Proliferation Papers

China's Space Ambitions

In collaboration with the Atomic Energy Commission (CEA)

Joan Johnson-Freese

Summer 2007

ifri Security Studies Center

Ifri is a research center and a forum for debate on the major international political and economic issues. Headed by Thierry de Montbrial since its founding in 1979, Ifri is a state-approved organization.
Created in March 2005 as the Brussels-based branchof Ifri, Eur-Ifri is a state-approved European think tank, set up to contribute to the diversity of policy-thinking in Brussels with a view to stimulating the political debate and to feeding the decision-making process in the EU institutions.

The views expressed in this article are the author's alone and do not represent the official position of the Department of the Navy, the Department of Defense, or the U.S. government.

IFRI
27 RUE DE LA PROCESSION
75740 PARIS CEDEX 15 FRANCE
PHONE : 33 (0)1 40 61 60 00
EMAIL: IFRI@IFRI.ORG

EUR-IFRI
AVENUE D'AUDERGHEM, 22-28
1060 BRUSSELS - BELGIUM
PHONE : 00(2) 32 2 238 51 10
EMAIL: INFO.EURIFRI@IFRI.ORG

WEBSITE: - www.ifri.org

Summer 2007

China's Space Ambitions

Joan Johnson-Freese

Proliferation Papers

Though it has long been a concern for security experts, proliferation has truly become an important political issue over the last decade, marked simultaneously by the nuclearization of South Asia, the strengthening of international regimes (TNP, CW, MTCR) and the discovery of fraud and trafficking, the number and gravity of which have surprised observers and analysts alike (Iraq in 1991, North Korea, Libyan and Iranian programs or the A. Q. Khan networks today).

To further the debate on complex issues that involve technical, regional, and strategic aspects, Ifri's Security Studies Department organizes each year, in collaboration with the Atomic Energy Commission (Commissariat à l'énergie atomique, CEA), a series of closed seminars dealing with WMD proliferation, disarmament, and non-proliferation. Generally held in English these seminars take the form of a presentation by an international expert. The Proliferation Papers is a collection, in the original version, of selected texts from these presentations. The following text is written by Joan Johnson-Freese.

Dr. Johnson-Freese serves as Chair, Department of National Security Studies, at the U.S. Naval War College. Previously, she was on the faculty at the Asia Pacific Center for Security Studies in Honolulu, Hawaii; at the Air War College in Montgomery, Alabama; and the Director of the Center for Space Policy & Law at the University of Central Florida. Dr. Johnson-Freese has testified before the U.S. Congress on several occasions regarding Chinese space activities and space security issues generally. She is on the editorial board of *China Security* and a member of the International Academy of Astronautics. Dr. Johnson-Freese's most recent book is entitled 'Space as a Strategic Asset', released in March 2007 by Columbia University Press.

Contents

Introduction

On October 15, 2003 China became only the third nation capable of manned spaceflight, joining the United States and Russia in that exclusive club. Subsequently, its second manned launch, this time carrying two *taikonauts*,[1] occurred on October 2, 2005. Then on January 11, 2007 China joined the United States and Russia in another exclusive club, becoming only the third nation to test an anti-satellite weapon (ASAT). Those two very different events indicate Chinese space activity involving a wide spectrum of capabilities. Capabilities are not especially hard to gauge; intentions, however, can be very difficult to discern and result in strategic miscalculations. Robert Jervis and others have also discussed the perils of ambiguity as related to security dilemmas,[2] where a spiral of preparations and tensions are created when the protective actions of one state lead to reactive countermeasures by another state, potentially leading to conflict or even war.

While China's Information Office of the State Council issued White Papers on space in both November 2000 and October 2006 detailing Chinese aims, principles and accomplishments, considerable speculation remains as to its pragmatic objectives in space. Because China has an expansive space program and given that 95% of space technology is dual-use, meaning of value to both the civilian and military communities, the question of China's intentions in space has become a subject of worldwide scrutiny, particularly in the United States. It also means that one cannot consider Chinese intentions regarding military space without looking at its entire program. Further, even those space activities which are not directly related to the military, such as manned space activity, can have significant geostrategic value. It is my contention that China seeks to exploit space for all the benefits it can reap, civil and military, within a restricted budget. Given that space is an inherently expensive area of development, China will have to make hard choices regarding what areas to pursue, and which to forego. It also means that there is an opportunity to externally influence Chinese ambitions toward the peaceful uses of space.

[1] Also known as *Yuhangyuan*.
[2] "Cooperation under the Security Dilemma", *World Politics*, Vol. 30, No.2, 1978.

The Benefits of Space

The wide-ranging benefits of a space program have been recognized since the days of the U.S. Apollo program, and only expanded since that time. Those benefits include prestige, the creation of technical jobs, dual-use technology and its spin-offs, motivating students into technical fields, and boosting economic development overall. Many of the benefits overlap and intensify the others as well.

Beginning with economic development, early European space efforts in the 1960's were spurred by the notion that space activity required technology, technology required the development of a strong industrial sector, and a strong industrial sector led to economic growth. This same premise holds true today and extends into the generation of a Knowledge-Based Society considered requisite for success in a globalized economy as well.

