

China Shoots the Moon

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November 23, 2020 launch of China's Chang'e-5 from Wenchang Satellite Launch Center in Hainan

Abstract: *With China's Chang'e 5 rocket launch, which landed on the moon on December 1, the long US-Russian domination of space has a major challenger. The issues extend beyond national pride to a global leadership initiative in rocketry whose implications extend to military, economic and diverse scientific applications at a time of mounting US-China rivalry in all spheres.*

Keywords: *China, US, Russia, Space Program, Great Power Conflict*

China's Challenge to US-Russia Space Exploration Hegemony

China is taking aim at the moon, establishing itself as a space power to be reckoned with. While currently playing catch-up behind the space accomplishments of the US and Russia, it is rapidly gaining ground as a result of an ambitious Chinese space program coinciding with domestic squabbling in the US, budgetary shortfalls in Russia, and lack of focused political will on the part of both space pioneers.

With the freshly-launched Chang'e 5 probe, locked into a moon orbit as of November 28, for the first time in forty years an attempt is being made to collect rocks on the moon and bring them back to earth for study.

The US Advance in Space and its Subsequent Decline

The heyday of moon exploration by the US and the USSR in the 1960s and 1970s coincided with a deadly serious space race that was effectively war by other means for the two reigning superpowers. With the epoch-setting launch of Sputnik, the USSR got off to a roaring start, putting the first man in space, the first woman in space and achieving a long catalogue of other firsts. Energized by the Kennedy challenge to put a man on the moon by the end of the decade, the US doubled down on investments in education and science, while the daunting technical requirements of the space program drove demand for silicon chips,

miniaturization and other novel technologies.

On July 20, 1969, the small step of one man was memorably deemed “a giant leap for all mankind,” but that noble sentiment did not stop Armstrong and Aldrin from planting an American flag on the moon, propped up artificially to make up for the utter absence of a breeze.

But winning the race to the moon in 1969 proved as anti-climactic as “winning” the Cold War in 1989. Both successes fueled American exceptionalism and nationalistic hubris, and possessing the high ground did nothing to deter the US from engaging in cruel and gratuitous warfare, above all in defeat in Vietnam. The same kind of ballistics and chips that enabled space flight were retooled to power cruise missiles, smart bombs and drones. A smug and careless complacency set in, rooted in narcissistic self-esteem and a generalized disregard for all rivals.

The audacious derring-do of those early days is underscored by the paucity of computing power back then: the Apollo program sent men to the moon to hand-collect bags of rocks using computer systems and cameras less powerful than the average teenager’s smart phone of today.

If the early programs lacked digital prowess, they were notable for pluck and excellent rocketry. The big rockets of the day, the Saturn and the Proton, developed with the help of former Nazi scientists on both sides of the Soviet-American divide, made the reach to the moon possible.

Computing power has grown by leaps and bounds since then, but US rocketry has declined to the point that NASA had no way to send or retrieve astronauts in space for a decade, dating from the retirement of the Space Shuttle in 2011. Until the advent of the Space X Crew Dragon earlier this year, US astronauts had to hitch a ride on Russia’s

Soyuz craft to access the US-built space station.



Space X Crew Dragon Demo-2

The exploits of astronauts and cosmonauts offer nail-biting narratives and crowd-pleasing photo ops, but with today’s advanced computer technology and robotics, unmanned missions suffice for most scientific purposes.

What scientific value space exploration?

During NASA’s slack years, a diverse series of unmanned spacecraft supervised by the US Jet Propulsion Lab conducted cutting-edge science, not only uncovering the unique attributes of various planets and satellites, but going a long way to help us understand related processes on earth. To gaze at other planets, is to ponder the past present and future of our own planet and the universe.

