China's Space Technology:
International Dynamics and Implications for the United States

Testimony of

Dr. James Clay Moltz
Naval Postgraduate School

For the hearing of the U.S.-China Economic and Security Review Commission on:

"The Implications of China's Military and Civil Space Programs"

U.S. Capitol Building
Wednesday, May 11, 2011

I thank the commissioners for the invitation to speak to you today on the topic of China's space technology and how its behavior in the civil space sector affects the United States. I want to emphasize that my remarks today are my personal views, and not official statements of the U.S. Navy or the Department of Defense.

China has emerged as a major spacefaring nation in the past decade after more than fifty years of effort and many setbacks. Today, it has Asia's second largest space budget (estimated at $2.24 billion) after Japan ($3.83 billion), but is narrowing the gap. It conducted as many launches (15) as the United States in 2010, second only to Russia.

Understanding China's space program and moving the U.S.-Chinese space relationship in a more favorable direction is critical to furthering U.S. interests in space. It is also essential for promoting the broader conditions of safety and stability in the orbital environment that are needed for the successful development and use of U.S. scientific, commercial, and military space assets.

In the emerging post-Cold War space environment, Asian countries—among them China, India, and Japan—have played an increasingly prominent role. The motives of these countries to date have been different from than those of the superpowers, putting a greater emphasis on domestic economic goals, regional competition, and international prestige, as compared to more limited geo-strategic military aims. China's 2006 White Paper on space listed the goal to "build up the comprehensive national strength" as one of the country's core rationales for space activity. Thus, while China has significant military aims in space, it also has important civil space purposes that are often underappreciated. Given the waning relevance of Communist Party doctrine to Chinese reality, the government is using civil space activities to promote its legitimacy in the eyes of its people.

As "second-generation" space actors, Asian space programs have also differed in their development from the superpowers' space programs in the much larger degree of international cooperation involved in their formation: including purchases of technology and joint activities with outside partners. U.S.-Soviet space technological developments, by contrast, took place much more autonomously. Space cooperation by Asian countries with other programs has been extensive and consistent, as states have reached out to foreign partners and have attempted to carry out typical late-developing "import substitution" strategies seen in other industrial fields (such as shipbuilding, electronics, and automobiles). Unlike during the Cold War, space technology is now widely available on the international market due to forces of globalization and the presence of advanced producers (Russia, France, Britain, Italy, Israel, and others) willing to sell. On the other side of the equation, China is now exporting space technology and serving as a trainer for developing countries interested in space. In fact, China has set up specific organizations to facilitate its cooperation with other space programs both within Asia and beyond. China wants to be perceived as a space leader and to build lasting relationships with developing countries.

For these reasons, viewing China's space program solely from the perspective of its military activities is misleading. While China is active in the military sector and is seeking to check current U.S. advantages in this area, China's challenge to the United States in space may eventually be equally significant in the *civil* space sector, where China's expanding infrastructure, growing cadre of space scientists and engineers, and active international outreach puts it in a favorable position for long-term competition. But China still lags behind the United States and suffers from some serious, structural weaknesses in regard to space: bureaucratic overhang, a lack of capable space allies, and tepid receptivity to its efforts at international leadership. Unfortunately, the United States has failed to exercise its advantages in some of these fields. The international space environment is changing, yet Washington has too often fallen back into Cold War patterns, which are ineffectual in the today's expanded space marketplace. The new National Space Policy and National Security Space Strategy have outlined important new directions, but specific steps are now needed to implement them in regard to China and, as importantly, with U.S. allies and friends in the region. Such combined policies would assist in the development of U.S. markets and increase U.S. space security.

My testimony examines how China reached to its current position in space, how it is currently organized for space technology cooperation, and how smarter U.S. policies of both competition and cooperation could better serve U.S. interests.

China's Early Space History

China's space program was founded in the mid-1950s thanks in part to a U.S. decision to expel Cal Tech-trained missile engineer Dr. Qian Xuesen in 1955 over suspicions of communist leanings. (U.S. Secretary of the Navy [1951-53] Dan Kimball called his expulsion: "the stupidest thing this country ever did.") But China's initial progress in the late 1950s suffered from the loss of Soviet technical help in 1960. Then, Mao Zedong's Cultural Revolution in the mid-1960s led to drastic cuts in its activities and personnel.