Space activity, particularly manned spaceflight, also yields considerable prestige, prestige that translates into political prowess. China, as a rising Asian power, is inherently interested in prestige cum geostrategic influence. The implications of a manned space launch did not go unnoticed, for example, by the Japanese. After the first Chinese launch in 2003, one Japanese official was quoted as saying, "Japan is likely to be the one to take the severest blow from the Chinese success. A country capable of launching any time will have a large influence in terms of diplomacy at the United Nations and military affairs. Moves to buy products from a country succeeding in manned space flight may occur."[3] The point about buying products from a country having successfully launched a man into space relates back to economic growth and the creation of technical jobs. As Tsinghua University Professor Yan Xuetong said in 2003, "Now people will realize that we don't only make clothes and shoes."[4]

Clearly, China is anxious to create the kinds of technical jobs that space activity affords and which also require technical education. Just as the United States experienced a clear surge of student interest in science and technical fields in conjunction with the Apollo program, China is experiencing the same phenomenon. While not all those trained in science and technology will work in the space sector, the work force will be

[3] "China's Launch of Manned Spacecraft Welcomed in Japan", *Japan Economic Newswire,* October 15, 2003.
[4] John Pomfret, "Chinese Officials Plot a Path to Space", *Washington Post*, October 16, 2003, p. A 26.

available for other industrial sectors that will hopefully open and grow as a result of a stronger image of Chinese technical capabilities due to their space achievements. That 80% of the workforce involved with Project 921, their manned program, is under forty years old (many are under thirty) illustrates China's success in attracting new talent to the field.

Finally, China shares the views of many other countries, including many European countries, that investments in dual-use technology are desirable because the rate of return on an investment is very high.[5] The U.S., on the other hand, sees dual-use technology development as something to be discouraged outside the United States, because of the potential for it to be used for military purposes. In fact, the U.S. assumption is that if dual use technology is being developed in China, it is for military purposes. While that assumption clearly overreaches, China is developing space technology for military as well as civilian purposes.

[5] See, for example, D. Davies, "Defence research: duel use or dual use technology?**"** *Engineering Management Journal*, Volume 4, no. 5, Oct 1994, p. 231 – 242; The Report of the European Commission, Report of Humanitarian Demining Cluster Meeting held in Brussels, 13th and 14th November 2001, Version 1.1 January 15, 2002, p. 3. "Both dual-use technology and parallel-use developments must be seen as ways to mitigate the investment risk of engaging in RTD activity where the market is small and diminishing as mines are cleared."

Chinese Space Capabilities

In launch technology, China followed the same pattern as in the United States, initially converting missiles into rockets. In the U.S., the Atlas, Delta and Titan launchers originated as missiles. In China, the Long March (CZ) family of launchers was originally derived from *Dong Feng* missiles. In order to carry out its ambitious space plans for the future, however, China needs a new launcher, the Long March (CZ) 5. Since they have reached the limit of boosters that can be strapped onto existing designs and reconfigurations possible, a new rocket design is needed, which will challenge Chinese designers. Though originally scheduled to be operational by 2008, in March 2007 entry into service was slipped into the middle of the next decade, likely delayed by both fiscal constraints and technical issues.[6] Without it, Chinese ability to lift payloads of 20+ tons, requisite for a space station, for example, is lacking.

The Chinese currently operate three launch sites. All recoverable satellites, including manned spacecraft, are launched from Jiquan Satellite launch Center in Gansu Province. Satellites headed for geostationary orbit are launched from Xichang Satellite Launch Center in Sichuan Province. Taiyuan Satellite Launch Center in Shanxi Province handles satellites bound for polar orbit. In 1999, China announced that it would build a spaceport on Hainan Island, though plans for such have been slow to mature.

Besides launch vehicles, China has indigenously developed numerous satellite programs, including the Dong Fang Hong (DFH) communications satellites. DFH-1, also known as Mao 1, was first launched in 1970 and is most notable for broadcasting the song "The East is Red" from orbit. Additionally, the Fanhui Shi Weixing (FSW) recoverable satellites were originally developed for photoreconnaissance, but now are also used for remote sensing. A third type of application satellite is the Feng Yun (FY) series, used for meteorology and remote sensing. The Chinese have also launched a series of Shi Jian satellites, carrying science or technology demonstration payloads. In March 2007, China announced its first blueprint for a space science program, including recoverable satellites for scientific experiments and joint science programs with Russia and France. While all are ostensibly for civilian purposes, the data derived and engineering experience gained from the programs will be – as it is in all countries – potentially useful to military programs as well.

[6] "Long March debut slips to middle of next decade", *Aerospace Daily & Defense Report,* March 12, 2007, p.2.

Clearly, China has developed wide-ranging satellite capabilities, often looking to cooperation for improvements.[7] China has worked with Germany on advancing the communications satellite technology. Indigenous Chinese Dong Fang Hong (DFH) communications satellites have gone through multiple iterations. The latest and most sophisticated DFH iteration, DFH-3, was cooperatively developed with Germany. It is three-axis stabilized, has 24 transponders for both telephone and television transmissions, and has an intended lifespan of eight years, twice that of the DHF-2.

The Ziyuan (ZY) satellite series is used for remote sensing and provides significant advances over the FSW series. ZY-1 was developed in conjunction with Brazil as the China-Brazil Earth Resource Satellite (CBERS). ZY-2, also known as Jianbian or Pathfinder, is an upgraded system believed specifically used for military intelligence.

China and Canada have had a relationship since the early 1990's focusing on radar satellites. In 1993, the Chinese Academy of Sciences first obtained the capacity to receive and process data from U.S., European, and Japanese Earth imaging satellites through a Canadian company. Then, Canada launched RADARSAT in November 1995, with sensors that can see through clouds and darkness. A civil satellite, it is used for flood monitoring, oil spill detection and many other applications. In 1996, a contract with Canadian company MacDonald, Dettwiler and Associates was signed to upgrade an existing ground station in China, to enable receive and process images of Earth from the RADARSAT satellite. The Canadian Space Agency played a key role in helping this project come to fruition through its government-to-government relationship with China.[8] Chinese access to RADARSAT data (as well as from other satellites) provides them with practical experience in analyzing and using satellite remote sensing data, data especially useful for monitoring naval activity.

