whose erosion and shifting crust constantly renew its surface, the moon remains frozen in time. By studying samples from different parts of the lunar surface, scientists seek information about the origin and evolution of Earth's satellite. But so far, the United States, the former Soviet Union and China have gathered samples only from the near side of the moon.

The far side of the moon — it is not actually the dark side of the moon — is distinct from the near side. It has a thicker crust, more craters and fewer maria, or plains where lava once flowed. But no one really knows why the two sides of the moon are so different.

"People want to know why this happened," said Yi Xu, a professor at the Space Science Institute of Macau University of Science and Technology and a member of the Chang'e-6 science team. "If we can collect some samples on the far side, then we can maybe get some clues to these questions."

What will Chang'e-6 do?

Chang'e-6 is the latest in a series of Chinese lunar missions designed to orbit or land on the moon. The mission will last 53 days.

The first to visit the far side of the moon, in 2019, was Chang'e-4, which included a rover to explore the moon's Von Karman crater. China remains the only nation to send a lander to the other half of the moon.

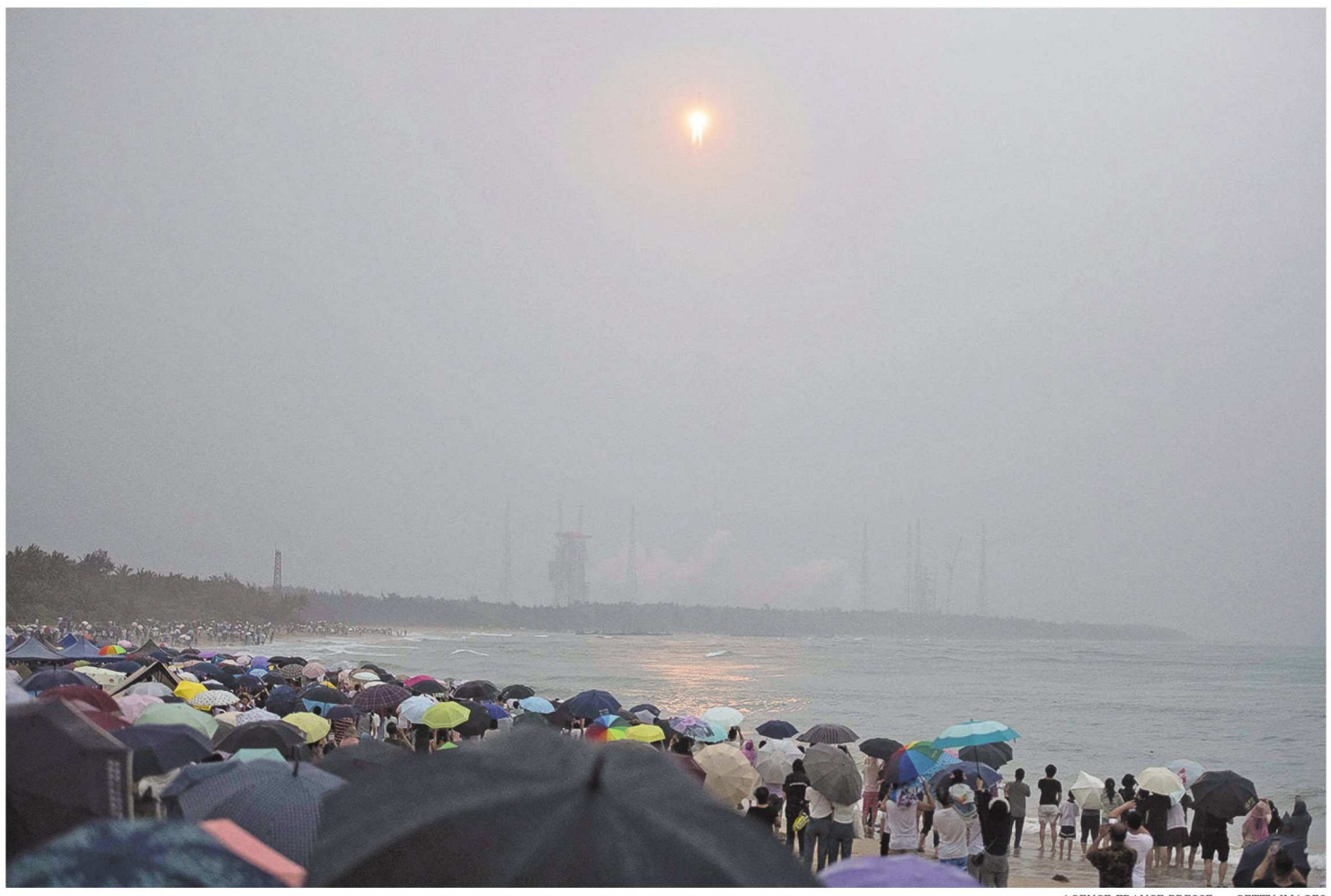
"China has found its niche, to explore the lunar far side," said Roberto Bugiolacchi, a planetary geologist also at Macau University of Science and Technology who has analyzed data from prior Chinese moon missions.

