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Asia in Orbit

Asian Cooperation in Space

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Since the launch of the first Chinese astronaut (*yuhangyuan*) into space in 2003, the Western media no longer questions the importance of the Chinese space program. Instead, the Chinese space program is seen as a global actor in competition with preeminent space powers. Subsequent achievements have reinforced this perception, including the launch of a probe to the Moon and the destruction of a weather satellite (Feng Yun-1C) by an anti-satellite interceptor. They have also renewed concerns about the weaponization of space. The Chinese space program has come to constitute one element of a broad conversation about the political, economic, and technological impacts of China's growing prominence in the international community.

One aspect of the Chinese space program that has escaped careful scrutiny from the mass media is its increasing influence on the space aspirations of developing countries. In the spring of 2007, the Chinese designed and launched a satellite for Nigeria, demonstrating the use of space technology as a means to exert soft power abroad. In reporting the story, *The New York Times* noted that Beijing is attempting to position itself as a "benefactor" to the developing world, particularly those countries with natural resources it covets.[1] Nations that

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either lack the capacity to develop satellite technology or are spurned by Western companies and agencies, because of such barriers to cooperation as politics or corruption, have recently avoided American and European firms in favor of seeking out Asian assistance. They particularly look to three nations that can competently and reliably deliver satellites to the Earth's orbit: China, India, and Japan.

China has carved out a dominant position in the industry by offering space technologies and services to developing nations. It has also made the Asia-Pacific Space Cooperation Organization (APSCO) its principal vehicle for regional cooperation. APSCO comprises nine nations: Bangladesh, China, Indonesia, Iran, Mongolia, Pakistan, Peru, Thailand, and Turkey. APSCO has not yet gained much publicity, but in the long-run it may prove one of China's most enduring and influential creations. Although small compared to established international cooperative bodies, such as the European Space Agency, APSCO has already established a viable network among developing countries interested in the uses of space technology.

The history and nature of APSCO deserves attention because it illustrates one aspect of the Chinese space program's increasingly global reach. The transfer of PRC space technology to the developing world demonstrates China's global economic clout. However, those exploring the political, economic, scientific, and military dimensions of China's space program have too often overlooked the role of APSCO. The article will begin by summarizing the foundation and goals of APSCO, in order to highlight the political, technological, and regional implications of the organization in the context of China's rising status as a global space power.

APSCO Formation. APSCO harkens back to the early 1990s, coinciding with China's first overtures in the commercial satellite market. Driven by the ability of space technology to strengthen multilateral cooperation between Asia-Pacific nations, China signed a Memorandum of Understanding with Pakistan and Thailand in February 1992 to initiate the Asia-Pacific Multilateral Cooperation in Space Technology and Applications (AP-MCSTA). In December 1992 China hosted a workshop with representatives from such nations as Australia, India, Indonesia, Japan, and South Korea. China led a liaison committee that held at least seven AP-MCSTA conferences over a period of nine years, from 1994 to 2003.[2] These meetings were designed to establish an institutional mechanism that would enact specific programs within the AP-MCSTA. Finally, the Asia Pacific Space Cooperation Organization (APSCO) was formalized on 28 October 2005. Eight member states—Bangladesh, China, Indonesia, Iran, Mongolia, Pakistan, Peru, and Thailand—signed the original convention. A ninth nation, Turkey, joined on 1 June 2006.[3]

Much of APSCO's activities have involved "education and training in space technology and its applications." China has hosted training workshops for 250 participants from 30 countries focused on areas, such as "the use of satellite remote sensing data in environmental studies/protection, natural

resource exploitation," and "disaster monitoring and prevention."[4] The need for remote sensing, namely the use of imaging sensors to remotely detect, monitor, and measure natural resources, has grown more urgent due to climate change. Space-based remote sensing platforms offer a cost-effective way to observe changes on the ground. For Asian nations, the threat of typhoons, earthquakes, and floods all underscores the need for adequate disaster monitoring efforts.

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APSCO held a weeklong workshop on remote sensing in the fall of 2006. Fifteen participants attended sessions run by the Academy of Opto-Electronics, a Chinese developer of remote sensing capabilities. The instructors represented various space-related institutions, and workshops included visits to Chinese remote sensing and applications institutes under the Chinese Academy of Science.[5]

Beyond educational activities, APSCO has primarily aimed to develop and launch satellites that support the common objectives of member nations. In April 1998, China, Iran, Mongolia, Pakistan, South Korea, and Thailand signed a Memorandum of Understanding to develop a Small Multi-Mission Satellite (SMMS), which represented the first step toward initiating a concrete space project. Bangladesh joined this project in July 1999.[6] The plan involved the development of a basic modular platform, derived from a three-axis stabilized Chinese satellite bus (known as CAST-968B), which could be altered or augmented for custom missions focused on remote sensing, disaster monitoring, agricultural management, and geographic surveying. Initial discussions centered upon implementing remote sensing and disaster management in two phases. The first phase includes two initial optical imaging satellites and one synthetic aperture radar (SAR)-equipped satellite. The phase two satellites would comprise four optical imaging and four SAR-equipped satellites.[7] Each satellite would use Chinese launch vehicles.

