A Long March Into Space

Untangling Fact from Fiction in China's Galactic Ambitions

By Joan Johnson-Freese

In the mid-1980s China began to open its theretofore closed space program internationally, offering commercial launches and seeking opportunities for cooperative programs, even though it still had a steep learning curve to climb in terms of its capabilities. China already had the foundations of a launch vehicle family, the Long March (LM), itself based on the Dong Feng ballistic missile first launched in 1964. Long March launched China's satellite, *East is Red*, in 1970 but the political extremism of the Cultural Revolution between 1966–1976 devastated the scientific and engineering communities, dramatically slowing satellite and launcher development.

Qian Xuesen, considered the father of the Chinese space program, was actually educated in America and employed at the Jet Propulsion Laboratory before being caught up in McCarthyism. He was deported in 1955 and thereafter, was unsurprisingly bereft of warm feelings toward the United States. While Qian provided the backbone of rebuilding the Chinese space program, he and others suffered harsh treatment—some were even killed or committed suicide—by the cultural revolutionaries who targeted mainly intellectuals.[1] Scientists and engineers had to be marshaled and labs reconstructed before China could even attempt to catch up with, or at least lessen the distance between it and other spacefaring nations, such as the United States, the then Soviet Union, Europe, and even Japan. Deng Xiaoping and other Chinese leaders recognized it was important to do so because space equated with technology, technology required industrialization, and industrialization brought economic development as well as international prestige, which translated into geostrategic influence.

▷ Chinese astronaut Liu Yang, on board the Shenzhou 8 spacecraft, June 17, 2012. *An Xin/Imaginechina/Corbis*

China's timing for re-entering the global space community was propitious. In the 1980s, the space shuttle was the centerpiece of U.S. space efforts; originally intended as

a transportation system to a space station, it emerged as an expensive trucking service into orbit after the space station was placed on indefinite hold by the Nixon administration. The Soviet Union was in domestic turmoil and economic free-fall, partially due to trying to keep up with the U.S. military's Strategic Defense Initiative (dubbed "Star Wars"). The Europeans and Japanese, then as today, had plans for space activity but found it difficult to follow through, largely due to bureaucratic politics and domestic priorities for government funding. Political will in these early front-runners in space was weak or waning.

China, on the other hand, with centralized planning not responsible to fickle politicians or electorates, initiated ambitious human spaceflight and robotic lunar exploration plans in the 1990s that are reaching fruition today. Consequently, as of 2013, China can be said to have "caught up to" or even surpassed other early front-runners in space by some definitions, like current human spaceflight activity. In other areas, however, China is still playing catch-up, hindered by its own domestic foibles and, more recently, hints of the same tentative political will that plagues other countries. Therefore, it is important to separate the fact of its achievements from the fiction often reported by the media, and to understand the problems that make the delineation of future Chinese intentions difficult at best.

The Chinese Moon Goddess

Chinese space activities—all national space activities—are inherently competitive for two related reasons: geopolitics and dual-use technology. Together, these factors create the perfect environment for what is known as a security dilemma, where countries pursue options (often involving technology) which ultimately are not in their best interests because they are seen as provocative to other countries. These other countries may respond in kind, leading to a spiraling of capabilities, and increased risk. Nuclear weapons are a good example. The challenge for spacefaring nations is to resist the sometimes-powerful temptations to pursue activities that will ultimately lead to such a security dilemma. But military threat calculations are largely based on capability, rather than intent, and dual-use space technology clearly offers capabilities valuable to militaries. That can render questions of "intent" irrelevant in some circles.

China is pursuing development of a full range of satellite capabilities—including communications, navigation, and reconnaissance—and is clearly making significant progress. China's development of its own satellite navigation system, Beidou (also known as Compass), began operational testing in 2012, and is expected to provide global coverage by 2020 through a constellation of thirty-five satellites. It also has plans for increased earth observation capabilities, including new polar and geostationary weather satellites, high-resolution imaging satellites, radar satellites, and

microsatellites for a variety of purposes—most to be developed solely by Chinese manufacturers. Of the just over one thousand satellites currently in orbit, America, Russia, and China own the most: the U.S. has 443, Russia 110, and China 93.[2]

China is also expanding its launch capabilities. The Chinese Long March 3B is currently its most powerful rocket in use, capable of lifting approximately eight tons to Low Earth Orbit (LEO). The LM-5, currently in development, will more than triple that capability to carry 25 tons to LEO. Development however, has been plagued by repeated delays, with 2014 the latest target date given for its maiden voyage. Besides its three remote launch sites currently in use, China is also building a new launch site on Hainan Island to accommodate the LM-5.

