

SURMOUNTING THE PEAK: CHINA'S SPACE PROGRAM

James A. Lewis
Center for Strategic and International Studies

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China is the third nation to put a human in orbit, and the Chinese government is understandably proud of this accomplishment. China's space agency has expansive plans for future space exploration. I'd like to briefly discuss the history of this program, its costs, the relation to military space, plans for the future, the possibility of cooperation, and some implications for the U.S.

China's space program started in the late 1950s and China launched its first satellite in 1970. The first Chinese launch used a Russian-built variant of the V-2. China's chief success in space lay in developing a series of launchers – the Long March family of launch vehicles. China's space launch vehicle program was closely tied to efforts to develop intercontinental ballistic missiles – the Shenzhou launcher is based in part on a Chinese ICBM, the DF-4. The CZ 2F, the man-rated version of the Long March family used to launch the Shenzhou can put 9 tons into low earth orbit.

Shenzhou is not China's first attempt at manned space flight. The first, named the "Shuguang" Project - Shuguang is Chinese for Dawn - began in the late 1960s. Shuguang aimed to orbit a human by 1973. Shuguang was stopped in the early 1970s because of political turmoil in China. Shuguang's design looked very much like the Gemini capsule. Another manned program that included plans for a space lab was announced by China in the late 1970s, and China's FSW recoverable satellite program of the 1970s may also have been intended at first to become a manned program.

The Shenzhou program began in 1992, after five years of preliminary research. When it began, the Chinese hoped to put a human in orbit by 1999, the year of the 50th anniversary of the founding of the Peoples Republic. Instead, 1999 saw the first test flight of an unmanned capsule. The Chinese orbited a monkey, a dog and a rabbit in March of 2002 and the first manned flight, Shenzhou 5, took place nineteen months later in October of 2003.

At first, there was some debate in China whether to pursue manned flight with a capsule or try to leapfrog directly to a space shuttle. Chinese space researchers had begun to design a shuttle in the late 1970s. Some analysts believe the design was based on the U.S. Dynasoar program. In the end, the Chinese decided that starting with a shuttle would be too hard and too expensive. Using a capsule would let them take advantage of the progress made with the Long March launch vehicles.

The Chinese took a close look at U.S. and Soviet capsule programs, including Vostok, Voskhod, Soyuz, Mercury, Gemini and Apollo. They settled on the Soyuz as the most successful model. While Shenzhou looks like Soyuz, it is slightly bigger. The Chinese claim that despite the outward similarities, Shenzhou is indigenously developed and uses only indigenous technology. This is probably an exaggeration. China's practice in other projects has been to discount foreign contributions and emphasize China's own technology. For Shenzhou, it's worth noting that in 1995, Russia agreed to provide space technology and astronaut training to China and before the Shenzhou launch, the Chinese publicly acknowledged the importance of cooperation with Russia on docking systems,

flight control, and life support. This is not to say that China needed Russian help to put a man into space, but it would have taken longer and been riskier.

Official figures show Shenzhou is amazingly cheap. The Chinese say that the entire Shenzhou program cost a little more than 2 billion dollars over the last decade. The Shenzhou 6 launch reportedly cost only 110 million dollars. But there are some problems with Chinese government accounting, so these figures are likely to considerably understate the actual costs. Based on work done by USTR in the early 1990s on China's commercial space launchers, I would guess that these figures represent perhaps a third of the actual cost of Shenzhou.

Western estimates place the cost of all Chinese space programs at perhaps two and a half billion dollars per year. This includes both military and civil space projects, but these figures do not include many space-related expenditures. China spends a little less than one half of one percent of GDP for all space programs, but as GDP is growing rapidly, this may mean that the space budget increases every year.

Finally, a note on the political context that has not appeared in many western accounts. October 16, the day Shenzhou 5 returned from orbit, is a special anniversary for China's scientific and political establishment. The day that Shenzhou 5 returned was the thirty ninth anniversary of the explosion of China's first nuclear weapon. The Chinese press noted this anniversary in its accounts of Shenzhou 5 and for many Chinese leaders, the two events are linked.

The China National Space Agency repeated this theme when it recently called on its employees to "carry out the spirit of "Two Bombs and One Satellite" and manned space flight, and overcome all difficulties to make positive contribution to peaceful use of space of human beings." Peaceful use of space sounds incongruous juxtaposed next to "two bombs," but the incongruity comes from our point of view and from our way of looking at space exploration after forty years of experience. For China's leaders, the juxtaposition makes sense. It's a different way of expressing how technological leadership provides international benefits that might not have sounded strange to an Eisenhower or a Kennedy.