In 2020, another mission, Chang'e-5, gathered nearly four pounds of regolith from the moon's near side and brought it to Earth. Scientists in other countries, including some in the United States, recently petitioned to study those samples.

Chang'e-6 will follow in Chang'e-5's footsteps, but on the lunar far side. It will take five days after launch for the mission to reach the moon. There, it will orbit the moon for about 20 days. Then, after a brief stay on the surface of 48 hours, it will spend additional weeks in lunar orbit preparing for a five-day return trip to Earth.

The mission's orbiter will circle the moon while its lander descends into the 1,616-mile-wide South Pole-Aitken basin on the lunar surface. The impact that created the basin — among the largest in the history of the solar system — is thought to have dug up material from the lunar mantle. If that material can be retrieved, scientists can learn more about the history of the moon's insides.

"It's very, very exciting," said Jim Head, a planetary geologist at Brown University who collaborated with Chinese researchers to analyze the Chang'e-5 lunar sample. "Just like before the Apollo samples were returned. But now, it's the other side of the moon."



AGENCE FRANCE-PRESSE — GETTY IMAGES

China's Chang'e-6 mission, which launched from the Wenchang space site on Friday, aims to retrieve samples from the lunar far side.

According to Yuqi Qian, a lunar geologist at the University of Hong Kong, the Chang'e-6 lander is equipped with a camera, spectrometer and radar to investigate its surroundings and pick a spot to collect a sample. It will gather soil from the surface using a mechanical arm and collect a subsurface sample from as far down as 6.5 feet with a drill.

A vehicle on the lander will then lift off from the moon, passing the sample on to the orbiter's re-entry module for its return back to Earth.

Because the same side of the moon always faces Earth, it is impossible to directly establish communications with the lunar far side. In 2018, China sent the Queqiao satellite into lunar orbit to relay information from Chang'e-4 to Earth. In March, it launched a second satellite called Queqiao-2. The pair will be used in tandem to remain in contact with Chang'e-6 during sample collection.

How does Chang'e-6 fit into China's broader space exploration goals?

China's lunar exploration program is one facet of the nation's growing presence in space, which includes missions to Mars and future visits to asteroids. The Chang'e mission series, designed in the 1990s, included three phases: orbiting, landing and sampling. So far, it has a 100 percent success rate.

With the return of the Chang'e-6 sample, Dr. Qian said, China's lunar exploration will pivot to a new strategy: investigation, construction and utilization. Its next two missions are already in development.

Chang'e-7, expected to launch in 2026, will search for water near the lunar south pole. Chang'e-8 will survey material in the same region that could potentially be used to build future infrastructure, according to the China National Space Administration.

China hopes to send astronauts to the moon in 2030 and is also working on establishing a permanent, international lunar research base by the 2030s.

What other missions have been to the moon this year?

If the first leg of Chang'e-6's journey is successful, the spacecraft will be the third to land on the moon in 2024.

Japan reached the moon with the Smart Lander for Investigating Moon, or SLIM, on Jan. 20. The small spacecraft ended up in an awkward configuration, with its engine nozzle pointed toward space. But it also made Japan the fifth country to reach the moon's surface. Unexpectedly, the SLIM lander has continued to function on the lunar surface long after Japan's space agency had expected to lose contact with the robotic vehicle.

The year's second moon landing was the first by a privately operated spacecraft. Odysseus, built by Intuitive Machines of Houston, reached the lunar surface on Feb. 22. But the spacecraft toppled over, limiting the amount of science it could finish before freezing during the lunar night. Intuitive Machines has plans for another mission soon.

The Demise of an Arms-Limitation Accord Could Be a Lifesaver for Taiwan

By JOHN ISMAY

WASHINGTON — During a military exercise with the Philippines that began last month, the U.S. Army deployed a new type of covert weapon that is designed to be hidden in plain sight.

Called Typhon, it consists of a modified 40-foot shipping container that conceals up to four missiles that rotate upward to fire. It can be loaded with weapons including the Tomahawk — a cruise missile that can hit targets on land and ships at sea more than 1,150 miles away.

The weapon, and other small mobile launchers like it, would have been illegal just five years ago under the 1987 Intermediate-Range Nuclear Forces Treaty, which prohibited U.S. and Russian forces from having land-based cruise or ballistic missiles with ranges between about 300 miles and 3,400 miles.

In 2019, President Donald J. Trump abandoned the treaty, in part because the United States believed Russia had violated the terms of the pact for years. But U.S. officials said that China, with its growing long-range missile arsenal, was also a reason the Trump administration decided to withdraw.

