Chapter 1

China's Space Development— A Tool for Enhancing National Strength and Prestige

In the latter half of the 1950s, China initiated a program of rocket research and development that led to the nation's first successful launch of a satellite in April 1970, making China the world's fifth space-exploring nation, following the then Soviet Union, the United States, France, and Japan. Further efforts in space development allowed China to launch a human into orbit aboard the *Shenzhou 5* in October 2003. China was the third nation to succeed in human spaceflight, following the then Soviet Union and the United States. Moreover, China's space development has continued to branch out to other fields, as seen in its successful interception of one of its orbiting satellites in January 2007, its launch of a moon explorer in the following October, and its plans to construct a space station.

The organizations involved in China's space development program share strong ties with the People's Liberation Army (PLA), and a large proportion of the satellites launched and operated by China are believed to be used for military purposes. Additionally, Chinese white papers on defense and space development define advanced space engineering as a critical element of defense. Although China has consistently advocated a ban on the deployment of weapons in space, this may be just an attempt to put a check on the United States, the nation most militarily active in space.

China's successful anti-satellite weapon test in January 2007 triggered strong concern in many countries as it demonstrated that China had acquired the ability to destroy the satellites of other nations as well. China responded to the negative reaction by declaring that it would not conduct further tests. Nevertheless, the experiment also posed a significant problem in terms of the space environment, since it had generated roughly 1,000 pieces of space debris. The United Nations (UN) subsequently addressed this issue by formulating guidelines that prohibit the intentional destruction of artificial satellites.

It is likely that China will continue to actively engage in space development in the years ahead, given that such development serves as a vital means of achieving military competitiveness against the United States, enhancing the PLA's system of C4ISR (command, control, communications, computer, intelligence, surveillance and reconnaissance), and raising national prestige. At the same time, the transfer of space technology represents an effective tool in diplomacy. For these reasons, it would be in the interest of the international community to continue monitoring trends in China's space development program.

1. Background of China's Space Development

(1) The Seventies and Eighties

China successfully launched its first satellite, the *Dong Fang Hong 1*, on April 24, 1970, fifteen years after it began full-fledged rocket research by establishing the Fifth Academy in its Ministry of National Defense in 1956. This achievement capped off China's biggest defense project at the time, the so-called "Two Bombs, One Satellite" program of developing an atomic bomb, a hydrogen bomb, and a satellite. It also made China the fifth nation to launch a satellite, thirteen years behind the then Soviet Union's launch of the world's first satellite, *Sputnik*, and following the successes of the United States (1958), France (1965), and Japan (1970). Japan's launch of the satellite *Osumi* took place on February 11, 1970, two months before China's launch.

After the *Dong Fang Hong 1* launch, China made thirty-one other satellite launches in the seventies and eighties, seven of which failed. The first several launches were test satellites, which were eventually followed by successful launches of several remote sensing satellites and communication satellites. In 1984, China achieved its first launch of a satellite into geostationary earth orbit (*Dong Fang Hong 2*, an experimental communication satellite). It should be noted here that China's remote sensing satellites were designed to be recoverable, a feature seen in some early reconnaissance satellites. In contrast, Japan's remote sensing satellites have always been designed to remain in orbit and transmit their data to ground stations. By the end of the eighties, China had developed practical satellites for communication and meteorological purposes. In 1988, China and West Germany collaborated in a joint satellite development project.

China initially used the Chang Zheng (Long March) 1 for its satellite launch vehicles, and began constructing in the late eighties the Long March 4, which is currently serving as the primary launch vehicle. The Long March 1 was developed by modifying an existing ballistic missile design, the Dong Feng. Such an approach to development has been typical in the world's history of rocketry, as ballistic missiles and launch vehicles share the same basic technology. The sole exception is Japan, which developed launch vehicles for space development only, without ever possessing ballistic missiles. China has made considerable progress in boosting the performance of its launch vehicles, as seen in the Long March 2F, which is capable of carrying a maximum payload of 8,400 kilograms to low earth orbit, and 3,500 kilograms to geostationary earth orbit. For comparison, the payload capacity of Japan’s most advanced rocket, the H-2A, is 10,000 kilograms for low earth orbit and 3,700 kilograms for geostationary earth orbit.