We want to be careful not to leap to the wrong conclusion about this linkage. Exploding an atomic bomb in 1964 was important to the Chinese because it put them firmly in the great powers' club, it demonstrated their technological prowess, and buttressed claims that they were catching up with the superpowers. It's the political symbolism of the bomb for China and the world that is important, not its actually military contribution, and the same is true for the space program. The key to understanding this lies in China's recent history.

Many Chinese are still motivated by the period in China's history when it was occupied by foreign powers and forced into a subsidiary position. This period only ended in 1950. Their analysis was that the cause of this lay in China's falling behind other nations economically and technologically. Catching up has been a national goal since the 19th

century, to guarantee independence and restore China's position in the world. It's interesting to note that Yuan Shikie, the Qing General who overthrew the last Chinese emperor in 1912, said that the way to restore China's prestige and power was to build "a wealthy nation and a strong army." This sounds like something that Deng Xiaoping or the reforming technocrats who run China today could easily agree with. When Shenzhou 5 returned from orbit, China's leaders greeted it by saying, "the great rejuvenation of the Chinese Nation is definitely coming true!"

China wants both symbolic and tangible benefits from space. The effort in space is one of the vehicles China's leaders hope to use to modernize their country. China's President Hu Jintao described the success of Shenzhou 5 as "an historic step taken by the Chinese people in their endeavor to surmount the peak of the world's science and technology."

The Shenzhou missions are only part of an ambitious program for space exploration. This includes both human and robotic efforts. The next phases of the manned program will be Shenzhou 7, planned for launch in 2007, with 3 astronauts. One of these astronauts will carry out a space walk. Between 2009 and 2012 there will be a docking maneuver with another spacecraft and the launch and operation of a space lab. The lab might be formed by docking two unmanned Shenzhou capsules together. The first crew for the lab would be carried by Shenzhou 10. The space lab would be occupied only intermittently, but it would be followed by the construction of a permanent space station – some Chinese space officials say that a permanent space station is the major goal of the manned space program.

China is also working on a separate unmanned lunar exploration program. The lunar program is named Chang'e, after a goddess in Chinese mythology who traveled to the moon. The lunar program has three phases planned over the next twelve years. Chang'e 1 will orbit the moon in late 2006 or in 2007 carrying a microwave sensor. The second phase will land a craft on the moon between 2010 and 2012. This craft may be a wheeled lunar rover. The third phase will have a craft land on the moon by 2020 and return lunar samples to China. The first phase of Chang'e has a published budget of 170 million dollars.

China hopes that success for Chang'e will help set the stage for a manned lunar mission. The drawback is that China does not have a launcher with sufficient payload for a manned lunar program. China has an R&D program for the next generation of launch vehicles and began in 2001 to design a launch vehicle, named the CZ-5, that will be able to put a twenty eight ton payload in LEO and a fifteen ton payload into geosynchronous transfer orbit (GTO). Chinese sources say that the CZ-5 will be comparable to the Ariane 5 in lift capabilities, but it will not be ready until 2012 at the earliest.

The plan is for CZ-5 to be followed by a launch vehicle capable of a manned lunar mission, called the CZ-6. Senior Chinese space officials say that the next step after the Chang'e lunar effort is the establishment of a manned lunar base by China, but this is a very distant possibility, no closer to implementation than is a U.S. base on Mars.

The lunar exploration project points to some of the strengths of the Chinese Space program. These include its incrementalism and its willingness to take advantage of systems developed for other programs. Chang'e will be based on the DFH-3 communications satellite bus and use a Long March launcher. Incrementalism is a strength for China's space program, but it is also a strategy to compensate for important weaknesses. Chinese sources complain about the compartmentalized nature of their space program and two studies by China's Natural Science Foundation found that China's space sector still has weak capabilities in innovation. Incrementalism is attractive when innovation is scarce.

One of the major benefits of China's space program is that it has helped build a strong technological base for China. There are hundreds of research institutions and thousands of engineers involved in the space program. One difference between China and the US is that the majority of the researchers involved in the space program are less than 40 years of age. This is the result of China's immense investment in science since 1986, but it also reflects the political turmoil of the Cultural Revolution in the 1960s and 1970s. There are few space researchers over 40 in China because of the Cultural Revolution dispersed an entire generation of scientists.

China has invested heavily in science and engineering. Its leaders are now asking how they can take advantage of this to increase technological innovation in space and in other areas. Strengthening innovation is a goal for many countries, but the sources of innovation are complex and depend on many factors. These factors include areas where China still has weaknesses, such as with its legal and financial system and its political culture. One key question for China is how quickly it can strengthen innovation, which calls for a certain amount of freedom, when its political culture is still relatively closed.