Tsinghua University, one of China's leading technical universities, formed a cooperative research arrangement in 1998 with Surrey Space Centre, a company formed by the University of Surrey, a leading small satellite research facility. Small satellites are attractive investments for a variety of reasons. They are relatively cheap and easy to both build and launch. Universities have had a long established interest in small satellites as an affordable way to put student experiments into space. They also provide a foot-in-door to space, reflected by Surrey's client list included such countries as Algeria, Turkey, and Nigeria. As onboard sensor technology has matured, however, their attractiveness to organizations beyond those with scientific interests has grown as well. Microsats offer a potential range of capabilities of interest to both the civil and military communities, such as communications and reconnaissance.

---

[7] For an overview of capabilities, see: Joan Johnson-Freese, "China's Manned Space Program: Sun Tzu or Apollo Redux?", *Naval War College Review,* Summer 2003.

[8] Press release, MacDonald, Dettwiler, and Associates, Ltd., "MDA to Deliver RADARSAT Capacity to China", October 8, 1996.

The Tsinghua-Surrey partnership led to the successful launch of a microsat in May 2000 by China. Under a “Know-How Transfer and Training Agreement” Surrey built the Tsinghua-1 satellite to conduct communications research in low Earth orbit, as well as being a demonstrator for an eventual constellation of five Chinese microsats intended to provide global, high resolution imagery. As a result of that partnership, China has developed its own indigenous capability in small satellites. In April 2004, China launched two such indigenously developed small satellites, a 452 pound microsatellite, called “Experiment Satellite I,” and a 55 pound nanosatellite called “Nanosatellite I,” or Naxing-I. As the follow-on to Tsinghua-I, the Naxing-I is interesting as a totally Chinese effort with some sophisticated upgrades. In fact, it is currently the smallest satellite with three axis stabilization. Its purpose is stated as “high tech experiments.” Chinese interest in smallsats is further evidenced in the December 2004 creation of a National Engineering and Research Center for Small Satellites, toward development of large-scale production capability.

Navigation satellites are of the same dual use nature as remote sensing, with potential force enhancement applications ranging from improved situational awareness to weapons guidance. The Chinese have had a three-satellite regional navigation satellite system called Bei Dou in operation since 2003. China has also been a partner in the European Galileo global navigation satellite program since 2003, though issues regarding the degree of involvement that would be allowed, and program delays, led Beijing to decide to expand Bei Dou into a global program called Compass. Some European and U.S. analysts suspect that the decision to pursue the Compass project was actually made in the 1990s, and its implementation planned all along. China launched its fifth navigation satellite in April 2007 toward achieving global coverage.

China's Heavenly Ambitions

Manned Spaceflight[9]

In the United States the cost of manned spaceflight is considered to be approximately ten times that of unmanned spaceflight for a similar mission, due to safety considerations and life support systems required to man-rate the spacecraft. While that figure may not translate exactly in China, manned spaceflight is nevertheless considerably more expensive than unmanned spaceflight. But, as the saying goes, nobody holds a parade for robots. Manned spaceflight garners attention simply because people are interested in other people. The same week that China launched its first *taikonaut* into orbit in 2003, India launched its most sophisticated remote sensing satellite. Yet that accomplishment received minimal global attention compared to China's manned launch. Attention for a successful venture translates into prestige, with techno-nationalistic overtones. That is, it provides both a positive rallying event for the Chinese population as a whole, providing a sense of pride and achievement, with spillover externally in terms of technical achievements being equated to national power.

Quite simply, prestige, as part of a larger package of actions, can have geostrategic implications. For the past several years, China has embarked on somewhat of a charm campaign throughout Asia and other parts of the world as well. It has carefully and deliberately sought to transform its image from that of a bully to that of a partner, using very realist political means. Aid packages to Africa, trade and aid packages throughout Asia, inroads into South American countries, not altruistically, but for resources, have nevertheless woven China into the tapestry of the international community. Polls taken in 2005 are indicative of China's success. According to a Pew Research Center poll taken in April and May 2005, "China now has a better image than the U.S. in most European nations surveyed."[10] China's manned space program provides gloss to its positive image, especially in the developing world, which is in its benefit to perpetuate.

Manned spaceflight also pushes China up the technical learning curve very quickly. In a 2003 interview in *People's Daily*, Zhang Qingwei,

---

[9] For extended examinations of the Chinese manned space program, see: Joan Johnson-Freese, "China's Manned Space Program: Sun Tzu or Apollo Redux?" *op.cit.*; "Space Wei Qi: The Launch of Shenzhou V", *Naval War College Review*, Spring 2004.

[10] Pew Global Attitudes Project, *U.S. Image Up Slightly, But Still Negative: American Character Gets Mixed Reviews,* Washington, D.C.: Pew Global Attitudes Project, 2005.

Deputy Director of Project 921 and president of China Aerospace Corporation (CASC), stated that China had achieved breakthroughs in thirteen key technologies in conjunction with their first manned spaceflight, including reentry lift control of the manned spacecraft, emergency rescue, soft landing, malfunction diagnosis, module separation and heat prevention.[11]

Indirect benefits accrue as well, some even more important because of their broad spectrum of relevance and applications. These include basic computer upgrading, manufacturing technology, electronic equipment, systems integration and testing. Systems integration, along with spacecraft navigation and propulsion,[12] are particularly noteworthy. China, as well as many other Asian nations, has long experienced problems with systems integration. Development of an indigenous capability in that area would be a significant engineering step forward for China. That capability, with navigation and propulsion advancements, would be particularly useful for military space programs as well.

