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## China Makes Its Move to the Moon [Excerpt]

China's current rank of eighth in the space race is misleading. The nation's engineers are drawing up plans for a moon-capable rocket more powerful than the U.S.'s Saturn 5

By [Chris Impey](#) | July 17, 2015 | 0

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Wan Hu would have been proud. Late in 2013, China sent a rocket to the Moon carrying the Jade Rabbit probe to place in the Bay of Rainbows. Despite the lyrical names, Jade Rabbit (“Yutu”) is a protean and workmanlike six-wheeled rover and the Bay of Rainbows is an arid volcanic plain. The mission is a major landmark for the world's newest superpower; it's been thirty-seven years since any country soft-landed a probe on the Moon.

The first space race was spawned by a rivalry that cast its shadow over most of the twentieth century, cleaving the world into capitalism and communism and pitting free markets against command-and-control economies. Orbital flight was the by-product of a ruinously expensive arms buildup that took the world to the brink of nuclear war. Surely the days of space travel orchestrated by governments and colored by military aspirations are over?

Not yet, and we may be witnessing a new space race.

Here's a snapshot of current international space activity. Spending on government space programs dropped in 2013, for the first time in two decades, as budget cuts in the United States offset rising investment by emerging space powers. The United States still has just over half of the total of \$72 billion annual spending, but it has declined by 20 percent from its peak of \$47.5 billion in 2009. Russia has been using buoyant oil revenues to pump lots of extra money into its space program. It's the only other country spending more than \$10 billion. China is in eighth place but moving up fast; relative to GDP, its spending is still modest. That means it has the capacity to make even greater strides in space.

China is a rapidly emerging superpower, with a GDP per capita (scaled to purchasing-power parity) that will exceed that of the United States in about five years. The purchasing-power-parity comparison makes sense, since goods and services are cheaper in China and



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they get a lot more bang for their yuan. Chinese spending in space matches the growth rate of the economy, which has been averaging 10 percent per year for the past two decades. It makes a dramatic contrast with Europe and the United States, where inflation-corrected spending has been flat or declining over the past two decades.

China's rank of eighth in the space league is misleading. As you know from your car, objects in the rearview mirror may be closer than they appear. Let's see how they got to where they are today.

The father of the Chinese space program is Qian Xuesen. He left Shanghai to study at MIT at the same time that Mao, who once lamented that his country couldn't launch a potato into space, began the Long March, a bloody retreat from the Nationalist forces that helped cement his grip on the Communist Party. Qian then worked at Caltech, where he helped famed rocket scientist Theodore von Kármán found the Jet Propulsion Laboratory. At the end of World War II, Qian and von Kármán went to Germany and helped coordinate "Operation Paperclip," which brought Wernher von Braun and other Nazi rocket experts to the United States. Qian became the foremost theorist on rocket propulsion in the country.

Then seismic forces of politics intervened. In 1950, Korea became a bloody battleground, with the United Nations and the United States supporting the South and China and the Soviet Union supporting the North. Mao felt that the world's superpowers didn't respect him, and he was convinced that only a nuclear deterrent would guarantee the security of the new People's Republic of China. Meanwhile, the "Red Scare" was sweeping the United States; Qian Xuesen was stripped of his security clearance and placed under house arrest. In 1955, he was allowed to leave the country in exchange for American pilots captured during the Korean War. Mao was delighted. He welcomed Qian back as a hero and put him in charge of China's ballistic missile program.

China was a poor country and progress was very slow. For a while, China benefited from Soviet expertise and hardware, but in 1960, Mao accused the Soviets of backsliding on communism and of ideological impurity. So China chose to go it alone—just when the turbulence and uncertainty of the Cultural Revolution was damaging to all scientific and technical activities. As a result, China launched its first guided missile in 1966, twenty years after the United States, and its first satellite in 1970, twenty-three years after the Soviets launched Sputnik. Then came major setbacks in the mid-1990s. In 1995, a Long March 2E rocket exploded shortly after launch, killing six and injuring twenty-three. A year later, a Long March 3B rocket blew up twenty-two seconds after launch and crashed into a nearby village, with a death toll of more than two hundred.