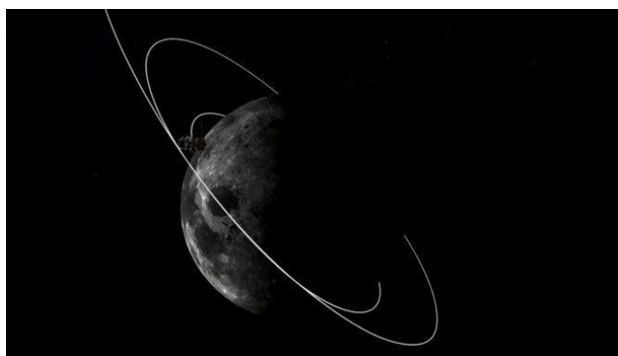
What caused Mars to lose its atmosphere and streams of liquid water? What was Venus like before a runaway greenhouse effect produced some of the hottest temperatures in the solar system? The Jovian moon Europa and Saturn’s Titan, the one containing an ice ocean, the

other a thick atmosphere, seem to possess the necessary conditions for the genesis of biological life as we know it.

Which brings us back to the moon, that lonely desiccated, cratered satellite locked in orbit with the watery planet earth. The birth of the modern environmental movement was in part inspired by the Apollo astronaut’s view of earth from afar; how fragile, how delicate, how alone.

The last man to walk on the moon, Eugene Cernan, packed up his bag of rocks in 1972, and no one’s been back since. The Soviet Union’s Luna mission, a robotic craft designed to ferry a few ounces of moon rock back to the earth, last flew in 1976.

Going to the moon for a walkabout might seem old hat but there’s still much science to be done, geology in particular. Studying rocks in a volcanic basin on the moon is the ostensible purpose of the Chang’e-5 mission, though the fact that uranium is thought to be abundant there is enough to imbue China’s modest automated rock collection mission with an aura of clandestine intrigue at a time of US-China clash on numerous fronts.



Xinhua graphic of Chang’e 5 entering moon orbit

But what the latest Chinese lunar probe is really about, though not explicitly stated, is Mars. If humankind is ever going to get to the Red Planet, competition for national prestige is likely to be a key driver.

Deadly solar radiation, unmitigated by either atmospheric or magnetic deflection, means that Mars, science fiction visions notwithstanding, is more likely to remain a lighthouse, a lonely scientific outpost, than an “empty planet” ripe for colonization. In either case, the long Mars journey requires mastery of challenging modular maneuvers that start with blast-off from earth, descent to another heavenly body, ascent back into space and safe propulsion back to the home planet.

China’s moon missions can be seen as a dry run for Mars-capable technology. Moreover, the moon also provides a viable, and relatively economical site from which to launch a Mars mission, whose technical requirements are too taxing for any current earthbound rocket to consider for purposes of direct human travel.

The Chang’e series of moon shots has made China a creditable moon power, first achieving a lunar orbit in 2007, followed by successful soft landings in 2013 and 2018. In January 2019, the Chang’e 4 made a daring landing on the far side of the lunar orb. This unprecedented mission required close coordination with the Queqiao, a lunar communication relay satellite that is required to keep the isolated landing craft, which remains permanently out of earth view, in touch with radio waves from the home planet.

The current Chang’e-5 mission, launched November 24, 2020, promises to cement China’s status as a leading space power if it succeeds at its rock-collecting task.

The Moon and Mars

China’s Historical Interest in Space Travel

China may be a late arrival to the space race, long dominated by the US and Russia, but not for lack of imagination. Literary legend Lu Xun translated “From the Earth to the Moon” by Jules Verne at the dawn of the twentieth century and dabbled in science fiction with his own “*Yuejie luxing bianyan*” or “Journey to the Moon,” hoping to promote an interest in science. Decades before China ventured into space, writer Mao Dun credited the traditional legend of moon goddess Chang’e (after which the latest line of moon craft is named) as a powerful native archetype for lunar exploration.

The Queqiao satellite references the “Magpie Bridge” in the Chinese legend of the Cowherd and Weaver, which is celebrated on the 7th day of the 7th lunar month, while the Yutu, or “jade rabbit” Rover refers to the steady companion of moon goddess Chang’e.

When Sputnik, the world’s first man-made satellite was launched, Mao Zedong hinted that Chinese satellites would follow. He joined Khrushchev to hail the flight of Sputnik II which was launched during his 1957 Moscow visit, carrying space dog Laika on a lamentable one-way journey.



