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# China's Advances in Space: Taking Stock of Recent Developments

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## Introduction

China conducted its first manual space docking in June 2012, a feat so far achieved by only two other countries: the US and Russia. This particular achievement, along with several others in the recent years, highlights the importance attached by China to building its expertise and assets in outer space. China has emphasised that these are for 'peaceful purposes'; still, it might be naïve to accept such declarations at face value. China's increasing advances in space technology under the direction of the PLA are likely to have serious military implications. There is no denying the fact that these applications have economic and commercial value but the military utility should not be ignored. An interesting aspect of China's programme is that it is promoting commercial initiatives within scientific laboratories in a big way. While on the one hand China's aerospace industry is expanding, Beijing has also frequently emphasised the national security dimensions of space. In one of his more recent statements, General Xu Qiliang, Commander of the PLA Air Force, reiterated the critical role played by space exploration in furthering China's national security interests. Earlier, the space White Paper of 2011 had also elucidated this stand: "The purposes of China's space industry are: to explore outer space and to enhance understanding of the Earth and the cosmos; to utilize outer space for peaceful purposes, promote human civilization and social progress, and to benefit the whole of mankind; to meet the demands of economic development, scientific and technological development, national security and social progress; and to improve the scientific and cultural knowledge of the Chinese people, protect China's national rights and interests, and build up its national comprehensive strength."[1]

This Issue Brief examines the major achievements of China in outer space in recent years, both from a technological as well as an arms-control perspective. The paper concludes by looking at the implications for India, both in the domain and in the broader regional security context.

## China's Vision in Space

Since 1949, Chinese leaders have paid close attention and given importance to the utilisation of space for the country's overall development. While China began its space programme as early as in 1956, the intellectual foundations were laid with the establishment of research centres such as the Beijing University of Aeronautics and Astronautics in October 1952. Beihang University, as it is currently known, is closely linked with the various arms of the government; engineers associated with the recent Shenzhou space project, Qi Faran and Wang Yongzhi, are products of Beihang. These efforts continued well into the 1960s, with China making significant investments in research and development (R&D) and also establishing important institutions such as the Academy of Satellite Spaceship, today known as the China Academy of Space Technology (CAST), responsible for spacecraft design and fabrication. China also started launching sounding rockets into space for suborbital flights. However, the space programme could not really pick up pace due to economic and political turmoil in the country following the Cultural Revolution.

It was in 1970 that China achieved a major success by launching its first satellite, the "Dongfanghong-I."[2] China's space programme has come a long way since then. Major highlights of the 1970s and 1980s include: launching of the first recoverable satellite in 1975; development of geo-stationary satellites in 1984; and becoming a big player in the commercial satellite launching area with the launch of AsiaSAT-I in 1990. The 1990s saw a major push, with China launching the Long March series of rockets under "Project 921". This project has assumed special status in China's space programme as it was the beginning of its manned space exploration programme. The aim of the Long March series has been to develop bigger and more powerful rockets required for a manned space programme.

Earlier, China had also initiated a few other programmes such as Project 863, which identified key high-technology sectors from nanotechnology and biotechnology to develop a sound biotechnological R & D level indigenously. This was followed by Project 973, a continuation of the Project 863, outlining technological needs for improving competencies. Project 211 was initiated to set up national universities and colleges with an intent to study and research technologies for future development. China has around 2,000 institutions of higher education of which about 100 are categorised under Project 211; these contribute 85 per cent of the state's key subjects in the technological arena, have 96 per cent of the state's key laboratories, and utilise 70 per cent of scientific research funding.[3]

Having made heavy investments in space, China carried out the first space flight of Shenzhou in 1999. In 2003, China achieved a bigger feat as it carried out its first human space flight mission and became only the third country to do so after the Soviet Union and the US. Another achievement for China came in February 2004 when it began implementing the non-manned lunar exploration project. The first phase of the project—orbiting the moon—has been completed. The second phase saw landing on the moon in October 2010. The mission was highly successful and produced some of the best resolution pictures ever taken.

Today, China has made significant progress in the technological realm and is on its way to developing its indigenous satellite navigation system–Beidou—and a space station by 2020. It has also entered in a big way the global satellite launch market and is likely to become an important player with a significant market share in the space industry. A major development which clearly indicated Chinese intent to use space for military purposes was the Anti-Satellite (ASAT) weapon test in February 2007 when China shot down its Feng Yun-1C meteorological satellite with a DF-21/KT-1 missile. The test generated large-scale debris in the orbit which provoked heavy criticism from the international community.

The next section will look at the recent developments in China's space programme, including the manned space docking and operationalisation of the Beidou satellite navigation system.