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But years of patient, well-funded work paid off. Half a millennium after Wan Hu's minions lit the forty-seven rockets that probably incinerated the Ming Dynasty official, China became the third nation to launch people into orbit using its own vehicle. Yang Liwei was dubbed a *taikonaut*—a purely invented English word designed to give China's spacefarers an equal footing with America's astronauts and Russia's cosmonauts. Since then it's been a steady upward arc. By the end of 2013, ten taikonauts had orbited the Earth in five launches. Between 2008 and 2012, China launched an average of twenty spacecraft a year. Most are doing mundane but essential work carrying telecommunications satellites into orbit.

The Chinese are acutely aware of their place in history and the way others perceive them. They also value ceremonial landmarks. So state media loudly trumpeted the launch of Shenzhou 10 in 2013, ten years after the first Chinese man traveled to Earth orbit. The crew included the second female taikonaut, Wang Yaping. She broadcast a live physics lesson to Chinese schoolchildren, joking, "We haven't seen any UFOs." As PR for the space program, it rivaled the efforts of Canadian astronaut Chris Hadfield, who played guitar and sang David Bowie's "Space Oddity" on the International Space Station. Shenzhou 10 also tested the docking capabilities of the spacecraft with a module that's a precursor to China's own full-size space station.

Wang Yaping has a light touch but the general tone of the Chinese taikonaut corps is earnest and patriotic. At the Shenzhou 10 launch, President Xi Jinping told the crew: "You make all the Chinese people feel proud. Your mission is both glorious and sacred." Commander Xie Haisheng responded in kind: "We will certainly obey orders, comply with commands, be steady and calm, work with utmost care, and perfectly complete the Shenzhou 10 mission." Wang Yaping was on message as well, saying that during parachute exercises with the Air Force, "We girls all cried while singing an inspiring song 'A Hero Never Dies' on our way back after the training."

It's not all been smooth sailing, however. The Chang'e 3 lunar probe was the first Chinese soft landing on an extraterrestrial body, but the Jade Rabbit rover only traveled 100 meters across the Moon before it was immobilized by mechanical failure. Engineers had not anticipated the demands of the harsh, fourteen-day-long lunar nights, and they declared that the problem was electrical not mechanical, with components suffering from "frostbite." As of mid-2014, the rover was sending back limited data and was alive, but only barely.

Meanwhile, China is drawing up plans for a Moon-launch rocket more powerful than the Saturn V. By 2020, China could launch its own space station, just as the International Space Station is being decommissioned and crashing into the ocean. By then, it could also be in a position to land taikonauts on the Moon, half a century after the Americans abandoned such efforts. The Chinese took advantage of not having to develop a lot of space technology first. Russia was cash-strapped in the 1990s and sold its technology to the Chinese, who reverse engineered and copied it. As a result, Shenzhou looks like the Soyuz capsule and Jade Rabbit looks like the Lunokhod rover. But now the Chinese are innovating and vaulting ahead. Their Long March rocket is original and has quickly eclipsed Russian rockets.

The average age of employees in the Chinese space program is twenty-seven, less than half the age of NASA employees. A decade from now, when that youthful energy is matched by experience, China will be a formidable player.

None of this makes officials in the United States very happy.

Suspicious of Chinese motives in space run deep in American political circles. NASA officials are barred from working with Chinese nationals and Congress has barred Chinese from visiting NASA facilities without a special waiver. The ban extends to the International Space Station, even though many of the partners in that project would like to draw China into collaboration rather than treat it like an adversary. US lawmakers were incensed by a 2007 Chinese anti-satellite test that created the largest space debris cloud in history when it pulverized one of its own aging satellites. Ironically, the ITAR legislation that so frustrates American space entrepreneurs was designed to stop "unfriendly" countries from getting their hands on technology with military applications, but it doesn't seem to have slowed the Chinese at all. Most of what they want, they build; what they can't build, they buy from other countries.

The Chinese space program is ascendant in part because they have followed the example set by the United States in the 1960s: healthy funding and a single-minded purpose. In addition, because China is a tightly controlled society run by a government with limited accountability, the People's Liberation Army is able to have a huge influence on the space program. Since its controversial 2007 test, China has continued to develop its antisatellite capabilities, and it's also within reach of having its own network of GPS satellites, which could have military as well as civilian uses. In April 2014, President Xi ordered his air force to speed up the integration of air and space capabilities. China is even developing its own spaceplane, a "black project" called Shenlong, or "Divine Dragon."

For those who worry about the militarization of space, this all brings to mind the purported Chinese curse: "May you live in interesting times."