Mao and Khrushchev in Moscow in July 1958

Subject to serious disruptions due to the onset of the Cultural Revolution, China did not launch its own satellite, Dongfanghong 1, until 1970. It

then famously beamed the iconic tune “East is Red” back to earth, but there was little follow up due to continued political distractions and economic constraints.

By May 1971, just before Mao’s second-in-command Lin Biao met his demise in a mysterious plane crash over Outer Mongolia, China’s Chairman revealed to visiting Romanian head of state Nicolae Ceaușescu that China had neither the capabilities nor interest to go to the moon.

Premier Zhou Enlai then reportedly cut in to say, “It doesn’t even have air or water... The problems on earth haven’t been solved, but they want to go up to the moon, it’s ridiculous.”

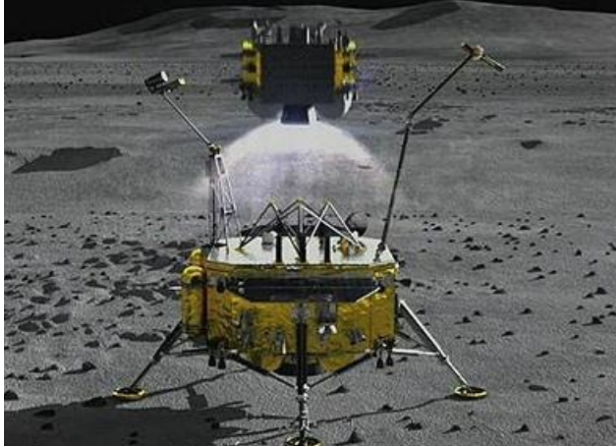
Zhou makes a valid lament about conditions on earth, but there may also be a touch of sour grapes to the dismissive comment about the US space program, coming as they did during the peak of the stunningly successful Apollo series of missions.

Fast forward 50 years and China, thanks to a booming economy and prudent investment in science, is a contender in technology and space. If everything goes according to plan, the Chang’e 5 lunar lander will scoop up rock samples from a lunar crater and return several kilograms of geological treasure to the Earth in late December.

China’s Chang’e Moon Program

The 18,000-pound craft, launched successfully by a Long March 5 rocket from a base on Hainan Island on November 23, is divided into four sections. It includes a service module and a “returner” capsule designed for re-entry to

earth along with a lunar lander and lunar ascender. The latter pair of units will land on the moon while the other pair will remain in moon orbit until it is time to return to earth.

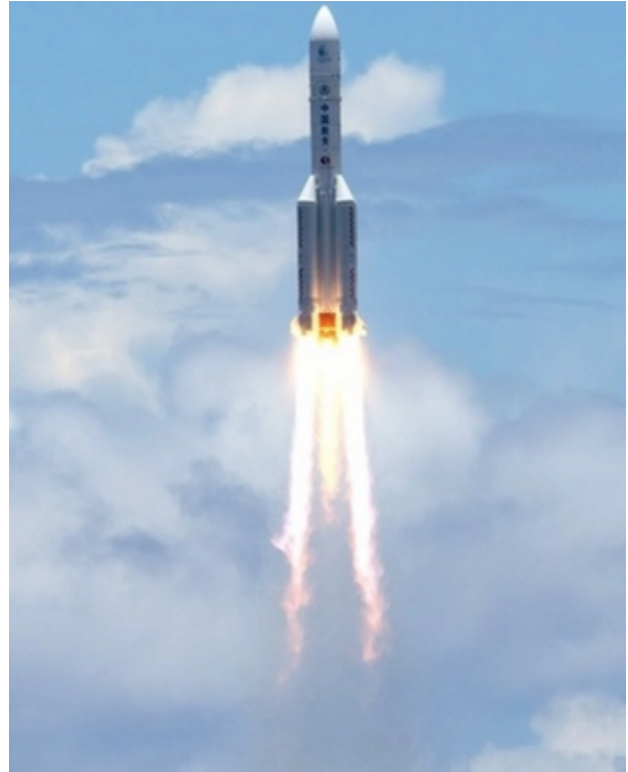


Simulation of Chang'e lunar ascender lifting off from lunar lander

After the moon lander takes measurements and collects samples on the lunar surface, the ascender section will then be shot back into lunar orbit, using the base of the lander as a launch pad, echoing the modular design of the Apollo lunar craft. The “returner” capsule is designed to catapult through earth’s atmosphere, using a “skip re-entry” to slow down for a parachute landing in Inner Mongolia.