(2) The Nineties

The nineties were an evolutionary decade for China’s space program. Prior to that time, the satellites launched by China were mostly test projects, with only a handful of practical satellites put into space. In the nineties, China continued to launch domestically developed experimental satellites, but it also started developing and launching a larger number of utility satellites, which served such purposes as communication, remote sensing, and meteorology. At the same time, China began to actively provide launching services for satellites manufactured by foreign countries and businesses. During this period, China used its rockets to launch numerous non-domestic satellites, including Australian, US, and Hong Kong civilian communication satellites (geostationary earth orbit), and small satellites for the US-led iridium civilian communication system (low earth orbit). China closed out the decade with the November 21, 1999, launch of the *Shenzhou 1*, its first spaceship designed for human spaceflight.

(3) Year 2000 to the Present

The period from the year 2000 to the present has been characterized by increasing enhancement of China’s space program. For example, China improved the reliability of its independently developed Long March series of launch vehicles, bringing their success rate up to par with the advanced rockets of Europe, the United States, and Japan. The missions that China launches today primarily include recovery-capsule/non-capsule remote sensing satellites, communication/

broadcasting satellites, meteorological satellites, science satellites, engineering test satellites, positioning satellites, and manned spaceships. In most cases, the advanced space-faring nations—the United States, Russia, Japan, and certain European countries—possess or are developing satellite systems similar to those launched by China. However, Europe and Japan presently do not have space vessels for manned flights, meaning that China is the third nation to have acquired the technology for human spaceflight. For a while, China's commercial launch services experienced a slowdown due to other nation's fears that their state-of-the-art technologies would be leaked to China, but the launch services were restarted in 2005 and have the potential to grow further in the years ahead. China is also becoming visibly active in joint international projects, such as the Galileo Project led by the European Union (EU), and cooperative efforts with Surrey Satellite Technology Limited, an enterprise that was formed by the University of Surrey and is a world leader in small satellite development.

As described above, China is rapidly expanding its space program as its national strength rises. Along with India, a nation that has been feverishly pursuing space development in recent years, China has joined the United States, Russia, Europe, and Japan as a space-faring power.

2. Organizational Makeup

(1) Space Development Organizations

China's space program was initially run by the Ministry of Space, but this national organ was dissolved in 1993 as part of the shift to a socialist market economy that was called for by the Fourteenth National Congress of the Communist Party of China (CPC) in 1992. Responsibility for the program was delegated to two organizations formed for this purpose, the China National Space Administration (CNSA) and the China Aerospace Science and Technology Corporation (CASC). One of the duties of the CNSA, a state organization formerly under the direction of the State Council, is to execute international agreements concerning space development. To date, those agreements have been made with such partners as the United States, the United Kingdom, France, Germany, India, Italy, Russia, Ukraine, Pakistan, and Brazil. The CASC develops and manufactures launch vehicles and satellites. Despite their separate roles, these two organizations were essentially undivided at first, as they shared many of the same personnel.

Starting in 1998, the line between governmental organs and state-owned companies grew increasingly distinct, and the CNSA and the CASC became, in substance, separate organizations. Later, another state-owned company, the China Aerospace Science and Industry Corporation (CASIC), was spun off from the CASC. Today, the technical side of China’s space development program is handled by both corporations, which operate under market mechanisms to a degree. Nevertheless, the CASC is in actuality the powerhouse behind space development, and many of China’s space research and development labs are under its wings. Of those labs, the China Academy of Launch Vehicle Technology (CALT) holds primary responsibility for launch vehicle development, while the China Academy of Space Technology leads satellite development. The CASC is a central corporation that is directly controlled by the national government via the State-owned Assets Supervision and Administration Commission, and its president is also a member of the CPC Central Committee. The direct control of space development by the state and the CPC demonstrates the heavy weight attached to it by China. The CNSA was repositioned from under the State Council to the Commission of Science Technology and Industry for National Defense (COSTIND), which was established in 1998.

China’s civilian space development budget was an annual average of slightly under 1.1 billion RMB from 2001 to 2005. Definite figures are not available for China’s military space development budget, but some observers believe that it is slightly below the civilian budget. While it is difficult to make a simple comparison with other nations, China’s skyrocketing growth in many fields suggests that its space development budget is very likely to rapidly expand in the coming years.