## Recent Developments

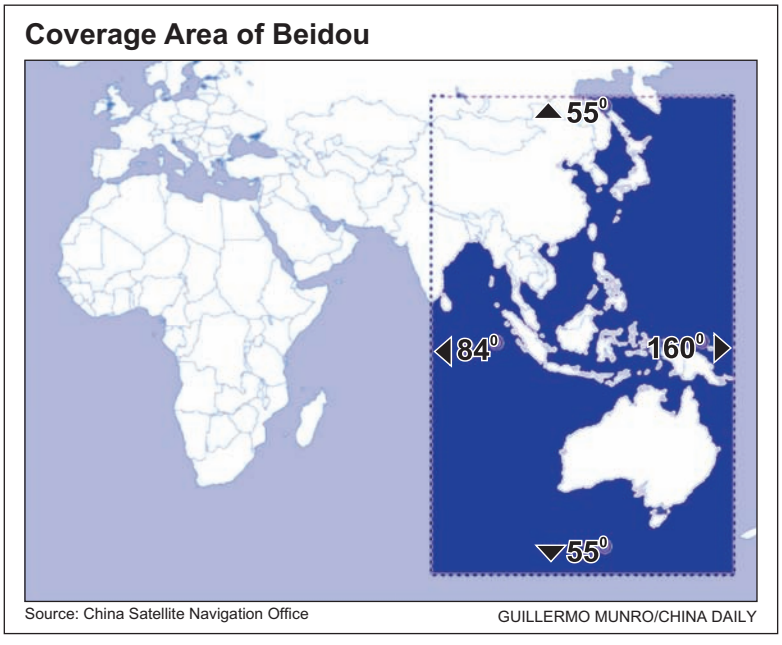
### *Manned Space Docking*

One of the most significant achievements in space for China so far has been the manual docking conducted in June 2012 when the spacecraft Shenzhou-9 was docked with the space lab Tiangong-1. Earlier in 2011, China successfully completed automated docking of Shenzhou-8 with the space lab. The astronauts of Shenzhou-9 conducted experiments during their mission, findings of which would contribute to future long duration missions. In a follow-up to this mission, Shenzhou-10 will be launched in 2013.

The Tiangong-1, in orbit since 2011, is part of a larger plan to build a space station by the year 2020, under an initiative known as Project 921.[4] The space station, which was approved in 1992, will be the only one left in space by 2020, as the International Space Station is due to retire in the same year. However, it is argued that the success of the Chinese space station will depend on the successful development of the Long March-5 rocket, which is likely to make its first flight in 2014.[5]

### *Beidou Satellite Navigation System*

The Beidou (also known as Compass) satellite navigation system is one of China's most ambitious missions in space. According to China's plans for Beidou, a total of 35 satellites will be launched in orbit which would cover the entire Earth by 2020 and send navigation data for users. As of April 2012, China had set 13 satellites into orbit. By the end of 2012, China will add three more satellites into the constellation, making a total of 16 satellites and covering the entire Asia-



Pacific, both for real-time navigation and weather monitoring purposes. Some countries in the region such as Mongolia and Pakistan have already expressed interest in using Beidou's services. Beidou, which is aiming to achieve a positioning accuracy of 10 meters, will make China the third country to possess its very own satellite navigation system after the US and Russia. With an operational navigation system of its own, China will not have to depend on the US to provide these services—a vulnerability that China has been keen to avoid. Beijing feels that during a crisis, the US could deny the services provided by its Global Positioning System (GPS). An article in the *China Daily* said, "There have long been concerns that the US might take its dominant GPS offline in certain international emergencies."[6]

### *Satellite Launches and Launch Vehicles*

China's satellite series today conduct a variety of functions including earth observation, communication, and broadcasting, as well as navigation and positioning. China's communication and broadcasting satellites have become successful in space-based data relays, tracking, telemetry and command (TT&C). These satellites today have substantially improved China's radio, television, data and voice communications. China's family of observation satellites consists of Fengyun (Wind and Cloud), Haiyang (Ocean), Ziyuan (Resources), Yaogan (Remote-Sensing) and Tianhui (Space Mapping) satellites. These are capable of providing global, three-dimensional and multispectral quantitative observation. The image resolution and coverage capacity of these satellites has also improved significantly over the years.

As far as China's satellite launch vehicles are concerned, the 'Long March' rocket series forms the backbone of the launching technology. From 2006 to 2011, the Long March rockets conducted 67 launches and sent 79 spacecrafts into space. In 2011, China conducted 20 rocket launches successfully which in itself is commendable; the country is developing an entire series—L5, L6, and L7—in the coming years.[7] The payload capability of these launch vehicles has progressed to an extent that for the first time China was able to launch two navigational satellites on one rocket on April 30, 2012. China's recent advances suggest that they may be in a position to have launch vehicles capable of carrying up to four satellites on one rocket. Additionally, they plan to conduct up to 100 satellite launches between 2010 and 2015, or an average of 20 launches per year.