Officially, China has announced a three-step program for its manned program: launching *taikonauts* into space, accomplished with Shenzhou V and VI; a space laboratory, and eventually a space station. While there are also reports of Chinese intentions to land a man on the Moon, there have been no official announced plans in that regard. As recently as March 2007, Huang Chunping, chief vehicle designer for Project 921, predicted that China *would be able to* send taikonauts to the moon with 15 years. Key, however, was that he said success would depend on Beijing providing adequate funding and successful key precursor missions.[13] There have been other reports as well, including one in 2005 that garnered considerable publicity. Shortly after NASA announced it would put a man on the moon by 2018, Chinese space official Ouyang Ziyuan was quoted as saying "China will make a manned moon landing at the proper time, around 2017."[14] Ouyang Ziyuan is a key figure in the Chinese robotic lunar mission, Chang'e (which has no connection to the manned program). He was either misquoted – a problem prevalent in sorting through Chinese space intentions and discussed later, simply speaking in terms of desire rather than official intent, or perhaps just goading NASA. Nevertheless his statement was widely reported in the United States, bolstering the perception of a space race between the United States and China, with China winning. While U.S. technology and capabilities are significantly ahead of China's in all areas, lack of political will in the United States to support manned efforts to the level they need to be for milestones to be successfully reached allows for the misperception to be perpetuated.

---

[11] "Advantages of 'Shenzhou' spacecraft, 'Long March' Carrier Rocket", *People's Daily*, October 21, 2003.

[12] See the June 2000 issue of *Xiandai Bingqi*, the monthly journal of a military technology research institute, referenced in James Oberg, "China's Great Leap Upward", ScientificAmerican.com, www.sciam.com September 15, 2003.

[13] Reuters, "Moonshot possible in 15 years", March 6, 2007.

[14] Reuters, "China Eyes 2017 Moon Landing", November 4, 2005.

In the meantime, proceeding toward step two of the planned manned program will involve mastering new skills such as extra-vehicular activities (EVAs, or space walks) and docking procedures. China's first space walk is expected some time in 2008. With those capabilities mastered, the design of the Shenzhou vehicle allows for the forward module to be left in orbit independently for use as a small space laboratory, and later redocking with another Shenzhou. The third step of the plan, a space station, is – like other of the more ambitious aspects of the Chinese program – dependent on a new heavy-lift launch vehicle, the Long March 5, still in development.

Finally, it must also be mentioned that China has long coveted participation on the International Space Station (ISS) program. ISS represents a partnership among the "family of spacefaring nations" to which China dearly seeks acceptance. That status would confer Western legitimacy on the Chinese space program, and by association the Chinese Communist Party which runs the country and backed the program. The United States has long balked at including China in ISS. For many years the excuse was that China had neither the money nor the technology to be a partner. With the inclusion of Brazil in the ISS partnership, a country with far less money and technology than China, it became clear that politics was the real reason for keeping China at bay. The feelings of U.S. government officials such as California Congressman Dana Rohrabacher exemplify the issue. In 2001, for example, Rohrabacher acknowledged that China might have the resources to contribute to the station, but ruled out inclusion due to China's human rights record, saying: "The space station's supposed to stand for something better."[15] More recently, China's January 2007 ASAT test will likely preclude any consideration that might have been percolating for altering the U.S. stance.

Space Science

The centerpiece of China's space science program is the Chang'e robotic lunar exploration program. Ambitiously, a lunar fly-by is planned for the later half of 2007, a soft landing in 2012 and a lunar sample return mission in 2017. If all these missions are successful, they may well serve as technical precursors for a manned lunar program. It is important to note, however, that just as scientists in the United States were dubious about all the science and research money being funneled to Apollo in the 1960's, to the detriment of other scientific fields, so too are Chinese scientists – and some politicians – skeptical of the need for focusing too narrowly on the Moon as a goal. Further, and this is a point not widely appreciated outside of China, the Chang'e and Shenzhou programs are competitive, not cooperative, in terms of bureaucratic support and funding. China suffers many of the same maladies – e.g. competition for funding manned versus unmanned, scientific versus applications – that NASA and other Western space agencies suffer from.

[15] Quoted in Marc Selinger, "Rep. Rohrabacher sees Progress in Bid to Boost Foreign Role in ISS", *Aerospace Daily*, August 30, 2001, p. 3.

As previously mentioned, in March 2007, the Commission of Science, Technology and Industry for National Defense (COSTIND) announced China's first plan for space science development. Included in the plans is the country's first astronomy satellite, to carry a hard X-ray modulation telescope, to be launched in 2010. Additionally three international cooperative projects are to be implemented in the five-year period covered by the plan. Those include two missions with Russia, including an unmanned mission to Mars, and the Small Explorer for Solar Eruptions (SMESE) mission with France to observe solar flares and coronal mass ejections during the next Solar Maximum in about 2011.

The emphasis on international cooperation in these projects is not surprising. China understands the value of cooperation in the sense of both climbing the scientific and engineering learning curves faster in some instances, but also in maximizing resources and building soft power relationships with other countries. Not just in space science, but in all areas, China has reached out and been largely successful in establishing a network of space partnerships. China has worked extensively with Russia on its manned program, Europe on a variety of ventures, including communication satellite development, Canada on space science, and a number of developing countries as well. In fact, China would like to establish itself as the leader of the developing countries in space activity.