(2) Close Ties with the Military

As noted above, China appears to be transforming its space program by replacing direct state control with business competition and market economy principles. The reality, however, is that the program continues to be guided by the government. The CASC and the CASIC, the two companies that research, develop, and manufacture China’s space equipment, are owned by the state and are directed by the CNSA. In turn, the CNSA is under the supervision of the COSTIND, and hence can be considered to hold strong ties with China’s military. In fact, the CALT, the most important institute within the CASC, is the main lab for not only launch vehicle technology, but also ballistic missile development. This status was underscored at a celebration of the academy's forty-fifth anniversary on December 16, 2002, when Vice Chairman of the Central Military Commission (CMC) Cao Gangchuan lauded the academy as China's foremost institute for research on ballistic missiles and launch vehicles.

Another link with the military is the PLA's supervision of launches and satellite tracking control. These operations are directed by the China Satellite Launch and Tracking Control General (CLTC), a unit of the PLA's General Armament Department, which itself is administered by the CMC. The CLTC operates a network of tracking stations and the nation's three inland launch centers: Jiuquan (Gansu Province), Xichang (Sichuan Province), and Taiyuan (Shanxi Province). China is also developing another launch center, Hainan (Hainan Province), which is better suited for launches since it is located near the equator and faces the ocean on its eastern perimeter. The efficiency of launches improves with proximity to the equator, and having open sea to the east helps to reduce the potential for collateral damage when ground control destroys a failing launch vehicle.

The space program's military connection is also evident in the decision to use a PLA officer for each of China's human spaceflights—the *Shenzhou 5* mission in 2003, which made China the third nation to achieve human spaceflight, and the *Shenzhou 6* mission launched on October 12, 2005. Furthermore, on the occasion of the March 15, 2002, launch of the unmanned *Shenzhou 3*, President Jiang Zemin declared that the Shenzhou project held great significance for the advancement of science and technology in China and for the modernization of its defense, a statement revealing that space development and the military were two sides of the same coin.

Many of the satellites launched and currently operated by China are believed to have military purposes. Foreign analysts surmise that China operates many reconnaissance satellites under the guise of civilian remote sensing satellites, and possesses mobile telecommunication satellites and electronic intelligence satellites. In addition, the PLA is naturally expected to be a user of the system of Beidou navigation satellites now under development, as well as a network of four optical satellites and four synthetic aperture radar (SAR) reconnaissance satellites that began launching in 2006 and is planned for completion in 2010. The PLA is also exerting an enormous influence over the satellites' development, manufacture, and operation. China has also already developed cruise missiles, and very likely operates them using data from its positioning satellites.

3. Space Development and State Policy

(1) White Paper on Space Development

China published its first white paper on space development, *China's Space Activities*, in 2000, and followed this up in 2006 with *China's Space Activities in 2006* (hereafter, *2006 CSA*) to highlight the rapid progress achieved during the interim, and to describe the program's course for the future.

The *2006 CSA* provides an outline of China's space activities as a whole, with little direct reference to national security. Nonetheless, the first chapter, "Aims and Principles of Development," patently states that China's space program is necessary for meeting national security needs and is aimed at protecting the country's interests. Moreover, the first principle listed in the same chapter declares that China's space development is "a strategic way to enhance its economic, scientific, technological and national defense strength, as well as a cohesive force for the unity of the Chinese people, in order to rejuvenate China." Since the same aims and principle are enunciated in the same place in the 2000 edition (first chapter and first principle), they appear to be positioned at the core of China's space development policy.

In addition to security, other principles laid out in the *2006 CSA* include taking a self-reliant approach, encouraging progress in Chinese space technology to promote development of domestic high-tech industries, and using space development as a vehicle for international exchange and cooperation.

After presenting principles such as these, the *2006 CSA* extols China's achievements in each field of space activity for the preceding five years. It then lists the following as tasks to be accomplished over the ensuing five years: (a) development of a larger launch vehicle; (b) implementation of a high-resolution Earth observation system; (c) enhancement of the satellite remote-sensing ground system; (d) development of communication broadcasting satellites with long operating lives; (e) construction of a positioning/navigation satellite network; (f) development of a "breeding satellite" to aid efforts at increasing crop yields through cultivar improvement; (g) development of various scientific satellites; (h) attainment of skills in docking and other human spaceflight operations; (i) development of lunar exploration technologies; (j) enhancement of launching facilities; and (k) improvement of tracking, telemetry, and control.