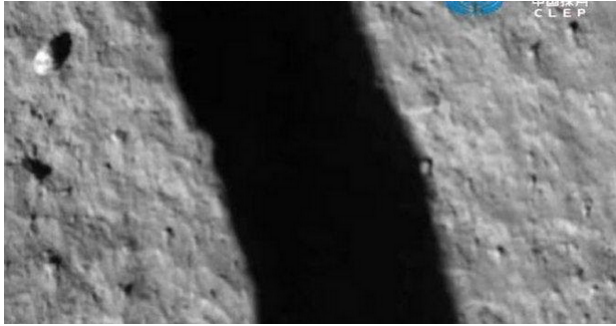
It’s a complicated mission that requires a tricky lift-off from the moon, orbital docking, an automated transfer of materials from the ascender to the return capsule and a high-velocity return to earth. A single failure anywhere in the complex chain of necessary tasks could end the costly effort instantly. Space travel remains a high-risk endeavor. Indeed, the Chang’e 5, experienced a three-year mission delay due to the July 2017 explosion of a Long March rocket resulting

from a first-stage booster failure.



Heavy-lifting Chang Zheng (Long March) rocket in flight

The Chang’e 5 craft is targeted to land in a lunar volcanic plain known as Oceanus Procellarum. NASA’s Apollo 12 and other craft landed in that same general region half a century ago, but this mission will focus on a particular volcanic formation known as [Mons Rumker](#). It successfully landed on December 1.



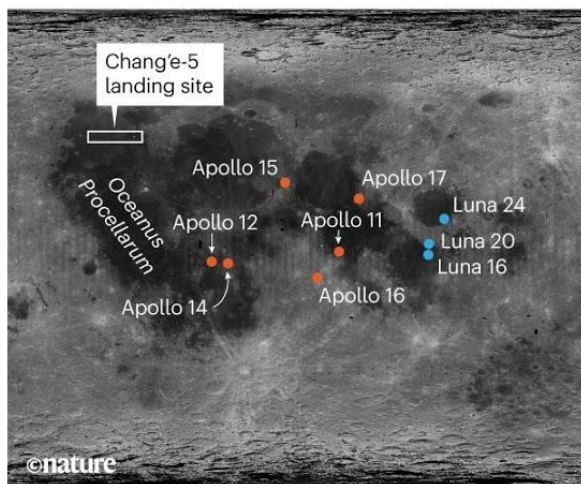
Chang'e 5 moon landing, December 1, 2020

The aim of the probe is to drill, dig and analyze relatively pristine lunar rock, (just over a billion years old) in contrast to the Apollo mission samples which have been dated at 3 to 4 billion years old. This seemingly arcane task will help geologists establish benchmarks for dating ancient rock on earth as well, where erosion from wind and water has irrevocably altered the surface.

LUNAR LANDINGS

China's Chang'e-5 mission is the first to collect lunar material since the Soviet and US missions in the 1960s and 1970s. It will touch down in the northern part of Oceanus Procellarum, a vast lava plain.

● US mission ● Soviet mission



The Chang'e 5 mission is an abbreviated one, scheduled to last a single day on the moon, a lunar day that is, which amounts to two weeks earth time. It will study its landing site with ground-penetrating radar, panoramic cameras, and an imaging spectrometer.

Once the sun sets below the cratered horizon of Oceanus Procellarum, an unimaginably cold night follows, with temperatures dropping to a minus 232 degrees centigrade. Chang'e, covered in reflective foil, is designed to handle the scorching day-time temperatures of 120 degrees centigrade, but being solar-powered, it is not equipped to deal with a deep freeze lasting a fortnight. During the Apollo program, manned visits were timed around lunar dawn and dusk when the shadows are long, the surface is in high contrast and temperatures are in transition from very hot to very cold.