The decision freed the Pentagon to build the weapons that are now poised to defend Taiwan from a Chinese invasion. It also coincided with a rethinking of modern war by U.S. Marine Corps leaders. They recommended retiring certain heavyweight and cumbersome weapons like 155-millimeter howitzers and tanks — which they thought would be of little use against Chinese forces in the Pacific — and replacing them with lighter and more flexible arms like truck-mounted anti-ship missiles.



U.S. ARMY

The U.S. Army's Typhon, which consists of a shipping container that conceals up to four missiles, arrived in the Philippines in April. Such a weapon is seen as a way to stop a Chinese invasion force.

At the time, the Pentagon had no land-based anti-ship weapons. Other militaries, however, already did. Then in April 2022, Ukrainian ground troops used a similar weapon, Neptune anti-ship cruise missiles launched from trucks, to sink the Russian cruiser Moskva in the Black Sea.

Despite the success of the Moskva attack, a group of retired Marine generals publicly criticized the Corps' plans to prioritize similar weapons at the expense of more traditional arms. They said the service was focusing on China to the detriment of other threats, and that getting rid of tanks and some heavy artillery would leave Marines unprepared for a major conflict in other parts of the world.

At a meeting of the Defense Writers Group in December 2022, Gen. David H. Berger, then the Marines' top general, acknowledged that he had been criticized by former colleagues but said his decisions were informed by intelligence reports the retirees could not obtain.

U.S. military and civilian leaders believed that President Xi Jinping of China planned to follow through on his many pledges to reunite Taiwan with Beijing by diplomatic means, or by force if necessary. And the Moskva's hull rusting on the seafloor pointed to a possible way to dissuade Beijing from military action.

Pentagon officials believed that deterring China would not require a missile like the newest Tomahawk, which can attack ships with the equivalent of about a half-ton of TNT, nor even one like Ukraine's Neptune, which carries a warhead about a third of that size.

Instead, positioning even smaller missiles to disable Chinese frigates, destroyers and amphibious craft could be enough, U.S. officials came to think, given their belief that Mr. Xi would try to invade only if he believed he would succeed in a relatively bloodless operation before American troops responded.

Targeting officers selected a Navy missile called SM-6, for Standard Missile 6, that seemed right for the job.

> ***The move to exit it has freed the Pentagon to build new weapons.***

With a warhead about half the size as the one carried by the Neptune, the SM-6 could evade a Chinese warship's defenses and, on impact, change the crew's mission from invasion to survival.

Setting squadrons of Chinese amphibious ships packed with troops ablaze in the Taiwan Strait, Pentagon officials believed, would not only protect the de facto independent island but may also make Mr. Xi's own grip on power within the Communist Party untenable.

Without the legal restrictions of the I.N.F. Treaty, the Pentagon began experimenting with existing assets.

Sealed canisters containing Tomahawk and SM-6 missiles were mounted onto small trucks and hidden in shipping containers.

Publicly, the Navy says the missile has a maximum range of about 115 miles. But the SM-6 can reach targets at ranges of 290 miles, officials confirmed to The New York Times, speaking on the condition of anonymity to discuss sensitive weapons capabilities.

In the event of hostilities with China, the Philippines could invoke its longstanding mutual defense pact with Washington, inviting U.S. forces to deploy mobile missile launchers to any of the nine Philippine military bases that the Pentagon has secured access to in the past decade.

Some of those partner bases are clustered on Luzon Island, where SM-6 missiles could threaten Chinese ships in the waterway between the northernmost reaches of the Philippines and Taiwan.

Last year the Pentagon gained access to a base on Balabac Island in southwestern Philippines. From there, the same weapon could reach China's collection of militarized reefs in the Spratly Islands, which have become a major base of operations for Beijing's efforts to control the South China Sea.

A new security agreement signed in August between Washington and Tokyo could offer a third strategic location for Taiwan's defense in case of war — military bases in Japan's far western Ryukyu chain. From one such facility on Yonaguni Island, where U.S. forces train with their Japanese counterparts, an SM-6 could hit any target surrounding Taiwan and threaten bases on the Chinese mainland across the strait.

Having the longer-range Tomahawk, truck-based launchers and Typhons secreted on small islands within a thousand miles of the Chinese mainland could largely obviate one of Beijing's greatest perceived strengths: missiles developed in China that its military leaders claim could sink an American aircraft carrier sent to defend Taiwan.

The New York Times

Any occasion. Every interest.
Give the gift of The Times.

Choose from a variety of gift subscriptions — there's one to suit nearly everyone.
Visit nytimes.com/gift or call 855-698-5273.



Reproduced with permission of copyright owner. Further reproduction prohibited without permission.