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China's Space Program: An Overview

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Summary

The People's Republic of China successfully completed its second human spaceflight mission on October 17, 2005. China is only the third country, after Russia and the United States, able to launch people into space. Its first human spaceflight was in 2003 when a single astronaut, or "taikonaut," made a flight lasting slightly less than a day. The 2005 flight lasted five days, and involved two taikonauts. As the United States embarks upon President Bush's "Vision for Space Exploration" to return astronauts to the Moon by 2020 and someday send them to Mars, some may view China's entrance into the human exploration of space as a competitive threat, while others may view China as a potential partner. This report will be updated as warranted.

Introduction

China has been launching satellites since 1970. Most of the launches are of Chinese communications, weather, remote sensing, navigation, or scientific satellites. Some of those satellites may be for military applications, or are dual use. Some were commercial launches for foreign countries or companies, primarily placing communications satellites into orbit. China launched its first astronaut, or "taikonaut,"¹ in October 2003.

China has three space launch sites: Jiuquan (also called Shuang Cheng-tzu) in the Gobi desert; Xichang, in southeastern China (near Chengdu); and Taiyuan, south of Beijing. Jiuquan was China's first launch site, and is used for launches of a variety of spacecraft, including those related to the human spaceflight program. Xichang, inaugurated in 1984, is used for launches into geostationary orbit (above the equator), primarily communications satellites. Taiyuan, opened in 1988, is used for launches into polar orbits (that circle the Earth's poles), primarily weather and other Earth observation satellites. China has several different launch vehicles; most are called Chang Zheng (CZ,

¹ The term "taikonaut" for Chinese astronaut was popularized by an independent Chinese space analyst, Chen Lan, who operates the "Go Taikonauts" unofficial Chinese space website [<http://www.geocities.com/CapeCanaveral/Launchpad/1921/>]. According to Mr. Chen, other Chinese terms for astronaut are "yahangyuan," "hangtianyuan," and "taikogren."

meaning Long March). Versions of the CZ 2 are used at Jiuquan; the CZ 2F is used for launches associated with its human spaceflight program. Versions of the CZ 3 and some CZ 2 variants are used at Xichang. CZ 4 is used at Taiyuan.

China's Human Spaceflight Program

China's First Taikonaut and the Shenzhou Spacecraft. On October 15, 2003 (GMT), China launched its first taikonaut — People's Liberation Army Lt. Col. Yang Liwei — into space aboard the Shenzhou 5 (Divine Vessel) spacecraft. Lt. Col. Yang landed on October 16, 2003 Beijing time, after a 21 hour 23 minute flight.

China's program to launch humans into space started in 1992 and is designated by the Chinese as "Project 921." (An earlier effort was discontinued due to economic pressures.) Two Chinese specialists trained at Russia's cosmonaut training facility in Star City (near Moscow) in 1997. According to Chinese press reports, the taikonaut corps consists of 12 trainees and two trainers, all fighter pilots.

The Shenzhou spacecraft design is patterned after Russia's Soyuz spacecraft, although the Chinese insist that the spacecraft are made entirely in China. Shenzhou consists of three modules: the descent module, a service module, and an orbital module. At the end of the primary mission, the descent module and service module detach from the orbital module. The service module positions the descent module correctly for reentry and fires its engines to initiate descent. It detaches from the descent module and disintegrates in the atmosphere as the descent module returns to Earth. The orbital module typically remains in orbit for several months. It has its own propulsion system, allowing it to make maneuvers. On some of the test flights, experiments were carried on the orbital module in addition to those in the descent module. Four orbital test flights of the Shenzhou spacecraft were conducted without crews between 1999 and 2003, in preparation for the flight of Shenzhou 5.

Shenzhou 6: Two Taikonauts on a Five-Day Mission. China launched its second human spaceflight mission on October 12, 2005 GMT (October 11, EDT). Carrying two taikonauts, Fei Junlong and Nie Haisheng, the Shenzhou 6 descent module successfully returned to Earth on October 17 after about five days (115 hours and 32 minutes). In addition to learning more about human spaceflight in general, the crew carried out scientific experiments. The Shenzhou 6 orbital module remains in orbit.