China's most publicized space activities are those related to the manned Shenzhou and the robotic Chang'e programs. Originally known simply as Project 921, the Shenzhou program was approved as a three-step plan for human spaceflight in 1992. China has been relatively open about it, and has stuck to the plan: send humans into orbit, demonstrate advanced capabilities through a small laboratory (the Tiangong program), and finally, build a large space station. The prototype Tiangong-1 has been and will be used to conduct experiments in conjunction with the Shenzhou 8–10 spacecrafts, with Shenzhou 10 currently scheduled for launch in June 2013. That will be followed by the launch of Taingong-2 (2013–14) and Tiangong-3 (2014–16). The Tiangong spacecrafts are not space stations intended for long-term use, or to be permanently manned, but form the basis for a small laboratory to test technologies similar to those tested by the United States during the Gemini program, including rendezvous, docking, and life support. Tiangong is likely to host manned missions later in its evolution.[3] At 8.5 tons, Tiangong is smaller than both Skylab (about 80 tons), and the 30-ton space station China has always planned as the culmination of its 1992 three-step plan.

Launch of the larger space station requires the availability of the LM-5. If China is able to meet an anticipated 2020 date-of-operation for its space station, that will be about the same time the currently orbiting U.S.-led International Space Station (ISS) is de-orbited, making the Chinese version the de facto replacement. There is a certain irony in that, as China had long wanted to participate in the ISS program, but was stymied by the U.S. from doing so; first with the rationale that China had little to contribute as a partner, and later by objections from blustering U.S. politicians of the inclusion of a non-democratic nation in a program symbolizing an "international family of spacefaring nations."

China is executing the robust Shenzhou human spaceflight program at a pace simultaneously incremental and accelerated: incremental in its timeline milestones and accelerated in its milestone achievements. For example, between Yang Liwei's first-ever manned flight in 2003 and Zhai Zhigang's spacewalk in 2008 there was only one

other Shenzhou program flight. Compare that to the number of flights that occurred during the Mercury and Gemini programs, and one finds a much higher number of U.S. launches, with smaller steps taken by each. Shenzhou 9, launched in June 2012, included China's first female taikonaut, Liu Yang.

Chang'e is the mythical Chinese moon goddess for whom the robotic Chinese lunar program is named. Chang'e 1 was launched in 2007 and operated until 2009, and demonstrated China's capability both to put satellites into lunar orbit and to return imagery. Chang'e 2 was launched in 2010. After flying in a closer-to-the-surface lunar orbit and providing imagery with a high resolution camera—pictures essential for an anticipated soft-landing Chang'e 3 mission in 2013—Chang'e 2 left lunar orbit for the Earth-Sun L2 Lagrangian Point, to test Chinese tracking and control capabilities. Prior to China, only the United States and the European Space Agency had visited L2. Chang'e 2 then set out for an extended mission to asteroid 4179 Toutatis. Chang'e 3 will be the first soft lunar landing since a Soviet expedition in 1976. Chang'e 3 and 4 are precursors for an intended Chang'e 5 lunar sample return, though that mission also requires use of the still-in-development LM-5.

The complex structure and opaque nature of the Chinese Communist government system and the behemoth bureaucracy that implements government decisions often makes Western analysis of Chinese decision-making a difficult challenge. It is known, however, that while civilian politicians through the state council make decisions about what space programs China will carry out, the military has a significant role in program execution. While partly a function of the People's Liberation Army having traditionally been entrusted with execution of programs considered of important national interest, the military value of the space technology being developed is key as well.

China is clearly expanding its military space capabilities in areas from command and control and meteorology, which have proved critical in enhancing terrestrial force effectiveness, to space weapons. In 2007, China conducted an anti-satellite (ASAT) weapons test, destroying one of its own defunct weather satellites using a direct ascent, kinetic-kill vehicle. Impact resulted in more than 3,000 pieces of space debris being created. The debris will take years to dissipate and in the meantime threatens potentially catastrophic damage if it collides with active spacecraft, including the ISS.