China has cooperative space programs with many countries, but substantive cooperation between the U.S. and China will be difficult to achieve. The Chinese have their own plans to build an independent capability and are not interested in being junior partners. China's plans fit well with Administrator Griffin's description of how he envisions cooperation – each nation builds its own highway to the moon and then we will cooperate on the surface when we get there.

Both sides have security concerns. The close economic ties that have grown up between the U.S. and China have not yet been matched by any great increase in trust. The intertwining of civil and military space in China can make cooperation difficult. China blurs the line between its civil and military space programs, and the military drives China's entire space program to a greater degree than is found in other major space powers. A senior military officer directed the manned space program. Many space research centers are 'dual-hatted,' and engage in both civil and military research activities.

There is no black or white answer to the question of civil or military. As part of its larger reform effort, China has been trying to disengage its military from civilian activities. At the same time, its leaders realize the military benefits of space and related technological

activities. This means that for some time, military space and civil space will be blended in China and overlap in ways that do not fit western organizational models. If the question is ‘civil or military,’ the answer for now is ‘yes.’

China’s military space programs seem, at the moment, to have taken second place after the manned space program. China has not assembled nor does it maintain the full range of capabilities in space needed for intelligence and military benefit and a manned program provides little direct benefit to military operations. In some cases, China appears to build a satellite in order to show what it can do rather than to meet an operational military or intelligence need.

The basis for this statement is on-orbit presence. China does not maintain an on-orbit presence for imagery or sigint. China does not have a continuous military space presence equal even to what the Soviets or the U.S. were able to muster in the 1960s. The launch rate is slow and episodic. In the last decade, the number of Chinese government satellite launches has totaled only about twelve percent of U.S. launches. In any given period, the Chinese operate no more than six to ten satellites, and most of these are for communications or navigation rather than sensor platforms. While China’s announced goal is to build and operate a multi-satellite military space system for continuous operation, they have not committed the resources to achieve this.

China has said that its space program will concentrate its resources on “a limited number of projects that are of “vital significance” to the nation. At first glance China’s space effort would appear to be spread too thin to be effective. However, a review of what China builds and launches suggests that the goal of China’s space efforts is a demonstration of technological prowess and national power. A desire to demonstrate self-reliance often seems to drive space activities. A White Paper on space put out by the State Council – the equivalent of our National Security Council - calls for “eye-catching achievements.”

We often talk about why people go into space and how it is man’s nature to explore, the quest for knowledge and discovery and so on. This may be true for people who work in space, but these are not the primary reasons that political leaders pay for space activities.

The motives that seem to guide both China’s civil and military space efforts fall into three categories that I call ‘catch-up,’ ‘leap-frog,’ and ‘conspicuous consumption.’ Catch-up involves China bringing its space capabilities up to par with other developed nations. “Leap-frog” has China taking advantage of new technologies, like microsatellites, to surpass developed nations. “Conspicuous consumption” involves those “eye-catching” activities that will enhance China’s prestige and influence. While there are elements of all three in China’s space efforts, judging from expenditures and payloads, the most important of the three motives is now “conspicuous consumption.”

There have been some complaints in China – muted because of the political constraints – over the decision to spend on space rather than on programs to help the hundreds of millions of Chinese who still live in poverty. The government has responded with the

arguments used by all space programs – that there will be spin-offs of immense value to the economy, that space programs will build the nation's technological strength and that they fulfill a long-standing dream of the Chinese people. These are all valid, but if unrest over poverty grows in China, it might lead to a slowdown for the space program.

A slow down, perhaps, but not a stop. Orbiting a human gives China real political advantages. It shows the Chinese people the progress they are making. It demonstrates to China's neighbors in Asia the seriousness of China's claim to regional leadership. Shenzhou 6 carried seeds from Taiwan in a symbolic assertion of China's sovereignty. Finally, it makes the point to America, Japan, Europe and Russia that China has arrived.

Does this mean it's a race? Space race is a term loaded with connotations. The race with the Soviets was really part of a larger competition between two different political systems. We are in a different kind of competition with China, and the Chinese have been careful to assert that they are not in a race. Unlike the 1960s and 1970s, we are not doing the same things, so a direct comparison makes little sense. But we should not ignore an element of competition and comparison that pervades Chinese thinking.

Why is the Chinese government willing to spend so much on space? The primary purpose of China's space program is political. Governments pay for space programs for political reasons; for prestige and influence, and for potential military and economic benefits to the rest of society. For China, it is especially important to show the world that it has reclaimed its place, after two centuries, among the leading nations.