Future Plans, Including the Moon. Chinese officials have been quoted discussing a three-step human spaceflight plan: send humans into Earth orbit, dock spacecraft together to form a small laboratory, and ultimately build a large space station.² Following the landing of the Shenzhou 6 crew, a Chinese space official said that a mission including a spacewalk was planned for 2007, and a mission involving rendezvous and docking planned for the 2009-2012 time period.

Whether the Chinese are planning to send humans to the Moon has become a topical subject since President Bush announced plans for the United States to return astronauts

² Lu Pi. Manned Space Flights: A Foreseeable Goal. Beijing Review (Internet Version-WWW) in English, May 9, 2002 (via Foreign Broadcast Information Service, hereafter "FBIS").

to the Moon (see CRS Report RS21720). From Chinese sources, the answer appears to be that such a mission may be under discussion, but there is no definitive program or timetable.

Most Chinese reports regarding lunar exploration plans discuss robotic, rather than human, missions. An oft-cited three-step scenario calls for the launch of a robotic spacecraft to orbit the Moon in 2007, then a robotic mission to land a rover on the Moon around 2010, and finally a robotic probe to return lunar samples to Earth around 2020.³ The first step of that plan, to build a probe to orbit the Moon, is underway. The launch of the probe, named Chang'e, is expected in 2007. Chinese space officials quoted in the Chinese media rarely mention plans to send humans to the Moon. However, reports on Chinese websites in 2002 and 2005 discussed a three-step plan to do so. The plan begins with human trips to Earth orbit, including Earth-orbiting space laboratories; then robotic probes to the Moon; and ultimately a human landing on the Moon.⁴ No timetable for the human lunar landing portion was provided in those stories. However, a 2005 report in a non-Chinese government owned newspaper quoted a “designer with the Chinese Lunar Orbiting Exploration” program as describing another version of the three-step plan: a robotic lunar orbiter in 2007; robotic probes to land on the moon and collect samples over 4-5 years; and “if things go well, we will send astronauts to the moon by 2020.”⁵

Still, other Chinese space officials assert they cannot be in a “space race” with other countries, citing factors such as China’s comparatively low per-capita gross domestic product, the gap between urban and rural areas, the lack of medical insurance for its 800 million farmers, and the lack of a rocket powerful enough to send people to the Moon.⁶

Guiding Principles and Funding

The Chinese government published a “White Paper” in November 2000 outlining its goals and guiding principles for the space program. The first principle is —

— Adhering to the principle of long-term, stable and sustainable development and making the development of space activities cater to and serve the state’s comprehensive development strategy. The Chinese government attaches great importance to the significant role of space activities in implementing the strategy of revitalizing the country with science and education and that of sustainable development, as well as in economic construction, national security, science and technology development and social progress. The development of space activities is

³ For example, see China’s Lunar Probe Program Facing 3 Major Difficulties: Project Chief Commander. Xinhua, September 9, 2005 (via Factiva).

⁴ (1) Wang Qian. China to Land on Moon by 2010. Beijing Zhongguo Wang WWW-Text in English, October 26, 2002 (via FBIS, which describes the source as an official PRC Internet site). (2) Yang Haiying and Shen Yanbin. PRC: Article Examines Preparations for Shenzhou VI, Plans for Moon Flight. Shanghai Xinwen Chenbao, September 28, 2005 (via FBIS).

⁵ Kristine Kwok. Shooting for the Moon and Beyond. Hong Kong South China Morning Post (Internet Version-WWW) in English, October 7, 2005 (via FBIS, which describes the source as Hong Kong’s most prominent non-PRC-owned English-language daily newspaper).