That test confirmed for many countries that space is a congested, contested, and competitive environment, for which they must prepare. Events that followed—the United States conducting Operation Burnt Frost in 2008 to destroy one of its own malfunctioning satellites using missile defense technology, the Chinese "missile defense" test in 2010, and India's 2011 test of missile technology potentially useful to the development of ASAT capability—are indicators of the kind of security dilemma spiral that can happen. While each of those activities was conducted in ways to minimize debris

issues, the potential threat to the space environment in non-test circumstances is clear. If there was any upside to the 2007 Chinese test, it was the frightening realization by all countries of the fragility of the space environment. Mankind's dependence on space assets—including through GPS (one of only two global utilities, along with the Internet) communications, meteorology and remote sensing—makes it in everyone's best interest to cooperate to maintain that environment.

China has now recognized this need to sustain the space environment and cooperated on relevant issues, particularly the space debris issue. Given that China was scheduled to host an international meeting on the issue only days after its 2007 ASAT test that significantly worsened space debris, and resulted in China cancelling the meeting out of embarrassment, some analysts see its current cooperation as somewhat hypocritical. At the very least there is a certain irony in that the U.S. military, which has the most sophisticated tracking abilities, has had to warn China of potential collisions between its own space junk and its own satellites.

A New Space Race?

Though China has a robust exploration space program underway, what has not been officially announced is a manned lunar mission. Individuals in China sometimes speak about manned lunar landings as a given (sometimes just to chafe and spin-up U.S. officials), but that is not the case. Outspoken space advocate Ouyang Ziyuan, a geologist and chief lunar scientist for Chang'e, for example, has long and very publicly endorsed a manned lunar mission—his comments are often mistaken by Western media as official government policy. He also hints at exploration of the moon for Helium-3, a potential fuel for a fusion reactor. Mining Helium-3 as an economic rationale for lunar exploration once made its way through Washington circles as well—though no fusion reactor exists where it could be used. This rationalization can signal efforts by scientists to quell political skepticism.

It has only been in recent years that a manned lunar mission has been seriously discussed in China, first within the space community and then among decision-makers. Chinese officials prudently first focused on testing requisite capabilities through the manned Shenzhou and robotic Chang'e programs. While there is certainly enthusiasm among some groups, there is also skepticism—just as there was in the United States regarding the Apollo program—among some scientists and politicians that such a program would require too much focused funding in one scientific area, at the expense of others. Still, Chinese leaders are aware that China has reaped significant regional—and global—geostrategic benefits, including the demonstration of technical prowess and attracting students to science and engineering programs, as well as dual-use military capabilities, from its space efforts.

Even with the planned upgrades and expansion, however, China has not approached or surpassed U.S. technical competence in space across the board—another claim often made by politicians and found in the media. Clearly, however, China is currently more active in exploration than the United States, while the United States transitions to a more public-private approach to space. Contrary to what is often reported, however, there is no space race between the United States and China.

The George W. Bush administration largely ignored China's human spaceflight accomplishments, though some members of Congress used them to try to generate a new lunar race (along with the requisite funding for NASA to execute its return-to-the-moon Constellation program). Government funding offered for Constellation, however, was nowhere near what was needed to actually implement the program in a timely, effective manner, but rather only enough to keep it alive. When President Barack Obama was left to finally pull the plug on Constellation, his realistic options were few, if any. Now, with President Obama's 2010 National Space Policy transitioning the U.S. space program into one of more private sector involvement in low Earth orbit activities so NASA can focus on new destinations, China is racing only itself—or maybe India—to the moon, where the United States already triumphantly went more than forty years ago.

The Obama administration has been more open to the possibility of cooperative space activity with China than was the Bush administration. Nevertheless, for reasons including the belief that China will find a valuable military reason for humans in space (something neither the United States nor the Soviet Union was able to do), allegations of spying and even human rights, some members of Congress, such as Dana Rohrabacher and Frank Wolf, have been adamantly against any such cooperation. Wolf even inserted language into the NASA funding legislation prohibiting bilateral NASA cooperation, or even communication with, China.