The degree to which member nations are facilitating hardware development remains unclear. Some nations are helping to develop the SMMS bus, while others are developing imaging systems.[8]

Chinese Motivations. The projection of Chinese "soft power" is undoubtedly one of the principal motivations behind China's involvement with APSCO. "Soft power" is what Joseph Nye has called "the ability to get what you want through attraction rather than coercion or payments."[9] The Chinese space program represents a small yet crucial element of growing Chinese influence in the developing world, as the PRC seeks to burnish its image as a global power.[10]

Beyond the projection of "soft power," competition serves as a motivating factor for China. The media paid great attention to the 2007-2008 "Asian space race," in which China, Japan, and India launched probes to the moon in pursuit of similar goals. China competes with both India and Japan, two other great powers that have created their own multinational mechanisms like APSCO to advance international space cooperation.

India's space program, as it has matured in recent years, is now an important player in Asia and worldwide. It operates a fleet of sophisticated satellites, reliable launch vehicles, and an extensive ground infrastructure in support of a space program largely focused on developmental goals. These vehicles include the Polar Satellite Launch Vehicle (PSLV), the Geosynchronous Satellite Launch Vehicle (GSLV), and their numerous variants. Indian satellites include the multipurpose INSAT series, the remote sensing IRS Earth observation satellites, and the newer Oceansat for the study of the oceans.

Such a high degree of competence in space technology has allowed India to consider spearheading regional arrangements. In 1995 India sponsored the creation of a Center for Space Science and Technology Education in Asia and the Pacific (CSSTEAP). The organization helps train scientists and engineers from regional nations on the operation of space systems, particularly those related to remote sensing and meteorology. Unlike APSCO, this center is affiliated with the United Nations, thus giving it some international legitimacy that APSCO lacks. Like APSCO, however, it provides training seminars and courses to representatives of fifteen nations. Only three of these fifteen also belong to APSCO, namely Indonesia, Mongolia, and Thailand.

Iranian Motivations. Iranian space development goals highlight the different motivations behind APSCO membership. Iranian actions have drawn the most scrutiny, as the West is concerned over the transfer of sensitive Chinese missile and space technology to the Iranians for use in military programs. Western nations have previously accused the Chinese of transferring critical technologies to the Iranians, specifically missile components and technical information. The U.S. government placed one Chinese vendor onto its list of institutions penalized for engaging in proliferation.[11] Although the United States removed the vendor from the list in 2008, this issue has remained sensitive, prompting the Chinese to place strict controls on the transfer of sensitive and/or advanced technology in the APSCO convention.[12]

One cannot discount technology transfer as a potential motivating factor for accession to APSCO. Countries, such as Iran and Pakistan, are "threshold" nations in space activities but also pose possible security risks. The Iranian space program has clearly benefited from help beyond its APSCO membership, particularly from Russia, India, Italy, and North Korea.[13] There is thus far no firm evidence to suggest that nations have used APSCO as a mechanism for technology transfer.[14] At the same time, one can surmise that Iranian investment into developing instruments for the SMMS project

somehow benefits indigenous satellite system development. The main Iranian contributions to SMMS include two sets of low-resolution multispectral CCD cameras for the first satellite, as well as telemetry, tracking, and control equipment.[15] Iran's contribution constitutes about $6.5 million out of a total of $44 million expenditure slated for the first SMMS vehicle.[16]

Iran has multiple motivations for participating in APSCO, and official Iranian statements have portrayed the organization positively. Parviz Tarikhi, a senior official at the Iranian Space Agency, sees APSCO as an important vehicle for a pan-Asian presence in space activities. He notes that APSCO could successfully function "like the European Space Agency" and reap potentially large financial benefits for member states. He also comments that if the "big players"—China, India, Japan, and Australia—cooperate with emerging powers—South Korea, Thailand, Pakistan, and Iran—"and pool their potential and their capabilities," then "they will save a lot of time and money while benefiting greatly from the collective synergy and outcome."[17]

Aside from China, Iran possesses the greatest competence in space research out of the eight member countries involved in APSCO. Iran demonstrated its abilities in February 2009 when the Iranian Space Agency used a *Safir-2* rocket to launch a satellite known as *Omid* (Hope) into the earth's orbit. It was the ninth nation or international agency globally to acquire that capability.