But China's continuing efforts in the missile delivery field allowed it to launch its first satellite in 1970. Political turmoil set the program back again subsequently, and only in the late 1970s under Deng Xiaoping did the space program began to gain a more stable footing. Deng linked space technology development to the broader process of Chinese economic reform, while freeing Chinese scientists and engineers to work with foreign governments and experts.

Following Nixon's visit to China in 1971 and trips by various U.S. scientific delegations to China as part of efforts to normalize relations, the two sides reached a 1978 pact called for U.S. assistance in installing a Landsat ground station and developing a civil communications and broadcast system for China through the purchase of a U.S. satellite, which would be launched by NASA but operated afterwards by the Chinese. While Premier Deng Xiaoping visited the Johnson Space Center in Houston in 1979, the agreement to acquire a U.S. communications satellite failed to materialize due to its high cost for China.

During the 1978-85 period, space became part of a national science and technology plan. China listed the following priorities for the period: satellites for remote sensing, ground stations, space science research, "skylabs," and new launch vehicles. Although China failed to achieve some of these goals, the government showed a new commitment to space. A front organization called the Ministry of the Space Industry offered a new pubic face for the space program in 1982, although its enterprises remained under the military.

Given shared perceptions of the Soviet military threat, the United States and China began to cooperate more extensively after the election of Ronald Reagan. Ties began to be forged in the area of commercial space, as China sought to enter the international launch services market. President Reagan even offered a slot on a future U.S. shuttle flight to a Chinese astronaut. While the manned mission never occurred (in part due to the *Challenger* disaster in 1986), cooperative scientific exchanges came to fruition when the United States flew two Chinese experiments aboard a U.S. space shuttle mission in 1992.

China rented transponders on French and West German satellites for communications purposes before achieving its first successful satellite insertion to geostationary orbit in April 1984. Its first fully functional communications satellite reached orbit and began operation in February 1986.

After twelve successful flights of its Long March booster, the Chinese government tasked the Great Wall Industry Corporation (GWIC) in 1985 with marketing the launcher's services abroad. President Reagan agreed in 1988 to allow U.S.-made satellites to be launched on Chinese rockets, but the deal required China to sign liability and technological safeguards agreements and agree to a limited quota. The two sides also established yearly government-to-government meetings to review their progress and discuss any problems. China had already joined the Outer Space Treaty in 1983, and it now moved forward with ratification of both the Convention on International Liability for Damage Caused by Space Objects and the U.N. Spacecraft Registration Convention in

December 1988. These steps marked a major step forward in China's integration into the world space community and its growing acceptance of international norms.

Meanwhile, China continued to develop its own satellite program—launching nine satellites from 1975 to 1987 and working on technologies associated with reentry and recovery of spacecraft. These missions helped China gradually expand its capabilities and put it on the verge of research into human spaceflight. To acquire technology and build its capabilities, China also cooperated with the European Space Agency (ESA) beginning in the late 1980s in both space science and in commercial applications. China's *Fanhui Shi Weixing-9* satellite in 1987 carried two payloads for a French company, representing one of China's first commercial contracts. China also experimented with photographic remote-sensing, returning wide angle images from film de-orbited to Earth suitable for basic land use and navigational surveys, but far from military standards. China eventually worked with Brazil to develop a higher-resolution Earth resources satellite (*Ziyuan-1*) in the late 1990s capable of digital transmissions, but it still faced considerable limitations.

By the late 1980s, GWIC had opened several offices in the United States and landed its first two contracts, both from the Hughes Corporation. Despite the political problems in U.S.-Chinese relations caused by the crackdown at Tiananmen Square in 1989, President George H. W. Bush waived economic sanctions to allow the launches to proceed due to the interests of the U.S. companies in the launches. Other U.S. corporations seeking to benefit from the Long March's low price and growing record for reliability included: Loral, Martin Marietta, Intelsat, and Echostar. China eventually launched 26 U.S. satellites in the years before 1998.