(2) White Paper on Defense

The white paper *China's National Defense in 2006* similarly defines advanced space technology as a tool for China's defense. The preface states that defense and military modernization are to be implemented in step with new global trends, and Chapter 8, "Science, Technology and Industry for National Defense," ranks space technology alongside nuclear weaponry, aviation, shipbuilding, weapons, and electronics as defense-related industries to be upgraded.

Interestingly, Chapter 8 lists among China's advances in defense-related science and technology such projects as manned spaced flights and lunar exploration, rather than, say, reconnaissance satellites or military communication satellites. Those two areas are mentioned as five-year goals by the *2006 CSA*, but without language directly associating them with national security issues. Yet the defense white paper, published in the same year, clearly ties them with security in its eighth chapter, and thus can be construed as proof that China perceives space development and use as linked to its national defense. Additionally, the Eleventh Five-year Plan of the Science Space Program, which was announced on October 18, 2007, by the COSTIND, specifies manned space flights and lunar exploration as focus areas for development, above such projects as the high-resolution Earth observation system, the Beidou navigation satellite system, and new launch vehicles. Japan's white paper on defense stands in contrast in this regard, as it does not define the domestic space program as an element of national defense.

(3) Proposals at International Conferences

China has consistently advocated a ban on weapon deployment in space in its statements at past sessions of the Conference on Disarmament in Geneva, as exemplified by its 1999 call for the establishment of a special committee for developing a treaty against space weaponization. In addition, China presented a series of working papers titled "Possible Elements for a Future International Legal Agreement on the Prevention of the Deployment of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects" at conference sessions in 2000, 2001, and 2002. The recommendations of the 2001 and 2002 papers were jointly submitted with Russia, Vietnam, Indonesia, Belarus, Syria, and Zimbabwe. In 2004, China and Russia began distributing a joint working paper containing the same elements as the earlier papers, all of which propose a treaty comprehensively banning weapon deployment in space. Specifically, the treaty would prohibit placing in orbit any objects carrying weapons, installing such objects on celestial bodies, and using or threatening force against objects in space. The proposal, however, allows for military satellites currently in common use that do not possess explicit destructive power. As such, it accepts the current usage of space for security purposes while strictly forbidding future attempts to place any weapons in space. More recently, Chinese Ambassador to the UN in Vienna Tang Guoqiang made a similar proposal at a March 2007 meeting of the UN Committee on the Peaceful Uses of Outer Space in Vienna (COPUOS).

These proposals possibly represent one element of the Chinese government's policies regarding arms control, disarmament, and prevention of proliferation. This interpretation is supported by the September 1, 2005, white paper *China's Endeavors for Arms Control, Disarmament and Proliferation*, in which the Chinese government specifically mentions as one of its basic policies the prevention of space weaponization and a space arms race.

It is not clear, however, whether China will maintain this stance as part of its space policy in the years ahead. China is aware of the United States' resolve, as the leading military space power, to maximize its freedom of action in space. In order for China to catch up with the United States' advanced space capabilities, it needs to place a check, even if limited, on the further expansion of those capabilities. Seen in this light, China's call for a space weaponization ban may just be an expediency designed to contain the United States.

(4) Foreign Relations

China has engaged in international space development cooperation ever since the beginning of its space program. As early as 1988, China jointly developed a satellite with West Germany, and in recent years has been involved in a number of cooperative projects and international initiatives.

One such undertaking is the China-Brazil Earth Resources Satellite (CBERS) program, in which both nations worked together to launch the project's first satellite in 1999, followed by a second in 2003 and a third in 2007. Presently, China is leading the development of a fourth CBERS satellite. As part of its Shenzhou human spaceflight program, China has entered into new cooperative arrangements with Namibia and Kenya to construct tracking stations within their borders. Also, China is building up stronger relations with Europe, such as by agreeing in 2003 to participate in the Galileo Project mentioned earlier, an EU-led endeavor aimed at creating a new global positioning system.

China was the main driving force behind the October 2005 establishment of the Asia-Pacific Space Cooperation Organization (APSCO), an initiative for regional multilateral cooperation. This organization grew out of a 1992 joint proposal by China, Pakistan, and Thailand to create a framework for multilateral cooperation concerning small satellite development and training in the Asia-Pacific region. The realization of this partnership was apparently accelerated by the success of China's human spaceflight project, and it reveals China's eagerness to actively take the lead in space development efforts in Asia. The original signatories of the APSCO convention, which was signed in Beijing in October 2005, are China, Pakistan, Thailand, Indonesia, Bangladesh, Mongolia, Iran, and Peru. Nations that have participated in the organization as observers include Brazil, Argentina, Malaysia, the Philippines, Russia, and Ukraine.