If Chang'e 5 proves a success, an almost identical model, the Chang'e 6, will aim to land near the south pole of the moon. The lunar polar area, with its oblique shadows and angled sunlight, contains murky craters likely to contain water in the form of ice. Elsewhere on the moon, the searing radiation of sunlight causes the instant sublimation of water and ice into the atmospheric vacuum, preventing any accumulation.

The shadowy pole area is deemed uniquely suitable for a potential moon base due to the likely presence of water, which is too heavy to transport from Earth but is vital for survival. Water can be used to produce food, rocket fuel, and breathable oxygen, and a layer of ice, if available in abundance, offers natural shelter from deadly solar rays.



Super-Power Competition or Cooperation in Space?

China's entry into a field long dominated by the US and Russia is reinvigorating the moribund competition of moon travel. It's also raising the important question of whether it's better to work together or go it alone. Protectionist US politicians, fearful of technical espionage, banned China from the US-led Space Station in 2011. The Wolf Amendment, also known as the [China Exclusion Policy](#), was proposed by Republican Senator Frank Wolf, and passed into law despite objections from NASA and scientific researchers. The amendment specifically targets China; its prohibitions on the sharing of space science are not extended to Russia, Japan or any other nation.

Being thus snubbed, China has set into motion plans to construct its own space station, the Tiangong, (Heavenly Palace) which may be the only viable station orbiting earth when the creaky International Space Science Institute

station is retired at some point in the next few years.

The International Space Science Institute in Beijing posted a picture of a commemorative Coca Cola, American in origin, celebrating the Chang-e 5 mission, but will Americans be welcome aboard the Tiangong and allowed to share the fruits of this historic mission?



According to [Russia Today](#), the US is pressuring China to allow "the global scientific community" access to any newly-gained moon rocks and other research findings. But that's just *Russia Today* gently trolling the US for its exceptionalist arrogance.

The same mean-spirited Wolf Amendment of 2011 that denies China access to the space station ironically denies the US access to moon

rocks and scientific findings from China's current moon missions as well.

While Newton posited that science necessarily involved borrowing, that is, standing on the shoulders of giants, and every developing and technologically advanced nation has done its own borrowing, lifting or stealing technology to get where it is today, it seems the US attitude these days is to "build a wall" to keep the science and technology of rival countries apart, as witnessed in the fierce US ban Huawei and the fight to control 5-G standards. In the jaundiced view of the US security establishment, the only thing worse than "backward" China copying US technology is a competent and advanced China outperforming the US in science and tech, as the Huawei case illustrates.

Certainly, vigorous arguments can be made pro and con for nuanced measures designed to limit the "stealing" of copyrighted technology, but the infelicitous unintended results of banning cooperation with China, and China alone, on the part of the US Congress are only beginning to be felt.

As if to justify the pre-existing hostile stance, the US national security establishment is casting a wary eye on the Chang'e program. Space Force General John Raymond sees Chinese success in space as a [threat](#) to US hegemony. The same rocket science that lifts Chang'e into orbit can carry missiles, and the same kind of precision and control of satellite technology as used in the moon shot can theoretically be deflected to disable US satellites and thus disrupt communications, if not the entire GPS system.

US Air Force veteran Raymond, who was deployed in both the war in Iraq and Afghanistan, illustrates this risk with hypocrisy, castigating China for its 2007 kinetic kill (deliberate collision) that involved targeting its own weather satellite, even though the US has experimented with its own satellite-killing

technology since the 1960s. Both nations are well aware that intercept and "kill" technology has possible military applications, though it can also be used to push malfunctioning craft into a fiery, self-obliterating descent to earth.