China's Rise to Space Prominence

Following the normalization of Sino-Soviet ties in 1989 after decades of bilateral hostility, China also purchased significant amounts of technology from the Soviet/Russian space program. Minister of National Defense Chi Haotian traveled to the Russia's Star City space-training facility in 1993, leading to an official bilateral space agreement in 1994. A large Chinese space delegation visited the following year. The Chinese purchased a spacesuit, a complete Soyuz capsule, docking equipment, life support system, and a variety of other hardware and design information to guide their planned human spaceflight program. Chinese delegations returned in 1996 and 1997, gathering more information on cosmonaut training techniques and space medicine. This Russian equipment and know-how proved critical to the eventual Shenzhou program.

In order to facilitate its increasing cooperation with other countries in space, China created the China National Space Administration (CNSA) in 1993. But while CNSA was portrayed by as a NASA equivalent, the bulk of China's space research, production, and operational functions remained within the defense industry. As part of its move to give industry more autonomy from the military, however, China eventually created the Chinese Aerospace Science and Technology Corporation (CASC) in 1999 from a prior industrial organization, bringing together some 300 research and production complexes under nominal civilian control (including those responsible for human spaceflight), as well as organizations like GWIC. The other major industrial actor is now the China Aerospace Science and Industry Corporation (CASIC), which shares an emphasis on rockets but also produces satellites and information technology for the military and civilian sectors.

By the mid-1990s, China had made significant progress in space applications. Beijing reported that communications satellites now reached 83 percent of China's population offering broadcasts, telephone communications to remote areas, data transfers (including printing national newspapers remotely), and educational services.

From 1992-96 China, however, suffered four Long March launch failures. Some crashed near the launch site, causing significant human casualties (many of them covered up), while others failed to deploy satellites into their proper orbits. The U.S. company Loral lost a satellite and Hughes had a satellite delivered to a useless orbit. Communications between the two companies and the Chinese breached U.S. export control regulations, causing the two to be fined. In 1999, the congressionally mandated Cox Commission concluded that the Chinese military had gained technology relevant to nuclear delivery systems from these meetings, although critics doubted these charges. But the result was a U.S. decision to re-categorize all space technology as munitions items under the International Traffic in Arms Regulations (ITAR). The new guidelines halted U.S. space cooperation with China.

Beijing continued to work with other countries to acquire technology and know-how and to promote its space interests. In terms of technology development, China engaged in ongoing cooperation with Brazil, France, Russia, Ukraine, Germany, and the United Kingdom on collaborative missions, commercial purchases, or actual joint development of spacecraft.

The growth of China's space market and the imposition of the U.S. ban caused major European satellite firms to increase their technological independence from the United States in order *not* to have their satellite sales limited by U.S. export control rules. The decision by the private French company Eutelsat Communications Group in 2008 to purchase insurance for up to nine satellites for future "ITAR-free" launches on Chinese rockets marked the effectual end of U.S. success in isolating China.

Other areas of European cooperation with China included joint scientific work between CNSA and the European Space Agency (ESA) from 2001-04 on the Sun's effects on the Earth's environment in the so-called Double Star program, one of the first significant operational missions CNSA conducted with a major foreign space agency.

Recent Civil Space Activity and Plans

For political reasons, China has invested heavily in human spaceflight. It launched its first taikonaut successfully on *Shenzhou V* in October 2003 and has since followed with a two-man flight in October 2005 on *Shenzhou VI* and then a three-man flight with a spacewalk on *Shenzhou VII* in October 2008. Chinese television proudly broadcast the 2008 mission and its spacewalk. The flight also involved the release of a 40-kilogram picosat (*BanXing* [or *BX*]-*1*), which took pictures of the *Shenzhou VII*.