4. January 2007 Anti-satellite Test

(1) Overview of Anti-satellite Test

The satellite targeted by this test was the *Fengyun 1C*, a Chinese meteorological satellite launched in 1999. It weighed roughly 960 kilograms at launch, and was orbiting at an altitude of 870 kilometers. It measured approximately 1.8 meters in height and 9 meters in width, including the length of solar panels extending from both sides. It is believed that China used a ground-launched missile to destroy the satellite by direct impact.

The impact produced a cloud of orbital space debris consisting of some 1,000 fragments ranging in altitude from approximately 200 to 3,600 kilometers. It also likely generated thousands of small, untrackable fragments. Rather than burn up from atmospheric reentry, most of the debris is expected to remain in orbit for centuries or even millennia. Artificial satellites can be impaired by collision with debris ranging from 0.01 to 1 centimeter in diameter, and can be destroyed by debris of larger sizes. Moreover, particles just 0.02 to 0.03 centimeters in diameter can penetrate the spacesuits used for extravehicular activity, as the material is less resistant to impact than spaceship exteriors.

Japan's information-gathering satellites travel in circular orbits about 500 kilometers above the earth, while the United States' KH series of military reconnaissance satellites orbit in elliptical paths believed to have a perigee of approximately 300 kilometers and an apogee of approximately 1,000 kilometers. The International Space Station, a project being jointly implemented by Japan, the United States, Russia, Canada, and certain European countries, orbits at an altitude of roughly 400 kilometers. As these examples illustrate, a large proportion of security and civilian satellites follow orbits similar to that of the satellite destroyed in China's test, and thus it is reasonable to assume that they have a significant risk of collision with the debris produced by the test. The satellites of the Global Positioning System (GPS), which is operated by the United States and is widely employed by users around the world, orbit at an altitude of 20,000 kilometers and thus have a very low risk of exposure to the test debris.

(2) International Reaction

The international community strongly condemned China's anti-satellite test, as many space-faring nations were aware of how space debris could critically damage military and civilian satellites of any nation.

At a morning press conference on January 19, the day after the performance of the test was confirmed, Japanese Chief Cabinet Secretary Yasuhisa Shiozaki indicated that Japan, after receiving a report of the incident from the United States, had contacted China's Ministry of Foreign Affairs via the Japanese embassy in Beijing to demand an explanation. Shiozaki also stated that the test represented a cause for concern with regard to national security and the peaceful use of space.

In the United States, the White House expressed similar concern over the test, and a National Security Council spokesman declared that "China's development and testing of such weapons is inconsistent with the spirit of cooperation that both countries aspire to in the civil space area." The United States' reaction was likely exacerbated by a previous incident in which one of the US military's low earth orbit satellites was damaged by a ground-based laser irradiator suspected to belong to China. Other countries also made statements of concern, including the United Kingdom, Canada, Australia, and South Korea.

China worked quickly to stem the tide of international condemnation. On February 12, Minister of National Defense Cao Gangchuan told visiting former Japanese Minister of State for Defense Fukushiro Nukaga that the test was a scientific experiment, and that it did not violate any treaties or represent a threat of any kind. Cao also said that China would not conduct similar tests in the future. On August 30, while making the first visit to Japan in a decade by a Chinese defense minister, Cao met with then Japanese Minister of Defense Masahiko Koumura, who protested the incident's lack of transparency and demanded further details. Cao responded by reiterating that the test was not a threat whatsoever, apparently seeking to alleviate the negative reaction that it had sparked.

(3) The UN's Reaction—COPUOS

China's anti-satellite test served as an impetus for the COPUOS Scientific and Technical Subcommittee's adoption of space debris mitigation guidelines, the formulation of which had been a pending issue for several years. The subcommittee, which included China as a member, approved the guidelines in Vienna in February 2007, and incorporated in the fourth guideline a ban on the intentional destruction of spacecraft. Although the guidelines are just a set of legally nonbinding technical principles premised on peacetime application, China, as one of the adopters of the consensus-based agreement, is not in a position to flagrantly ignore them (see "Excerpt from the Space Debris Mitigation Guidelines"). The COPUOS approved the guidelines in June of the same year, and the UN General Assembly mentioned them in a resolution passed in December.