China has worked with Brazil on high-resolution electro-optical imaging satellites, but more recently has focused on the commercial potential of building and marketing communications satellites. In 2004, China landed the contract to build Nigeria's first communications satellite, NIGCOMSAT-1. "The successful delivery of NIGCOMSAT-1 will rank us among the very few in the world capable of providing a satellite manufacture, launch and servicing package," according to Wang Haibo, President of the China Great Wall Industry Corporation, adding that design and production of the satellite, its launch vehicle and ground stations were well on course. [16] NIGCOMSAT-1 was successfully launched in May 2007. Since U.S. export laws prohibit China from launching U.S. satellites and satellites using U.S. components, China's focus on package deals for developing countries makes sense. In 2005, an agreement was signed for China to build a satellite for Venezuela. The only country it has not been able to build a partnership with is the United States, primarily due to U.S. concerns about Chinese space intentions.

Military Space

Beyond all of the benefits of space activity already discussed, in the mid-1990's China also was developing a lucrative commercial launch business. China launched satellites for a number of Western nations, including the United States. It then suffered a series of catastrophic launch failures, most devastatingly the February 1996 loss of the Intelsat 708 satellite shortly after lift-off from China's Xichang launch site. That disaster triggered a series of events culminating in the United States with the 1999

[16] Zhao Huanzin, "China: Great Wall to Launch Satellite for Nigeria", July 1, 2005, http://naijanet.com/news/source/2005/jul/1/1005.html

House Select Committee on U.S. National Security and Military/Commercial Concerns with the People's Republic of China, dubbed the Cox Committee after its chair, Christopher Cox (R-Calif). As a result of the report of that Committee and consequent actions taken by the State Department to implement its recommendations, U.S. export controls laws on aerospace technology generally and satellite technology specifically were changed in ways that basically arrested the Chinese commercial launch sector.[17]

That report, which accused China of stealing space technology to improve its missile capabilities, was one of several U.S. actions noted by the Chinese and likely *influenced* Chinese military space plans. U.S. emphasis on space control and space dominance, to potentially include counterspace operations including space weapons,[18] and the Schreiver Space War Games between 2001-2005 were others. In the first of those well-publicized war games, the scenario involved a large land opponent threatening a small island neighbor, *à la* Taiwan. It didn't take long for China to conclude that it could be the target of U.S. space weapons. Nevertheless, China has its own reasons for developing a military space capability and is not simply reacting to the United States. U.S. actions are, however, influential when choices are made of where to focus limited resources.

Just as is the case with European countries, Japan, India, Pakistan, Russia and others, China intends to develop space-based force enhancement capabilities as part of its military modernization efforts. Like most countries and militaries of the world, China recognized the advantages space yielded to the United States during the Gulf War in 1990-91.[19] Chinese warfighting doctrine has shifted in recent years away from large battles fought with large platforms, to smaller, high-tech wars – similar to U.S. doctrinal shifts where information is critical.[20] China has no illusions that it can dominate in space, or even reach parity with the United States. It doesn't feel it needs to. It needs only to develop capabilities to retain its

---

[17] See: Joan Johnson-Freese, "Becoming Chinese: Or, How U.S. Satellite Export Policy Threatens National Security", *Space Times*, January-February 2001, and "Alice in Licenseland: U.S. Satellite Export Controls Since 1990", *Space Policy*, vol. 16, no. 3 (2000): p. 195-204.

[18] See: Air Force Doctrine Document 2-2.1, *Counterspace Operations*, issued August 2004.

[19] Phillip Saunders, Jin-dong Yuan, Stephanie Lieggi, Angela Deters, "China's Space Capabilities and the Logic of Anti-Satellite Weapons, CNS Research Story of the Week, July 22, 2002, http://cns.miis.edu/pubs/week/020722.htm

[20] While the emphasis on high-tech warfare in the U.S. military has been largely considered part of former Defense Secretary Donald Rumsfeld's "transformation" efforts, the shift is actually part of larger, more widely supported effort to move to capabilities-based joint force planning rather than platform, service-specific force planning, *and in recognition of the the prominent role of information technology in force planning*. Those changes have not abated with Rumsfeld's departure from the Pentagon. While the relevance is not apparent in Iraq, the Pentagon remains convinced it is the way of the future, as reflected in the latest Quadrennial Defense Review (QDR). Mark Mazzetti, "Pentagon Planning Document Leaves Iraq Out of Equation", *Los Angeles Times*, January 24, 2006.

sovereignty and freedom of action on issues of critical national interest, such as Taiwan, if China faced the advantages the United States has because of its space assets.

Let's be clear: Chinese military strategy, planning and capability development is, first and foremost, about Taiwan. If China felt it had to hold Taiwan by force and assumed that the United States would intervene on behalf of Taiwan, China's best option might be to hold the United States at bay for some minimal amount of time, 48 hours for example, to pressure Taiwan into acquiescence. Because the United States military is so dependent on space systems for virtually all activity, being able to disrupt or disable those systems might buy China the time it feels it needs to bring Taiwan back into the fold. While there are a number of scenarios about how China might approach a crisis with Taiwan that do not heavily rely on either space system usage on their part or disruption of U.S. space systems, such as a submarine blockade, the Chinese are acutely aware of U.S. space dependence as a potential Achilles' heel. Disrupting or denying the U.S. military use of its space systems exploits the asymmetrical balance of military power between the U.S. and China in China's favor. It also "fits" with Chinese military doctrine which emphasizing the importance of securing information dominance and the use of "soft kill" rather than "hard-kill" space systems – those that interfere with satellites and their transmissions. The Chinese recognize, as does much of the world, that it is futile to take on the U.S. military directly, and therefore seeks all ways it can to find an asymmetric advantage.

Of the four military space missions defined in the United States, space support (e.g. launch and satellite maintenance); force enhancement (capabilities to increase the advantages of the warfighter, such as precision guided munitions and C4); space control (the ability to use space when needed and deny to the adversary); and force application (space weapons), China is clearly focusing for the present on the first two.