### *Commercial Launching*

While China entered the international satellite launch market in 1985, it has gone far ahead in the last three decades. Today, China is launching satellites for countries in Latin America, Africa, as well as Pakistan. Experts believe that given China's increasing expertise in commercial launching, it will most likely acquire a large share of the commercial satellite launch market in the future. It is reported that Beijing seeks to gain 10 per cent of the world's commercial satellite market and 15 per cent of commercial launch business by 2015.[8]

### *Space-based Solar Power*

Given its growing economy and the rising hunger for energy resources, China has plans to develop clean energy options in space such as utilising space-based solar power (SBSP). By August 2011, China had

completed the initial study for the project which aims to begin commercial use of the solar space station by 2040. China's plan, drawn by one of its space pioneers Wang Xiji, aims to look at various aspects of space-based solar power applications, designs and key technologies that would make the option economically feasible in the first instance and sustainable by 2020. Highlighting the importance of exploring the space-based solar power options, Wang said, "whoever takes the lead in the development and utilization of clean and renewable energy and the space aviation industry will be the world leader."[9]

While India and the US have been talking about SBSP, China has actually made the pioneering moves. While utilisation of space assets for energy purposes should be seen as environment friendly and therefore a positive step, the spin-off benefits of technological development and their utility in the military domain cannot be overlooked.

### *Chinese Lunar Exploration Project*

Since 2007, China has been engaged in moon missions probing the lunar surface for scientific data. In 2007, the Chang'e-1 lunar probe mapped the entire surface of the moon. The Chang'e-2 launched in October 2010 provided high-resolution maps of the moon's surface. China claims that these pictures are the highest resolution images of the moon captured so far. Meanwhile, the Chang'e-3 lunar probe is undergoing preparations and is scheduled for launch in 2013. The device is designed to conduct land surveys, living conditions assessment and space observations over the moon for three months and will be equipped with advanced recognition and navigation systems. Additionally, China plans to do a moon walk some time between 2020 and 2030.

China's interest in the lunar mission is also related to exploration of natural resources. It plans to bring back soil and rock samples from the moon. Apart from other potential use, including exploration of the known mineral reserves such as iron, China has done considerable research on exploration of Helium-3, a source for nuclear fusion. Ouyang Ziyuan, head of the first phase of lunar exploration, has said: "There are altogether 15 tons of helium-3 on Earth, while on the Moon, the total amount of helium-3 can reach one to five million tons … If we human beings can finally use such energy material to generate electricity, then China might need 10 tons of helium-3 every year."[10] Meanwhile, China also has plans for a Mars mission. It had originally planned for a mission in collaboration with Russia. However, after the failure of the first mission that was also carrying the Russian Mars Orbiter, China has decided to go solo on the next mission, possibly in 2013.

## China's Space Diplomacy

China is party to several international agreements on outer space, including: the Outer Space Treaty; Convention on the Registration of Objects Launched in Outer Space (Launched Registration Convention); Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (Rescue Agreement); Convention on International Liability for Damage Caused by Space Objects (Liability Convention); Agreement Relating to the International Telecommunications Satellite Organisations (ITSU); and International Telecommunications

Constitution and Convention (ITU). Additionally, China is a member of the UN Committee on the Peaceful Uses of Outer Space (COPUOS) since 1981.

Being a space-faring nation, China has been active in the international debate on issues concerning space. In one of Beijing's recent official statements, Chinese Ambassador Cheng Jingye, at the Legal Subcommittee of COPUOS, reiterated China's policy of using outer space for peaceful purposes and against weaponisation. The latest space White Paper has also emphasised on the "peaceful development and peaceful exploration, exploitation and use of outer space." Cheng reiterated that the Chinese government opposes "weaponization and arms race in outer space and dedicates itself actively to the effort of maintaining peace and security in outer space. China continues to believe that elaborating relevant international legal instruments through negotiation is still the best option to preserve long lasting peace and security in outer space."[11]

While in certain international fora, China officially maintains a policy of peaceful use of outer space, it has sent an entirely different message in other quarters. For instance, as the European Union began bilateral dialogues with different countries on universalising a space code, China made it clear that space debris cannot be a major item in any normative exercise. Such a posturing on the part of China results in wariness among its neighbours as well as other global space powers.

While China has articulated a policy of non-weaponisation, it is a fact that there are military spin-off benefits from the advancements it has made in space because of the dual-use nature of the technology, as well as the fact that its space programme is almost entirely run by the PLA. While non-weaponisation is a point of emphasis in the Russia-China co-sponsored "Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects" (PPWT) at the Conference on Disarmament, there exists a huge lacunae given that the treaty mentions only the placement of weapons in outer space. Not mentioning the use of ground-based weapons for operations in space is significant, potentially suggesting that China wants to keep open the option of using ASAT weapons.

