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China's Unique Space Ambitions

China's space program is venturing beyond simply seeking prestige and status.

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China's space ambitions and goals are unique. Unlike the space rivalry between the United States and the former USSR, which was mostly about "who got where first" (prestige and status) as well as geopolitical rivalry, China's space ambition is to harness the vast resources available in space to benefit and sustain its economic rise.

When Sputnik burst into the skies on October 4, 1957, it took the United States by surprise. For one, the U.S. considered itself to be the leaders in science and technology; for another, the U.S believed that the USSR was a poor, peasant-based economy, incapable of cutting-edge space technology. Sputnik was a shocker as it showcased the Soviet Union's high-end technology, skyrocketing its international prestige and aggravating U.S. fears that the USSR could now use rockets to transfer inter-continental ballistic missiles (ICBMs) to space, from where the U.S would be an easy target. Almost all space endeavors after the Sputnik moment between the U.S and USSR were informed by prestige-seeking behavior, jealousy, and Cold War rivalry.

Unlike Cold War geopolitics and space politics, China's space program, which achieved technological prowess in the early 21st century, is venturing beyond simply seeking prestige and status. While it is prestigious to show off one's technological capabilities in space, China's space

program exhibits a long term vision to explore space for harnessing resources from the moon, asteroids, and establishing a permanent presence.

There are three areas in particular where China's space activities are focused at this point in time: Space-Based Solar Power (SBSP), lunar and asteroid mining, and establishing its own space station.

China's SBSP Program

SBSP has the potential to harness solar power in space, where the rays of the sun are constant, and beam that energy from satellites by the use of microwave technology to receiving stations on earth. This energy is clean, renewable, and constant. China's space solar ambitions were outlined in a report by its leading space agency, the China Academy of Space Technology (CAST). The report stated, "In 2010, CAST will finish the concept design; in 2020, we will finish the industrial level testing of in-orbit construction and wireless transmissions. In 2025, we will complete the first 100kW SPS demonstration at LEO; and in 2035, the 100mW SPS will have electric generating capacity. Finally in 2050, the first commercial level SPS system will be in operation at GEO."

An SBSP station would need to clear many technological hurdles: the discrepancy between the station's weight (10,000 tons) compared to what rockets can lift today (100 tons); the problem of transferring energy from space via microwaves; precise attitude control as well as on-orbit manufacture/assembly/integration (MAI). Significantly, however, China has recognized that investing in SBSP research and development is to think big long term in order to ensure a seamless energy flow for future generations. Thus China is committed to start working on building space solar infrastructure in orbit, especially in low earth orbit (LEO) and geostationary Earth orbit (GEO) 22,000 miles above earth.

China's energy consumption levels grew from 18 quadrillion Btu in 1980 to 37.1 quadrillion Btu in 1996. It is projected to be 98.3 quadrillion Btu by 2020. China is also projected to become the world's largest economy by 2028, both in Purchasing Power Parity (PPP) and Market Exchange Rate (MER), and its energy demands have to sustain its economy, According to Lt. General Zhang Yulin, deputy chief of the Armament Development Department of the Central Military Commission, China will be developing space technology to exploit the earth-moon space to harness solar energy once its space station is built by 2020. Zhang stated that "The earth-moon space will be strategically important for the great rejuvenation of the Chinese nation."

Lunar and Asteroid Mining

China's next big space ambition is to exploit resources like titanium, helium-3, and water from the far side of the moon. Its Chang'e lunar exploration program, launched on Long March rockets, is an ongoing robotic mission to the moon led by the China National Space Administration. The Chang'e 1, launched in 2007, was primarily aimed at building the basic infrastructure required for exploration of the moon; analyzing the distribution of resources like helium-3 on the lunar surface; as well as obtaining three dimensional images of the moon. Chang'e 2, launched in 2010, has now reached the Lagrangian point L2 about 1.5 million km

from Earth, "where gravity from the sun and Earth balances the orbital motion of a satellite." The Chang'e 3, launched in 2013, was China's first moon soft lander, carrying Yutu, the moon rover. In 2017, China plans to launch the Chang'e 5, which will be a sample return mission aimed at getting 2 kg of lunar soil and rocks back to earth for research.

Resource-rich asteroids are the next big step. For example, Asteroid Ryugu, made up of tons of nickel, iron, cobalt, is estimated to be worth $95 billion. And there are millions of asteroids in space waiting to be harnessed, carrying resources like gold and platinum. In July 2015, an asteroid rich in platinum worth $5.4 trillion flew 1.5 million miles from earth. While the Outer Space Treaty of 1967 prohibits any country from appropriating space territory as sovereign territory, the treaty is rather vague with regard to space resource ownership; if it is "first come, first serve" — as was the case with the moon rocks that the U.S. astronauts brought back with them after the moon landing in 1969 — China could fundamentally follow the same principle.

The Chinese are understandably intent on racing ahead with both lunar and asteroid exploration programs due to their future energy needs. Ye Peijian from CAST stated that China is investing in research in both Mars and asteroid exploration. Hexi Baoyin, Yang Chen, and Junfeng Li at Tsinghua University in Beijing have published findings on how to nudge an asteroid into Earth's orbit. The idea is to capture a Near Earth Object (NEO) or asteroid with low energy orbit and place it on earth's orbit temporarily in order to develop the capacity and technology to extract resources from NEOs.

China's Space Station

China, prevented from participating in the International Space Station (ISS) by an Act of the U.S. Congress since 2011, has invested heavily in developing its own space station by 2020, named Tiangong (Heavenly Palace). China launched the Tiangong 1 in 2011. The Tiangong 2 is to be launched in September this year and the Tiangong 3 in 2020. The Tiangong orbital space station, consisting of a 20 ton core module as well as two research modules, will support three astronauts for a long term stay. Given the ISS is scheduled to retire by 2025, the Tiangong may be the only human space station we are left with.

Here too, China's space ambition is different from both the United States and Russia. It is focused on creating a long term, permanent presence in space. Despite stated goals by former U.S. President George W. Bush and President Barack Obama to work toward cementing the U.S. presence in space, the NASA budget has been declining over the years, the Apollo space shuttle program has retired, and U.S. space activity appears to lack both inspiration and imagination. Only private parties like Planetary Resources have shown interest in asteroid mining. On the other hand, China is investing heavily on its official space program.

China has long term ambitions for deep space exploration as well as a mission to Mars. Most importantly, its space program is not focused primarily on geopolitical rivalry, resulting in short stays as was the case with the U.S and former USSR (now Russia). Rather, China is focused on long term activities to generate resources and establish a permanent space presence. The ambiguity of international space law with regard to ownership of property in space will work to China's advantage as it will be based on "first come, first serve." The rules of the game therefore

needs to be crafted within the next five years to create a level playing field in space, the common heritage of humankind.