Officially, China launched two military satellites in 2006: the Yaogan 1 imaging-radar satellite and the Zhongxing-22A telecom satellite. However, dual-use technology makes it impossible to neatly present information on Chinese military space assets. For example, in September 2006, China launched a communications satellite designated ChinaSat 22, officially owned by the China Telecommunications Broadcast Satellite. It is, however, widely believed to be controlled by the People Liberation Army (PLA), under the name Feng Huo-2 and part of a data relay satellite system known as the Qu Dian; part of a C4I system that allows theater commanders to communicate with other forces. Sinosat 2, a direct broadcast satellite and intended as the first operational use of China's newest DFH-4 spacecraft bus, was also launched in 2006. Although again designated for civilian purposes, it was important to the military as it could have been adapted for military purposes to distribute information on the battlefield. It is also important to note that, overall, use of commercial communications satellites by militaries worldwide – including, and most of all, in the United States – has been on the increase, diminishing the relevance of military/civilian distinctions between communication satellites.

China also launched an ostensibly civilian remote sensing satellite, called Remote Sensing Satellite-1, in April 2006. However, the satellite also has a military designation, JianBing-5, and development is believed to have been fully funded by the PLA. JianBing-5 is believed to be China's first space-based synthetic aperture radar (SAR) system, important to the PLA as it can "see" through clouds and smog, as well as detect objects underwater or underground. Being able to "see" underwater provides important information to Beijing as part of its efforts to expand and enhance Chinese naval capabilities.

Other Chinese programs of note in the area of satellite reconnaissance include the already-cited China-Brazil Earth Resources Satellite (CBERS) program with the CBERS-1 and CBERS-2 remote sensing satellites. These satellites are capable of taking 66-foot (20-meter) resolution images in swaths exceeding 62 miles (100 kilometers), and transmit those digital images to earth stations. Three more satellites are planned, with increasing camera resolution capabilities.

China has also expressed interest in a disaster/environmental monitoring satellite constellation called Huanjing. A two phase program, phase one calls for three satellites, two with sensors visible, infrared, and multi-spectral imaging, and the third a synthetic aperture radar (SAR) satellite. Phase two of the Huanjing initiative calls for eight satellites: four imaging and four SAR in orbit simultaneously. According to the May 2006 report *Military Power of the People's Republic of China: A Report to Congress,* issued by the U.S. Office of the Secretary of Defense, "In the next decade, Beijing most likely will field radar, ocean surveillance, and high-resolution photoreconnaissance satellites. China will eventually deploy advanced imagery, reconnaissance, and Earth resource systems with military applications."[21] In the meantime, China can supplement is coverage through commercial satellite systems such as SPOT (French), Landsat (U.S.), Radarsat (Canada) and from the Ikonos (U.S.) high resolution satellite. China is also believed to buy considerable imagery from Russia.

China also benefits from the technical and experience gained through its manned activities. Beyond those areas already cited, upgrades to the Jiquan launch site and its entire space tracking system certainly benefit military efforts. For Shenzhou V, there were four upgraded tracking ships in the Pacific, Indian and southern Atlantic oceans, and a ground station in Namibia, to follow the spacecraft. Other military satellite programs also use these assets, including those associated with ASATS, though they are still Spartan by U.S. standards, and lacking in such areas as a tracking system with global reach, and vulnerable infrastructure.[22] China does not have space-based missile launch warning assets either; nothing even

[21] http://www.cfr.org/publication/10767/annual_report_to_congress.html

[22] See: Phillip Saunders, Jing-dong Yuan, Stephanie Lieggi, and Angela Deters, "China's Space Capabilities and the Strategic Logic of Anti-Satellite Weapons", Center for Nonproliferation Studies, Monterey Institute for International Studies, July 22, 2002, http://cns.miis.edu/pubs/week/020722.htm

remotely equivalent to the U.S. Defense Satellite Program (DSP).[23] All of these "need" areas are on their menu for consideration though, within very tight budget parameters. The military does, however, benefit from their manned program in terms of experience in areas such as in-orbit maneuvering, mission management, launch on demand, miniaturization, and computational analysis.

While Chinese anti-satellite (ASAT) activities were ambiguous until recently, as they remain in the United States, with China's successful January 2007 test of a ground-launched hard-kill system, China's active capability for a Low-Earth Orbit destruction became clear in a most reckless and fool-hearty manner. Some technical experts feel "the weapons system was used against a satellite that was much harder to hit than more strategically important satellites such as communications and early warning satellites in geostationary orbits."[24] Previously a leading advocate, with Russia, for a treaty banning space weapons, China's enigmatic move raised questions worldwide about motivations, and protests about the space debris issue that it created, putting numerous satellites – and potentially the International Space Station – at potential risk for years to come. It also froze if not invalidated recent steps toward cooperation with the United States, initiated consequent to NASA Administrator Mike Griffin's trip to China in September 2006.

The technology used by China was strikingly similar to U.S. missile defense technology. The kinetic kill vehicle (KKV) was likely boosted on a two-stage DF-21 type launcher. Reportedly, there were several prior tests of the system. It is now believed that the direct-ascent program is part of a larger Chinese ASAT program, including ground-based lasers and jamming of satellite signals. That China was virtually silent on the test for 12 days afterward, uncoordinated messages (including a denial by the military) indicates, at best, a lack of clear communications strategy and likely a larger lack of internal coordination about the test. It is not unlikely that compartmentalization within Chinese institutions and bureaucracies, still rampant, played a part in the debacle as well, leaving the Foreign Ministry to twist in the wind when international protests began pouring in.