In space science, China's first high-prestige mission came in the form of the *Chang'e 1* lunar probe, which orbited the Moon from 2008 to early 2009, mapping the lunar surface and analyzing the lunar environment. China continues to contract with Russian space enterprises for their expertise in instrumentation, equipment, and control systems for major space missions. In 2006, Russian Space Agency Deputy Director Yuri Nosenko reported that China signed contracts with Russian space enterprises worth tens of millions of dollars. The two sides have announced plans to cooperate on lunar- and Mars-related robotic exploration, including with automated rovers.

China's priorities for the coming five years in space applications, include development of higher-resolution remote-sensing satellites and related ground stations, implementation of its Beidou precision navigational system, completion of the mission of its second lunar orbiter (*Chang'e 2*) launched in October 2010, conduct of a lunar mission and a later sample-return mission in 2017 to 2020, and development of a series of three small space laboratories (called *Tiangong-1*, *-2*, and *-3*) in the coming decade. Further ahead, China has announced plans for a 60-ton space station to be launched by 2020. Some officials have mentioned a possible 2024 Moon mission as well.

China's International Outreach in Space

China has also used space to pursue its foreign policy goals. In 1992, it founded the Asia-Pacific Multilateral Cooperation in Space Technology and Applications (AP-MCSTA). This group, which included Pakistan, Thailand, and a number of other developing countries, eventually began cooperating in several areas, including in the joint development of satellites based on Chinese technology. In 2008, China led a subset of this group to establish the Asia-Pacific Space Cooperation Organization (APSCO)—a formal, membership-only group modeled on ESA. The APSCO organization now includes seven dues-paying members: China, Bangladesh, Iran, Mongolia, Pakistan, Peru, and Thailand. China has high hopes for APSCO, but it has yet to attract more accomplished space powers to the group. APSCO engages in joint research and data-exchange efforts, as well as formal training courses for scientists and engineers from the Asian-Pacific region in space technology and remote sensing.

Through these efforts, China has been able to portray itself as a "purveyor" of space know-how and technology to lesser-developed states in Asia and elsewhere. One target of interest has been Indonesia, which recently received satellite ground stations and communications equipment from China, as well as visit by Chinese taikonauts.

In recent years, China has also begun to engage in considerable commercial space *exports*. It has sold satellite laser-ranging equipment to Argentina and ground stations and satellites to Venezuela, Pakistan, and Nigeria, among others. While China's space enterprises are seeking profits abroad, China also uses space exports for political purposes. Its space deals with Nigeria and Venezuela, for example, were motivated by Chinese interests in long-term energy security. In both cases, these deals for Chinese-built and launched geostationary communications satellites were officially commercial, but on very favorable credit terms to the purchasing countries, with China providing some costs and offering low- or zero-interest rates on its loans. China also provided technical training to each country's space scientists, as well as building ground stations on their territories. This strategy offers political benefits but imposes costs on the Chinese government and the space industry. Looking ahead, China has contracted with Laos to build and launch *Laosat-1* and with Bolivia for the *Tupac Katari* communications satellite.

Another example of China's use of space to promote its political interests is the country's history since the mid-1990s of contracting with Intelsat to make direct-to-home broadcasts of China Central Television available in approximately 100 countries.

Chinese Space Problems

But China's recent rise in space does not guarantee its success. China remains behind world standards in a number of critical space technologies, raising questions among partner nations in terms of the quality of its spacecraft. Despite Thailand's membership in APSCO, for example, Bangkok turned to a European consortium to purchase its *Thailand Earth Observation Satellite* (*THEOS*), whose remote-sensing technology is more sophisticated than China's. Similarly, China had technical problems with its *Nigcomsat-1* due to a faulty solar array, causing the spacecraft to cease functioning in 2008. Beijing has had to offer a replacement satellite.

Another problem that China may face in the future relates to its state-run model of organization. With the steady expansion of private entrepreneurship in global space activities, it remains to be seen whether the Chinese state is flexible enough to thrive in the next stage of international space competition. A 2010 study by China expert Eric Hagt for the U.S. Army War College, for example, described China's space industry as "dispersed, bloated, and located in geographically isolated regions." The sector has also had to deal with a series of reforms as Chinese authorities have sought to inject greater civilian management and innovation into hide-bound defense industries. With this in mind, the Chinese State Council demoted the old umbrella organization for scientific research and development for the defense industry, COSTIND, in 2008. In its place, a new department called the State Administration for Science, Technology, and Industry for National Defense (SASTIND) has been created under the new super-Ministry of Industry and Information Technology. Still, many of China's state-run organizations continue to suffer from legacy inefficiencies of the socialist economy.