Excerpt from the Space Debris Mitigation Guidelines

Guideline 4: Avoid intentional destruction and other harmful activities

Recognizing that an increased risk of collision could pose a threat to space operations, the intentional destruction of any on-orbit spacecraft and launch vehicle orbital stages or other harmful activities that generate long-lived debris should be avoided.

When intentional break-ups are necessary, they should be conducted at sufficiently low altitudes to limit the orbital lifetime of resulting fragments.

Source: Space Debris Mitigation Guidelines of the COPUOS Scientific and Technical Subcommittee

(4) The Test’s Background and Significance

China’s anti-satellite test was likely conducted with the intention of containing other nations’ military activity in space. The type of missile used in the test is certain to be capable of destroying not only US satellites, but also the information-gathering satellites recently launched by Japan. As mentioned earlier, China is also suspected of having irradiated a low earth orbit satellite with a ground-based laser, and it may possess a satellite jamming system. As such, it appears that China is simultaneously developing various forms of technology to boost its capabilities in satellite destruction and jamming across a wide spectrum. With the exception of satellites in geostationary orbit (an altitude of nearly 36,000 kilometers), most civilian satellites orbit at altitudes susceptible to the sort of attack carried out in China’s test, and hence China’s anti-satellite capability poses the potential for an even greater impact.

Satellites are an essential part of national security and civilized life for much of the world, especially developed nations. China’s anti-satellite test means that other nations’ satellites, whether military or civilian, may become gravely threatened in the event of escalated international tensions.

International law naturally allows the right of self-defense to be exercised in space as well, so there is the possibility that a destructive act like China’s test will be committed in space in the future. The Outer Space Treaty, which was inaugurated in 1967 and has as of January 1, 2007, been signed by 125 nations, 99 of which ratified it, states in its third article that the UN Charter and other international laws apply to space activity. On the other hand, the current space environment is not conducive to attempts to intentionally destroy satellites, given that many civilian satellites share, as noted earlier, the same orbital paths and altitudes as military satellites, and hence there is no distinction between “military space” and “civilian space.” Another reason is that a rapidly growing number of states and businesses possess and operate satellites or are dependent on satellite services. In fact, China itself has pledged to refrain from further destructive tests, and has supported the adoption of international guidelines banning the intentional creation of space debris, so there is ample potential that regulations against anti-satellite attacks will be implemented in the future.

Nevertheless, *China’s National Defense in 2006* indicates that China will actively seek to improve its military technology with respect to space. This stance may be an expression of China’s desire to enhance its international presence, as the country is also working hard to play a key role in space for non-military purposes as well. It has successfully accomplished human spaceflights in recent years, and is enlarging its vision to include space station activity and lunar exploration. These are all big steps in space development that have already been taken by the United States, including with regard to military-related space activity. China's anti-satellite test can be interpreted as but another effort of China to increase its prestige by standing eye to eye with the United States. In addition, China is eager to expand its reach, so its pursuit of space activities may, like its endeavors to operate on the high seas, be an attempt to broaden the sphere of its interests.

Some analysts believe that China's potential use of its anti-satellite system during a conflict with Taiwan could shape the outcome. The United States might come to Taiwan's assistance during such an emergency, but the power of the US military to operate would likely be hindered, if China were to disable several of the many military and civilian satellites that the United States uses for security purposes. However, even if the precision of such satellite support were reduced, the United States would likely fill the gap by using civilian commercial satellites and other alternatives. Moreover, this conflict scenario is easily imaginable, so the United States could sufficiently prepare itself for such a contingency. In any case, the United States is extremely dependent on space assets, and thus continues to be the nation most vulnerable to the effects of anti-satellite systems. In contrast, China's dependence on satellites is still considerably low, so there is great potential for the emergence of an asymmetric situation to the United States' disadvantage. Although such a situation is not easy to avoid, the United States is well aware of the risks posed, and has begun taking action to patch up the vulnerabilities of its space assets. One example is the United States' development of the TacSat series of responsive small satellite systems. Under this program, a small satellite can be fitted with the necessary sensors and be placed in low earth orbit for operation in just one week following the deployment order. The performance of these and similar systems is inferior to that of existing large satellites, but they offer a quick remedy for responding to situations where military operation has been compromised by satellite destruction.