China's motivations for testing the system were likely multifaceted, including technical and political objectives. If a country is developing a capability, sooner or later it must be tested or it has little value. Also, the timing indicates that China likely wanted to demonstrate to the United States that dominating space through technology was not going to be as easy as implied in the new September 2006 U.S. National Space Policy (NSP). That policy, widely seen as taking the United States down a more militaristic and nationalistic path in space than previous policies, perhaps most dangerously implied that the U.S. could protect space assets exclusively with technology, a position that the Chinese ASAT test draws

[23] For a discussion on the link between U.S. space and nuclear policy, see: Joan Johnson-Freese and Thomas M. Nichols, "Space Security & the New Nuclear Triad", *The Brown Journal of World Affairs,* Winter/Spring 2007.

[24] Geoffrey Forden, "Evaluation of the Chinese ASAT Test", *Janes Intelligence Review*, March 2007.

into question.[25] Similarly, the United States government has strongly stated that there is no space arms race nor is one brewing. Here as well, the Chinese ASAT test suggests otherwise. China may also have been trying to establish itself as a space power worthy of attention from the United States, toward persuading the United States to negotiate a space arms control agreement. If that was the intent, Chinese actions will, in the short-term at least, likely backfire. Those who had been supporting the position that space arms control and cooperation with China were in the best interests of the United States have been overwhelmed by those advocating increased funding for technology programs and not working with China.[26] The latter position will likely be maintained as long as advocacy for missile defense drives U.S. space policy, and that is purely political since missile defense has been a Republican quest since the Reagan Administration.

All that being said, it is still far more likely that China will focus its efforts on force enhancement capabilities than space control or force applications. It will do what it feels it must to thwart U.S. plans for space dominance, but likely only that much. It clearly has no budget for the kinds of gee-whiz space weapons of the sort the United States seems intent on developing. Even within the area of force enhancement, China does not have the resources to commit to the multitude of space activities that the United States already has, nor is it likely sure it wants to. While Chinese military modernization efforts emphasize the importance of "information" in future conflicts, China understands that, as the Chinese military increasingly relies on space assets, it will become as vulnerable to the threat of ASAT as is the United States now. China has observed not only the advantages that space affords the United States, but also the dependence it creates.[27] "China is starting a large modernization and expansion of its military and it might be waiting to see if it should invest in space-centered weapons systems – as the U.S. has done with its emphasis on GPS guided munitions and high-bandwidth battlefield communications – or whether those will prove to be too valuable to anti-satellite weapons before committing a large portion of its military budget to them."[28] Because their telemetry, tracking and command capabilities are still rudimentary in many areas and need both expansion and upgrading as part of modernization efforts, China must pick and choose where to focus carefully.

[25] Joan Johnson-Freese, "The New U.S. Space Policy: A Turn Toward Militacy?" *Issues in Science & Technology,* 23, no. 2 (2007): 33-36.

[26] See, for example: Senator Jon Kyl, "China's Anti-Satellite Weapons and American National Security", Heritage Lecture #990, Delivered January 29, 2007, posted February 1, 2007, http://www.heritage.org/Research/NationalSecurity/hl990.cfm

[27] Peter Brookes, "China's Space-Attack Test", The Heritage Foundation, January 22, 2007, http://www.heritage.org/Press/Commentary/ed012207a.cfm

[28] Geoffrey Forden, March 2007.

Conclusion: Future Challenges

As stated at the beginning of this paper, disagreements among Western analysts on *what* space capabilities China has or is developing are far less than disagreements about *why*. Part of the problem is cultural. The Chinese, like many Asians, see information as a commodity to be shared sparingly. They simply do not willingly, indeed eagerly, share information with others on all topics as is the propensity in the West. Beyond that cultural trait, information about space falls into the security realm, bringing it into the purview of laws protecting state secrets. Because what is and what is not protected is not always clear, "better to be safe than sorry" is the general rule. Add to that a heavy dose of bureaucratic compartmentalization within the Chinese government system resulting in one hand not knowing what the other is doing – glaring evident after the January 2007 ASAT test – and complaints about a lack of transparency from China ring true.

The Chinese did realize that if they wanted favorable global publicity about the Shenzhou manned missions they had to be more forthright about their program and plans, and allow press access. With each mission, they got better about allowing press to cover the events. Old habits die hard though, and even during NASA Administrator Mike Griffin's trip to China in 2006, there were problems. Griffin and his party were to visit the Jiquan launch site. At the last minute they were told that they would be allowed to go, but basically only get a bus tour of the facilities. The party declined, deciding that the trade-off between the time it would take to get to the Gobi desert site versus what they would see would not make the time spent worth it. Griffin was gracious in his press conference comments about the cancellation of that part of the itinerary, noting the launch site is a military facility and that as a NASA delegation they could only accept invitations offered,[29] but it was clear something had gone amiss. Likely one bureaucracy, including the military, was not talking to the other.

After the 2007 ASAT test and the worldwide condemnation that followed, China reacted badly. Not only was it not forthcoming with an explanation, but subsequently it seems to have taken a step back in terms of transparency and acting as a responsible member of the family of space-faring nations. China cancelled the 25th meeting of the Inter-Agency Space Debris Coordination (IADC) Committee meeting scheduled for April 2007, only weeks – days – before it was scheduled to begin. Apparently, the

[29] TRANSCRIPT: NASA Administrator Michael Griffin, Press Conference, Shanghai, China, 9-27-2006. Available at: www.nasa.gov/pdf/159546main_Griffin_Shanghai_China_060927.pdf

Chinese were concerned that the meeting would turn into a forum to criticize China for its ASAT test and the debris created. Delegates had, however, already purchased tickets and made reservations and China provided no good explanation for the cancellation. These are the kinds of actions that make other countries questions China's willingness and ability to act – even on simple matters – as a responsible member of the international community.