Another potentially limiting factor is the fact that the State Council and the Military Commission of the Communist Party's Central Committee have since 1997 implemented new export controls and a licensing system. Since 2002, the Military Products Export Control List—administered by SASTIND—has included a special Category 8 for military space items, while other regulations now govern civilian space exports. While possibly reducing China's space trade, this recent development of space-related export controls must be viewed as a positive development from a U.S. perspective, bringing China into greater compliance with international efforts to prevent the proliferation of technologies that could be used for military purposes. Indeed, most Chinese space exports today focus on delivery-on-orbit products and services, rather than direct technology transfer.

Although China's relationship with Europe was reaffirmed in a recent European Union statement calling for new cooperation with China, one sore point has been China's role in Europe's planned Galileo navigation system. Initially, China pledged some $300 million in investment funds in order to become a full partner in the Galileo project, which Beijing viewed as a counterbalance to the U.S.-controlled Global Positioning System (GPS). But the Europeans eventually ousted China out of security concerns and irritation with Beijing's plans to build a competing commercial system as part of its Beidou program, as well as to broadcast its military signal on the same frequency the Europeans had planned to use.

Finally, as noted with APSCO, China has no close allies in space with significant space capabilities. While it cooperates with Russia, the two sides do not share strategic interests, and the bulk of China's cooperative agreements involve developing countries. Thus, China has no capable space allies that it can rely on in a crisis.

Considerations for Renewing U.S.-Chinese Space Cooperation

Supporters of the current freeze in U.S.-Chinese space relations argue that Washington is sending a signal to Beijing about its deplorable human rights record and is also limiting China's ability to develop advanced space systems. Unfortunately, while well-intended, current U.S. policy is ineffective sends a weak and off-target signal. Unless the United States is also willing to halt U.S. investment in Chinese manufacturing, cut off Chinese access to the U.S. export market, and find a new client for U.S. debt, holding space cooperation hostage will have no significant impact on China, except pushing it to cooperate with others. In addition, it puts the United States in the odd position of promoting "protectionism" in space and adopting a "defensive" strategy, when opening markets and reducing U.S. export barriers instead would strengthen the U.S. space industry and promote American security through greater engagement with the region.

Efforts to keep China off of the *International Space Station* (*ISS*), for example, have only strengthened China's resolve to build its own space stations. Former NASA Administrator Michael Griffin, notably, argues that failing to work with China may cause the United States to be left behind in new international missions, particularly given the fact that current NASA funding will not sustain a unilateral return mission to the Moon, much less continue shouldering of the lion's share of the *ISS* budget. A step-by-step process to begin space science cooperation and (if successful) allow gradual Chinese participation on the *ISS* (first via joint research, then a taikonaut visit, then a possible module) would make more sense: reducing U.S. costs and increasing U.S. knowledge about Chinese space activities.

Similarly, U.S. legislation and ITAR restrictions barring U.S. space technology from being launched aboard Chinese boosters have harmed U.S. satellite sales worldwide, leading to the production of ITAR-free satellites and causing erstwhile clients to turn to other suppliers to avoid U.S. red tape.

The 1999 shift in U.S. policy aimed mainly at addressing national security concerns. But it was an overly blunt instrument, taking up all space technologies rather than only those that cannot be found on the international market. China (like other countries) is certainly interested in acquiring U.S. space technology, yet it is important to point out that the Loral and Hughes investigations in the 1990s did *not* involve illicit Chinese access to U.S. commercial satellites. The problem instead involved improper meetings by U.S. company officials with the Chinese. Thus, the logical solution is not to ban all U.S.-Chinese space contacts, but instead to ensure that U.S. companies observe export control regulations in their meetings. Fortunately, U.S. companies have ample incentive to protect what is actually *inside* their satellites, as they do with Russia and other countries.