Though both India and China deny an Asian techno-nationalist race, where technology becomes symbolic of national power (toward regional and global influence), actions sometimes speak louder than words. India once proudly proclaimed it was interested in space only in ways that would benefit the Indian people, like communications, weather satellites, and remote sensing. More recently, however, India has acquired plans for space that are far more expansive than directly relevant to the Indian people.[4] The Indian space program now includes human spaceflight in its plans, as well as the development of significant military space capabilities, including those that could potentially be used as space weapons.

The term *Shashou Jian*, translated as Assassin's Mace, often finds its way into analyses of Chinese space ambitions. The term is used in ancient Chinese strategy to reference use of an asymmetric weapon to rapidly and decisively defeat an enemy who

relies on conventional strengths. Today, the connotation is the development of a new technology to defeat an enemy. With space technology so heavily dual-use, the idea that China could develop a Death Star or some such fantastical super weapon, is easy to suggest yet is based on little evidence. (Ironically, President Obama was recently presented with a citizen's petition to have the U.S. build a Death Star. The White House rejected the proposal.) The same, however, is true for any country. Recent U.S. interest in 3D printing to assemble replacement parts and tools for the ISS[5] could certainly be seen differently by other countries: as the U.S. having the potential to create crude ASATs in space, for example. While the possibility of any country developing an Assassin's Mace exists—and perhaps because it does so—extra care must be taken to minimize misunderstandings, which could lead to catastrophic events in space that have the potential to threaten space assets valuable to all people in all nations.

Code of Conduct

China is a country of such size and diversity that analysts can find evidence for any hypothesis they seek to prove. Consequently, some analysts see virtually all Chinese space activities as nefarious. Others argue that the Chinese space program is inherently competitive, but with cooperation incorporated as well. (There is a term sometimes used called "coopetition" which, while facile, does convey a likely accurate portrayal of the situation.) Further, Chinese intentions are likely neither entirely benign, nor totally nefarious.

Where China is concerned, because of the dual-use nature of space technology, largely everything it does in space can be—and has been by some analysts—considered a threat, especially in the United States. It is certainly appropriate that U.S. analysts, especially military analysts, consider worst-case scenarios, but political prudence and economic necessity demand careful and thorough analysis, to differentiate wild speculation from valid conclusions. Unfortunately, this has not always been the case.[6]

The importance of recognizing the frequency with which misperception, miscommunication, and misinterpretation occur between the U.S. and China (and other countries as well perhaps) cannot be overstated. Recently, a short piece on the military affairs website *AOL Defense* looked at the poor sources used by some U.S. analysts to support claims about the development and testing of a Chinese spaceplane[7]—the point being that while activity is certain, it is not useful to hype threats. This only adds to the security dilemma problem. The problem is that when everything a country does is considered a threat, the real threats may not be adequately addressed.

Realistically, analyses of the intentions of any country are considered through a nationalistic filter of another country, a filter of geopolitical considerations. Therefore, consideration of the geopolitical relationship between the U.S. and China is useful.

The U.S. "pivot to Asia" or "rebalancing" policy that redirects U.S. strategic attention from the Middle East to Asia has resulted in considerable consternation in China. Concerning space specifically, restrictions imposed by Congress on the NASA budget prohibit bilateral interactions of any kind with China—after the Obama administration indicated interest in increased interactions—and baffle the Chinese regarding who makes U.S. policy, and what it is.

On the other hand, Chinese military modernization, seen as expansive and alarming in the U.S. and Asia, generates concerns. Additionally, the techno-nationalist rewards China has garnered can generate regional suspicion, if not rivalry. That is perhaps most evidenced in India's recent expansion of space goals into heretofore-ignored areas.

It also appears that Japan is going to challenge the "soft power" influence China has garnered from its space program with developing countries, by supporting and funding third party efforts. Initiatives through the Asia-Pacific Regional Space Agency Forum (APRSAF)[8], an eclectic group of thirty-five countries (and even more international organizations) ranging from China, Japan and Myanmar, to Israel, Germany, Canada, and Kazakhstan, serve as an opportunity for Japan to assist developing countries. China has coveted the idea of being the leader of space initiatives in developing countries.

Also on the horizon for consideration is China's potential perspective on a draft International Code of Conduct for Outer Space Activities (CoC), initiated by the European Union in 2008 and conceptually supported by the United States in 2012. Several points can be drawn from that issue regarding apparent Chinese positions about space that are relevant to the future.