A problem that seems to be gaining both increasing awareness and increasing frequency is that of miscommunication, either deliberate or unintentional. First, there is an increasing number of publications and information sources coming out of China now than in the past, when everything could be assumed state approved. That being the case, there is increasing instances of documents or information sources being misinterpreted as indicating government views, when they did not, and with mistranslations that conferred very different meanings to communications than perhaps intended. Gregory Kulacki and David Wright at the Union of Concerned Scientists in the United States have made it a point of trying to correct some of the more egregious wrongs,[30] but errors seem to just keep coming. More disturbingly, these miscommunications seem to be used by the U.S. government in their analyses both of China's capabilities and their intentions. World Security Institute China Program Director Eric Hagt, speaking before the U.S.-China Economic and Security Review Commission on March 30, 2007, raised that point in his testimony, stating the danger. "Misinterpretation based on problematic analysis and translation could lead to a worsening of U.S. security in space through misjudgment and overreaction." [31]

There is a reciprocal problem on the Chinese side as well. While the difference between a government policy statement, an opinion voiced in *The New York Times*, and a blog article may be apparent to Americans, as the difference between a government statement, a *Le Monde* article, and a blogger's opinion would be in France, the Chinese can have difficulty determining the credibility of sources in the West. This entire issue is exacerbated by the deluge of information, good and bad, available on the web. All parties must get better at sharing and interpreting information. To do that, communication of all sorts – but particularly in person, where questions can be asked – must be encouraged.

While contacts and connections between China and much of the rest of the world have steadily increased over the past ten years, the same has not been true with the United States, where it is most needed if a

[30] Gregory Kulacki, "Lost in Translation", *Bulletin of the Atomic Scientists*, May-June 2006; Gregory Kulacki and David Wright, "New Questions About U.S. Intelligence on China", http://www.ucsusa.org/global_security/china/new-questions-about-us-intelligence-on-china.html; Gregory Kulacki and David Wright, A Military Intelligence Failure: The Case of the Parasite Satellite", http://www.ucsusa.org/global_security/china/a-military-intelligence-failure-the-chinese-parasite-satellite.html

[31] http://www.uscc.gov/hearings/2007hearings/written_testimonies/07_03_29_30wrts/07_03_29_30_hagt_statement.php

security dilemma is to be avoided in the future. Without a clear understanding of what others intend, actions can be taken not ultimately in anyone's best interests. It can be expected that China will pursue a wide range of space activities, what that means to other countries, particularly the United States, can best be determined through increased direct communication. Admiral William Fallon, speaking in March 2007 about the Chinese ASAT test, stated that China, as a sovereign nation, will sometimes take military measures that others won't like. "A nation is going to do what they think they need to do."[32] USSTRATCOM Commander General James Cartwright had voiced similar comments in testimony before the House of Representatives earlier in the month.

The Chinese ASAT test in January 2007 did not change the geostrategic balance in Asia or globally, or challenge U.S. space superiority. But it did demonstrate both the offensive-defensive range of missile technology, and the limits of that technology. China has long been an advocate of space arms control within the context of Prevention of an Arms Race in Space (PAROS) discussions at the United Nations. China, with Russia, has repeatedly called for a treaty banning space weapons and garnered significant support from other countries, while for the first time in 2005 the United States voted against, rather than abstaining, such a treaty. China's supportive attitude regarding space arms control is clearly more pragmatic than altruistic. If the United States cannot develop space weapons, then China does not have to spend its limited resources to counter them. Concern in the United States is that China would take advantage of a slowing in U.S. research and development (R&D) efforts to catch up technologically. However, while the United States could likely not test technology subsequent to a space arms control agreement, it is doubtful that R&D would cease.

China should be encouraged to denounce further ASAT tests. Because of the difficulties in trying to ban dual-use technologies or even limit its uses, the United States has shunned interest in space arms control. Using the debris issue that drew international outcry after China's ASAT test as a rallying point, however, an agreement outlawing the deliberate creation of space debris might be both useful and possible. This is an area where the United States would do well to reconsider its position, toward including arms control in its mix of space control efforts, rather than relying exclusively on technological "fixes." An international Code of Conduct should also be considered, giving space parameters for acceptable behavior much as is the case on the high seas.[33]

Finally, the best hope for integrating China into nations seeking to promote space for peaceful purposes, is to include China in international partnerships to support the peaceful uses of space. Space is a high cost venture and China's funds are limited. Encouraging China to participate in

[32] "Fallon: U.S. Shouldn't Be Shocked at Chinese Anti-Satellite Test", *Inside the Pentagon*, March 22, 2007, p. 1.

[33] The Stimson Center in the United States ahs been among those groups active in promoting such a Code of Conduct. See: http://www.stimson.org/space/?SN=WS200702131213

programs of our choice, in areas such as environmental monitoring and space science, is a better option than allowing China to focus on perceived threats to which it feels it must respond. While the risk of technology transfer will always be present, at least it will be under U.S. control rather than outside our sphere. Without a monopoly on a particular technology, its spread cannot be stopped, but at best managed. The United States does not have a monopoly on the technology China seeks, and is largely able to obtain elsewhere.

In a globalized world – and China is increasingly integrated to the rest of the world economically – countries which are connected with other countries will find it in their own best interests to maintain the system rather than perturb it. Europe is far ahead of the United States in understanding and implementing this premise. While care must be given to how and how fast China is integrated in areas involving dual use technology, it can be done, and will ultimately increase the security of all.