All things considered, China is, as already explained, currently pursuing a diverse set of space projects, and these endeavors will likely increase the space asset dependence of certain high-tech PLA units. The vulnerability that comes from that heightened dependence will expose China to greater and greater risk of running into disadvantageous situations in its usage of space. In light of this risk and the current US-China balance of power in space activity and other areas, it seems unlikely that China will use its newly acquired anti-satellite capabilities to intensify its military pressure on other nations.

5. The Future of Chinese Space Development

(1) Space Development for Countering the United States

Today China appears determined to become a center of resistance against the United States, the post-Cold War world's leader in many arenas. This opposition is seen in not only China's economic activities, but also its national security efforts. Having minutely analyzed the United States' current strengths and weaknesses, China is endeavoring to narrow its gap with US capabilities in established weapons systems by exploring such possibilities as construction of an aircraft carrier and reinforcement of its nuclear capabilities. At the same time, China is building up its cyber war capabilities.

China is also countering US dominance in security-related space activities by developing technologies to exploit the vulnerabilities of US space assets. This capability was amply demonstrated by the success of the anti-satellite test described earlier.

China's resistance is further manifested in its proactive involvement in the Galileo Project, the European program aimed at developing a navigation satellite system that will not rely on the United States' GPS. As such, the project serves as an opportunity for China to deepen its ties with Europe while challenging US supremacy. Moreover, China is carrying out its own initiatives, such as the Beidou system mentioned earlier. It also appears to be enhancing its optical reconnaissance satellites and developing SAR reconnaissance satellites; these projects, if successfully realized, will allow China to dramatically improve its capabilities in space asset use and space-based information gathering.

(2) Space Development for Domestic Use

China's domestic use of space is progressing in both security and civilian applications. Space usage for meteorological, communication, and other civilian purposes is expected to continue growing. Data from space can effectively support efforts related to the environment and disaster mitigation, including: water utilization surveys and land usage enhancement in urban centers, suburbs, and agricultural regions; natural resource exploration; pollution monitoring; forecasting of Asian dust (yellow sand) events and sandstorms, and development of countermeasures; disaster prediction; and assistance for disaster-stricken areas. Of greater interest to China, however, is the use of satellite data to improve agricultural crop cultivars. China possesses less than ten percent of the world's arable land, yet must feed a population that accounts for more than twenty percent of humankind. China is attempting to develop better cultivars by exposing seeds in space to micro-gravity, near-vacuum, and cosmic radiation. If all goes well, the improved seeds may revolutionize the Chinese agricultural industry. The practical orientation of China's space program is visible in other areas as well. China's becoming the third nation to achieve human spaceflight and the announcement of new projects for space station construction and lunar exploration are not just means of boosting national prestige; they also show that the nation is steadily making progress in practical space use. This trend may accelerate in the years ahead, and it is unlikely to slow down.

(3) Space Development for Diplomacy

In addition to serving national security and domestic civilian use of space, China's space activities are also being used as a tool for diplomacy. The nation's space-related international cooperation efforts, which began with a bilateral arrangement for satellite development, have blossomed to include the establishment of satellite tracking stations and a leading role in multilateral frameworks. China's pursuit of such international cooperation is expected to expand in the future, and will likely help the nation to secure its necessary supply of resources and energy. In light of this posture and China's growing efforts to provide African nations with official development assistance and debt relief, projects like the China-Nigeria partnership in communication satellite development and launches can be seen as examples of China's exploitation of space activities as a diplomatic tool.

It is highly probable that competition between China and other advanced space-faring nations will intensify with regard to space development and use in general. The use of space is certain to become an increasingly vital element of China's security and civil needs. However, as a nation that operates in the globalized world, China is starting to realize that growth in science and technology cannot be achieved outside of that environment. Consequently, China and other nations might vie with one another to take the initiative in future space activities, but that rivalry is very unlikely to escalate into sharp military conflict.

Still, space is a region indispensable to national security, and thus China’s enhancement of space development capabilities and its expansion of space-based military capabilities are bound to continue being shaped in part by security concerns. China’s use of space as a diplomatic tool will likely continue growing as well, so the international community should keep a watch on trends in China’s space program.