China has consistently stated a policy of using outer space for peaceful purposes and opposing weaponization or any arms race in outer space. With Russia, China submitted a draft treaty in 2008 on Prevention of the Placement of Weapons in Outer Space and the Threat or Use of Force against Outer Space Objects (PPWT) at the United Nations Conference on Disarmament. China clearly prefers legally binding agreements to address multilateral policy questions. The European CoC, however, is part of a "soft law" trend, using Transparency and Confidence Building Measures (TCBM) to deal with threats such as misperceptions and miscommunications that could heighten tensions and lead to escalation—without a legally binding agreement that might be impossible for some countries (such as the United States) to ratify due to domestic politics. Any TCBM that will aid in abetting the many misunderstandings already discussed and those likely in the future will be useful—and China appears to recognize this.

The voluntary nature of the CoC has been cited by Lu Jiqian, professor at China University of Political Science and Law, as a "big obstacle" for China.[9] But although

China favors a legally binding treaty, Chinese representative Wang Qun stated at the UN that TCBMs are not at odds "with efforts to prevent an arms race in outer space, and such TCBMs are useful supplements to legal instruments."[10] Chinese analyst Jinyuan Su from Xi'an Jiaotong University has suggested that substantive differences between a treaty approach and a CoC approach focus on the failure to ban ground-based ASAT, a lack of a verification regime in the treaty, and the failure to constrain space-to-Earth weapons, and potentially make the CoC unacceptable to China (and perhaps other states).[11] China has also made it clear that it won't agree to any arrangements that will potentially affect its development in the military space domain, a view also likely shared by other spacefaring nations as well. Here is where misunderstandings may arise over dual-use technology and sovereignty to develop capabilities.

Meanwhile, China is forging ahead with space program expansion.[12] A massive new factory in Tianjin, a port city not far from Beijing, will be completed around August 2013, and begin operations later in the year. Floor space of the facility is estimated at about 100,000 square meters, or 1.08 million square feet, big enough to allow for product construction and testing.

The main products to be produced in the facility are modules for China's space station—the flagship of its currently approved human spaceflight program—and powerful reconnaissance satellites, undoubtedly for military use. Tianjin facility officials say the facility will be capable of producing six to eight large spacecraft each year. These are the space station modules that require the Long March 5 for launch. The location of the facility may be for ease of transporting the module to the new launch facility on Hainan Island.

Representatives of the China's General Armaments Department, responsible for military satellites (among other areas of spacecraft development, including the anti-satellites weapon developed in 2007), were present at the groundbreaking, evidencing military involvement in the facility. China clearly intends to expand both its overall number of satellites in orbit and the types of satellites. By 2020, China will likely have about 200 satellites in orbit, or about 20 percent of the total. Whether for civilian or military use, or both, remains to be seen. In any event, more spacecraft in orbit raises the potential for collisions, incidents or misunderstanding regarding intent in general, further raising the importance transparency of actions, and a Code of Conduct.

Politically, however, issues of domestic politics must also be considered regarding the potential for China to support a Code of Conduct. Little substantive decision-making can be accomplished on controversial policy issues during periods of political transition in any country, which is currently occurring in China. Initially, it was suggested that China (like India) was not supportive of a CoC because it felt excluded from initial negotiations. However, it has been mostly Indian analysts rather than Chinese analysts

suggesting this view.[13] China seems to be closely studying the costs and benefits of a "soft law" approach to the multitude of issues (space debris high among them) related to the sustainability of the space environment and it has not ruled out that approach. Part of what China will likely be looking at is whether support for a CoC will weaken or even nullify the PPWT, and with it, geopolitical advantages garnered from co-sponsoring a treaty on a subject of concern to a great many nations—and which the U.S. has consistently blocked. Politics and diplomatic strategy is a many sided prism where gain in one area may have to be weighed against losses in another.

Whether China will lean toward the promotion of cooperation or competition in the future will be known by its adherence to best practices—in other words, actions will speak louder than words. China has shown that it is a spacefaring nation in for the long haul. Its exploration programs will continue and potentially expand to include a manned lunar mission. And its military capabilities in space will expand as part of a general military modernization. For China to continue to reap benefits from space—both in the military and exploration realms—it will have to join with other nations to protect the sustainability of the space environment. That self-interest gives cause for optimism.

The views expressed in this essay are those of the author alone and do not represent the views of the U.S. government, the Department of Defense or the U.S. Navy.

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