On February 21, 2008 President George W. Bush authorized the shoot-down of a US satellite with an attack missile launched from the deck of the USS Lake Erie missile cruiser. A bravado show of US technical prowess, the militaristic "kill" of spy satellite [USA 193](#) was spun in US government press releases as being an environmentally-friendly "clean-up." It was supposed to reduce the risk of toxic hydrazine fuel and space debris returning to earth, though it ended up creating a debris cloud which led to launch delays of other craft. The exercise earned a rebuke from Russian defense observers unimpressed by the phony cover story.



SM-3 missile that intercepted USA-193 (Wiki)

US General Raymond concludes that space “underpins all our instruments of power” and warns that Russia and China will cooperate against American interests. There’s more than a whiff of self-fulfilling prophecy in Raymond’s prognosis. Thanks to the Wolf Amendment and earlier restrictions, China’s program, by necessity, has hewed close to Russian prototypes. The Shenzhou capsule, for example, is modeled after the sturdy and dependable Soyuz craft.

On the other hand, history shows that Sino-Russian cooperation is not a given. Shortly after Mao met Khrushchev in Moscow, extolling bilateral solidarity, diplomatic relations

between the two powers went into freefall, and it wasn’t until the end of the Gorbachev era that cooperation got back on track. Meanwhile, the US and Russia have cooperated not just in the realm of space science and shared use of the Space Station, but in nuclear disarmament.



Soyuz



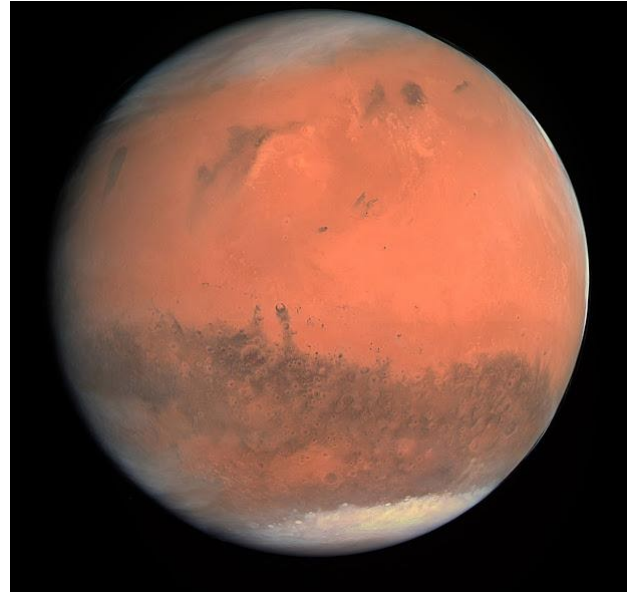
Shenzhou

US go-it-alone pride and intransigence in the era of America First has surely played a part in pushing Moscow and Beijing closer together. Likewise, hostility towards all things Chinese threatens not just commerce and diplomatic cooperation, but scientific cooperation on vital

issues such as climate and Covid-19. Educational cooperation likewise is eroding due to new, severe restrictions on Chinese access to American higher education and technology. The hostility whipped up by paranoid and borderline racist politicians threatens to discourage some of the best and brightest Chinese students and researchers from studying or working in the US. It also impacts on Asian Americans as well as a result of hostility toward China ranging from scapegoating China for the Covid-19 pandemic to its favorable balance of trade.

Is it really in the US interest to “punish” China if it results in pushing China and Russia into developing a high level of interoperability, shared specifications and synergistic cooperation?

If Chang’e 5 proves a success, an almost identical Chang’e 6, will endeavor to land near the moon’s south pole, a big step on the road to building a lunar base and a promising way station for a manned mission to Mars.



See “[Late to the Space Race, China is making strides with Chang’e 4 Moon Landing](#)” *South China Morning Post*, November 28, 2020

[Portuguese translation of this article](#) is available on *nova margem*.

Please also read about [the mission accomplished](#).

Philip J. Cunningham is the author of *Tiananmen Moon*, a first-hand account of Beijing student demonstrations of 1989 released by Rowman & Littlefield in an expanded edition in 2014. He has done research on Asian media issues on grants from Fulbright, Knight/Microsoft and the Abe Foundation. His newspaper commentary is posted on [Pacific Wave](#), which also



includes links to essays and novels about Thailand and Japan.