While China has been active on space debris mitigation efforts within the UN COPUOS and the Conference on Disarmament, it has been resistant to making debris a major issue even in a non-legally binding code of conduct on space. For instance, Ambassador Tang Guoqiang at the 46th session of COPUOS said: "As a responsible space-faring country, China supports the SDMG [Space Debris Mitigation Guidelines] recently adopted by the STSC [Scientific and Technical Subcommittee] and stands ready to continue exploring and promoting ways and means of sustainable development in the peaceful uses of OS (Outer Space)."[12] Four years later and after the missile defence test in January 2010, China has continued to argue on similar lines. For instance, Wang Qun, the Chinese Ambassador for disarmament affairs said at the First Committee of the UN General Assembly: "The outer space is a common wealth of mankind as the global public space. The permanent peace of outer space is correlated to all nations' security, development and prosperity. Safeguarding the peaceful use of outer space and preventing the weaponisation of and an arms race in outer space are common interests and obligations of all countries."[13]

However, activities of the PLA have gone on undeterred and recent advances are a reflection of this. The stated official policy continues to be one that supports the space debris mitigation guidelines and peaceful uses of outer space; however, Chinese opposition to space debris which comes out in unofficial parleys such as the EU negotiations on the Code, as mentioned earlier, reflects a different reality.

## Implications for India

Technologically, China may be far behind the US and Russia; the fact is, however, that Beijing has been making steady progress in recent years. The development of the indigenous satellite navigation system, space lab module, and the manned space docking experiments, are only some examples that highlight Beijing's continued progress in this area. These developments also highlight the growing gap between India and China, with Beijing moving closer to becoming a top-tier space power. This could have a significant impact on the balance of power between the two Asian giants.

China's growing capabilities have military and security implications for India. For instance, the Beidou navigation system is being used by the PLA to conduct operations such as border and coastal control, wherein Beidou data is being used by the troops.[14] This could further transform into becoming the backbone of Chinese military operations at a future date. The Beidou will be in a position to provide detailed coordinates and other data of troops on the ground, significantly improving operational efficiency. India should also be mindful of China's advancements in the field of satellite imagery that may be able to provide better, real-time data on Indian military installations and positioning. India should also consider that China may provide such data to Pakistan, which might prove particularly relevant during times of conflict.

China's advancement in commercial satellite launching capability is something that India should be concerned about and take corrective steps. China's ability to conduct nearly 20 launches per year, as against India's low number of four, requires focussed attention. Cost is an additional factor in which China has clear advantage.

While SBSP has remained a dream project for several countries including India and the US, China has made fast progress with plans to establish the first commercial solar power station by 2040. This will ensure China not only secure and reliable sources of energy but also technological spin-offs which would be significant. China's initiatives in this regard should be a wakeup call for many countries, including India. India should also take note of the geostrategic implications of China's space programme.

While Pakistan's space capabilities are nowhere comparable to that of India's, the fact that the former is receiving assistance from China is of immediate consequence. A repeat of what China did in the nuclear arena, providing Pakistan with assistance in nuclear design and technology, cannot be ignored.

As evident in several statements by Chinese leaders and the development plans announced periodically, China is likely to invest more resources to develop capabilities in outer space, both civilian and military. The increasing militarisation of political issues would provide Beijing a justification for its growing military space programme. An arms control measure that would bring about restraint on China, in the

form of a code or a legally binding mechanism, will be in the interest of India. India as an established space power should take the lead in Asia and abroad in developing a consensus on this issue.

While India has many programmes similar to those of China, including military communications and manned space flights, its programmes continue to be subcritical in nature and the resources are spread too thin to be effective. Instead of adopting a knee-jerk reaction to developments on the Chinese side and attempting to catch up with China, India needs to prioritise and develop capabilities from a commercial and national security perspective. As noted recently by former President and former scientific advisor to the Prime Minister, Dr. A.P.J. Adbul Kalam, India has to shed the "fifth nation" syndrome and aim for the number one slot in selective fields including space. India also needs to be mindful of the benefits of issuing a white paper on space outlining its long-term aims and objectives, in both commercial and military space domains. This would bring about the much-needed clarity and prioritization in the space domain and additionally open up avenues for international cooperation.

Lastly, while India's space programme has come a long way in terms of its technological prowess, with its utilities applicable including in the military domain, the priorities and directions have been so far set forth largely by the scientific bureaucracy. Neither the UPA nor its predecessor, the NDA government, had lent political leadership to India's space programme. This approach needs to change if India has to develop a vibrant programme that best secures its national interests in the backdrop of newer challenges.

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