Supporters of current restrictions also argue that the policy helps protect U.S. space launchers. Indeed, highly inflated costs for U.S. boosters have supported a few U.S. companies. But they have also hurt the U.S. space industry overall by reducing timely and affordable access to space. Fortunately, thanks to recent developments by such U.S. companies as SpaceX (with its Falcon 1 and 9 boosters), the U.S. launch services sector is becoming competitive on the international marketplace without the need to fall back on protectionism. A stronger U.S. policy would focus instead on lowering global barriers to space competition and reducing subsidies by European producers. As a condition for opening the American market to Chinese launchers, the United States should insist that China open its domestic market to U.S. satellite producers for on-orbit services. The United States fought and won this battle with Japan in the late 1980s and should now use the World Trade Organization and other mechanisms to win this case with China, India, and other countries with closed space markets.

But enhanced U.S.-Chinese space cooperation cannot occur without stabilization of the security relationship with China in regard to space. In this area, it is encouraging that bilateral military-to-military talks are likely to begin soon to discuss parameters for improved space security in the context of the new strategic dialogue with Beijing. It as yet unclear what direction these talks will take, or what initiatives might be possible. Chinese military receptivity and transparency—not seen in recent years—will be necessary to move this dialogue forward. However, if China shows a willingness to respond, the United States should be ready with concrete ideas aimed at creating a framework for more responsible Chinese behavior and mutually beneficial cooperation. Actions by the Nixon administration in the early 1970s established mutually beneficial norms with the Soviet Union under far more difficult circumstances. At a minimum, measures with China should include similar mutual pledges of non-interference with "national technical means" of verification, as well as early-warning satellites. In addition, given China's 2007 ASAT test, it would be beneficial to exchange joint statements rejecting debris-producing events involving orbital objects, particularly those above 150 miles in altitude. Finally, getting China to agree to regular (at least annual) consultations on space security would improve U.S. knowledge of Chinese military programs and create the mechanisms for the prevention of dangerous activities. All of these mechanisms are in U.S. national interests.

Conclusion

U.S. policy toward China's space program is following respectable but unrealistic goals: to change Chinese human rights policy and military behavior through space sanctions. Sadly, this policy is not working. It is time to explore other options.

The marketplace for space technology has become globalized. It is also now much less dependent on U.S. products. For this reason, our strategy aimed at isolating China in space has become ineffective. Other advanced countries recognize the value of the Chinese space market and can produce technologies that are attractive to China. The United States stands aside to its own disadvantage and to the detriment of our space competitiveness. Russians and Europeans have ITAR-free products that provide nearly comparable space services. Overly restrictive export controls also harm U.S. *political* influence in the space field, as emerging countries form ties with China as a favored supplier.

But, as noted, the United States should not change its space policy without reciprocity. Beijing will need to show more transparency and a willingness to accept restraints on its military programs, as well as new openness in terms of its domestic market. Continued stagnation in the bilateral space relationship and the imposition of blanket ITAR controls on U.S. space technology worldwide, however, puts the United States at risk of losing additional market share in satellites. It also isolates the United States from its own friends and allies, while heightening mistrust and prospects for conflict with China in the space security realm.

Renewing civil and commercial space cooperation with China—as begun by the Reagan administration—is not a blank check and need not provide China with sensitive technologies. Instead, it can be carefully structured to allow reasonable cooperation in space science and in space commerce involving products and services available on the international market. Similarly, building a firm basis for space security relations—while recognizing our differences with China—should be pursued out of American interests. Such contacts need to be regularized and used to prevent harmful activities, increase transparency, and reduce tensions. Absent such contacts, the United States will continue to lack access, knowledge, and leverage on Chinese space activities.

Finally, we need to pursue closer space-related links to U.S. allies and friends, especially in Asia, to help strengthen U.S. capabilities and resiliency. Such actions will help create a stronger political network for U.S. space leadership and establish lasting cooperative ties. Fortunately, the administration has begun such work in the context of the new National Security Space Strategy. But it needs to stay the course and to keep Congress informed of its progress.