⁶ For example, see Xinhua ‘News Analysis’: More on China Has No Intention of Vying With Others in Space. Beijing Xinhua in English, October 17, 2005, 0550 GMT (via FBIS).

encouraged and supported by the government as an integral part of the state's comprehensive development strategy.⁷

Xinhua, China's official news service, stated in October 2005 that China spent 19 billion yuan (about \$2 billion) on Shenzhou 1-5, and 900 million yuan (about \$110 million) on Shenzhou 6 (currency conversions are from the Xinhua text).⁸ Annual spending on the total Chinese space program is difficult to ascertain. Dr. Joan Johnson-Freese, chair of the Department of National Security Studies at the Naval War College, estimates that China spends \$1.4 billion-\$2.2 billion annually on space, but cautions against direct comparisons with U.S. space spending because of currency conversion issues, China's command economy, and "deliberate over-employment."⁹

Commercial Space Launch Activities

China announced its intention to enter the commercial space launch business in 1986. (Commercial space launch competition is discussed in CRS Issue Brief IB93062.) Chinese launch services are marketed through China Great Wall Industries Corporation (CGWIC). Virtually all communications satellites requiring commercial launch services are built in the United States or include U.S. components, so U.S. export licenses must be granted to send the satellites to China for launch. The United States thus has played a key role in the evolution of the Chinese commercial launch services business. In 1988, the Reagan Administration approved the first export licenses for three satellites to be sent to China on the condition that China sign three international treaties concerning, among other things, liability for damage from space launches; negotiate a fair trade agreement with the United States regarding launch services; and reach agreement on protecting technology from being transferred while satellites are in China. All conditions were met by January 1989. At that time, commercial communications satellites were on the U.S. Munitions List and export license requests were handled by the State Department. Following the Tiananmen Square uprising in June 1989, the Bush Administration suspended all export licenses for items on the Munitions List, including the three satellites. The suspension was ultimately lifted, and the satellites were launched by China.

The incident underscored the coupling of commercial communications satellites export licenses and overall relationships between the United States and China. The 1990s witnessed repeated instances where export licenses would be granted, suspended, and reinstated, depending on the political situation. In 1997, allegations surfaced that China was obtaining militarily useful information by launching U.S. satellites. The charges concerned investigations into launch failures involving U.S.-built satellites where two U.S. companies (Loral and Hughes) allegedly assisted China in understanding the cause of the accidents and how to remedy them. By that time, responsibility for commercial communications satellite exports had been shifted from the State Department to the Commerce Department. In response to the allegations, Congress returned export

⁷ White Paper: "Full Text" of 'China's Space Activities.' Beijing Xinhua in English, November 22, 2000, 0211 GMT (via FBIS).

⁸ Xinhua 'News Analysis, op. cit.

⁹ Joan Johnson-Freese. September 29, 2003 presentation to Center for Strategic and International Studies [<http://www.csis.org/china/030929johnson-freese.pdf>]. Dr. Freese authored *The Chinese Space Program: Mystery Within a Maze*, Malabar, Florida, Kreiger Publishing Co., 1998.

responsibility to the State Department as of March 15, 1999. The State Department has not granted any export licenses for sending communications satellites to China since then, and Chinese commercial space launch operations consequently have been suspended. (See CRS Issue Brief IB93062 for more details on the Loral/Hughes controversy and the financial penalties imposed on the companies in settlements with the U.S. government.)

Military Space Activities

Chinese officials routinely call for using space for peaceful purposes, and argue against the militarization of space in settings such as the U.N. Conference on Disarmament. However, the November 2000 White Paper includes national security as one of the purposes served by the space program, and China's remote sensing, communications, and navigation satellites presumably satisfy both military and civilian objectives. The Chinese space program is conducted by the China Aerospace Science and Technology Corporation (abbreviated CASC by the Chinese), a state-owned enterprise that develops and manufactures strategic and tactical missiles in addition to spacecraft, launch vehicles, and other aerospace products. CGWIC (see above) is a part of CASC. CASC's website is [<http://www.spacechina.com>].

The U.S. Department of Defense (DOD) publishes an annual report on "Military Power of the People's Republic of China." The current edition (2005), available at [<http://www.defenselink.mil/news/Jul2005/d20050719china.pdf>], discusses China's efforts to develop new space and "counterspace" systems (pp. 35-36). The DOD report lists a number of activities that are ongoing, or in which China appears interested, that DOD asserts have potential military applications: the human spaceflight program; remote sensing satellites; electronic intelligence satellites; and an assortment of what DOD describes as small satellites (not further defined), microsatellites (weighing less than 100 kilograms), and minisatellites (weighing between 101- and 500 kilograms). The missions for those various classes of small satellites include remote sensing, communications, and navigation. The DOD report states that in the next decade, China "most likely will field radar, ocean surveillance, and improved film-based photoreconnaissance satellites. China will eventually deploy advanced imagery, reconnaissance, and Earth resource systems with military applications." Finally, the report states that China "is working on, and plans to field, [antisatellite] systems," including conducting research to develop ground-based laser antisatellite weapons.

International Cooperation

China is very interested in international cooperation in space. The 2000 White Paper discusses it extensively, and China has cooperative arrangements with several countries, including Russia, Brazil, and Europe.

As for cooperation with the United States, there is no government-to-government level cooperation. The National Aeronautics and Space Administration (NASA) has reported in the past, however, that it has engaged in low level scientific cooperation, data exchanges, and participation in multilateral coordination groups with China. China has expressed interest in participating in the U.S.-led International Space Station (ISS) program (for more on the ISS, see CRS Issue Brief IB93017, *Space Stations*, by Marcia S. Smith). The United States has declined to bring China into the program.

Following the Shenzhou 5 flight, President Bush congratulated Chinese President Hu [http://www.whitehouse.gov/news/releases/2003/10/20031019-5.html] and wished China continued success. Then-NASA Administrator Sean O'Keefe called Shenzhou 5 an "important achievement in human exploration" and wished China "a continued safe human space flight program."¹⁰ His successor, Dr. Michael Griffin, issued a statement congratulating China on Shenzhou 6 [http://www.nasa.gov/home/hqnews/2005/oct/HQ_05343_Griffin_China_statement.html].

President Bush announced a new Vision for Space Exploration for NASA in January 2004, directing the agency to focus its activities on returning humans to the Moon and someday sending them to Mars. He invited other countries to join. In November 2004, NASA sponsored an "international exploration workshop" for other countries interested in the Vision, and Chinese space officials participated. The head of the Chinese space agency, Laiyan Sun, made a courtesy call on Mr. O'Keefe. Those actions sparked discussion of whether China might be included in implementing the Vision. In January 2005, the trade publication *Aviation Week & Space Technology* (AW&ST) quoted Mr. O'Keefe as supporting cooperation with China: "The Bush Administration now believes that 'measured and appropriate levels of space cooperation with China' are viable, O'Keefe told AW&ST."¹¹ Dr. Griffin released an implementation plan for the Vision in September 2005 that did not focus on the role that other countries might play.

Representative Ken Calvert, chairman of the Space and Aeronautics subcommittee of the House Science Committee, was quoted by AW&ST in October 2005 as expressing concern that China might send humans to the Moon before NASA returns astronauts there. "Even if we follow the president's vision and we're back to the Moon by 2020, I also serve on the Armed Service [sic] Committee, so I have the ability to look at a lot of things. ... And looking at things that are not classified, more than likely the Chinese will be on the Moon before that. I would rather be on the Moon to greet the Chinese rather than going to the Moon and have the Chinese greet us."¹² He reportedly added that "Any cooperation with the Chinese at this point I suspect would be more one-way than it would be two-way. Plus the fact that we need to be cautious about how we go about doing [cooperation] and what our policy should be. So I would be careful." The AW&ST article cautioned, however, that Representative Calvert's assessment that China might land astronauts on the Moon before the United States returns there had a "risk it could backfire over the long term if it becomes clear he was bluffing." Citing an unnamed congressional source, the AW&ST article stated "it would be hard to make an argument that the U.S. is in a race to the Moon when China has only one human orbital flight under its belt and is preparing to send two men on a five-day mission ... reminiscent of ... Soviet ... flights in the 1960s."

¹⁰ NASA press release 03-333, October 14, 2003.

¹¹ Craig Covault. The China Card. *Aviation Week & Space Technology*, January 31, 2005, p. 27.

¹² Frank Moring, Jr. Space Race Redux. *Aviation Week & Space Technology*, October 3, 2005, p. 24-25.