The Iranian Space Agency has announced plans for six new satellite projects, and even a human spaceflight program in the distant future. Achieving these ambitious goals would require not only firm political commitment from the Iranian government, but also key cooperative agreements that would facilitate the transfer of technologies. Given its pariah status in the Western world, it would behoove Iran to embrace a cooperative venture under China's aegis to expand its competence in space activities. Given the blurry nature of dual-use technologies, especially in terms of remote sensing, one can expect that these technologies would have uses beyond SMMS missions. Tarikhi explicitly mentions that in developing the CCD sensor for the first SMMS, "some of the technologies used to develop the device have enhanced Iran's long-term sensor design and manufacturing capabilities."[18]

Bangladeshi Motivations. APSCO membership also provides benefits to less developed nations. Building upon the experience of handling ground data from National Aeronautics and Space Administration (NASA) remote sensing satellites, the Bangladeshi government established the Bangladesh Space Research and Remote Sensing Organization (SPARRSO) in 1980. Since then, it has acquired a significant level of competence in receiving, managing, analyzing, and making use of remote sensing and meteorological data from international satellites. The primary goal of SPARRSO is to "apply space and remote sensing technology for surveying natural resources and monitoring the environmental and natural hazards in the country for attaining sustainable development." With a miniscule budget (roughly $450,000

during 2006-2007) and a small workforce (approximately 150 researchers), it continues to accomplish remarkably effective work on agricultural research, disaster monitoring, environmental studies, GIS applications, forestry, fisheries, water resources, and oceanography. Bangladesh is beset by natural disasters year after year. However, due largely to SPARRSO, the country possesses an exemplary disaster management system and trains other developing nations for disaster preparedness.[19] Given that a lack of funding has always limited SPARRSO's work, Bangladesh has depended upon outside assistance for much of its training and research. The entirety of its space-based information comes from NASA, Chinese satellites, and Japanese satellites.

APSCO provides an essential vehicle for the continuing expansion of Bangladeshi space activities, despite chronic budget shortfalls. Three goals drove Bangladesh's interest in APSCO: the need to develop and expand ground infrastructure, the need to optimize the application of remote sensing and disaster monitoring data, and the need to train its personnel in various fields of space science and application. APSCO effectively provides an institutional mechanism for all of these goals. In the short-term, it is unlikely that Bangladesh will participate in the development of satellite instrumentation. However, in the long-term, it is possible that APSCO will proceed in a fashion similar to Thailand, Pakistan, and other APSCO members that are developing in-space hardware.

One can also examine Bangladesh's involvement in APSCO within the broader context of South Asian space activities. One might expect that the common geographical, meteorological, and agricultural concerns of the South Asian nations—India, Pakistan, Bangladesh, Nepal, Sri Lanka, Bhutan, and the Maldives—might have generated a common mechanism for space research in the region. This has not occurred, given enduring tensions between India and Pakistan. The South Asian Association for Regional Cooperation (SAARC) has a disaster management center based in New Delhi, which has slowly gained some legitimacy through a series of important joint workshops. However, its activities are not well-integrated with the respective South Asian space programs.

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Neither Bangladesh nor Pakistan has any bilateral agreement on space research with India due to political, economic, and strategic factors. They have chosen to ally themselves with other powers, particularly China and Japan. Both Pakistan and Bangladesh, for example, are members of the China-led APSCO and the Japan-led Asian-Pacific Space Agency Forum

(APRSAF), but neither are signatories to the India-led CSSTEAP. These competing South Asian organizations represent a kind of factionalism that has migrated from the political to the scientific arena.

Space Techology Globalization. The launch of the first Chinese SMMS satellite was shrouded in confusion and mystery. On 6 September 2008 the PRC used a CZ-2C (or Long March-2C) rocket to launch two satellites into orbit from its Taiyuan Satellite Launch Center in Shanxi Province. Official Chinese statements noted that the two satellites, *Huanjing-1A* and *Huanjing-1B*, were designed to "monitor the environment and natural disasters" and "enhance the country's capacity to forecast natural disasters." Surprisingly, the Chinese media underplayed the satellite's international role, instead focusing solely on its role in domestic disaster prediction and monitoring. To carry out their mission, each satellite carried "state-of-the-art imaging systems and infrared cameras" to "provide a global scan every two days."[20] Each 470 kilogram satellite bore two charge-couple device (CCD) cameras with 30-meter resolution and 720-kilometer swath. *Huanjing-1A* also carried an imaging multispectral (visible and infrared) radiometer with a spatial resolution of 100 meters, while *Huanjing-1B* carried an infrared camera with a maximum resolution of about 150 meters.[21]

An official APSCO publication clarified some of the confusion, noting that the original SMMS project was "delayed because of . . . funds and technology" and that "in 2002, China independently invested and developed Environment and Natural Monitoring Satellites A and B [i.e., *Huanjing-1A* and *Huanjing-1B*] based on domestic application, need, and planning, and made the satellite A as the SMMS satellite." This satellite, according to the statement, "carries a Ka-Band communications experimental payload developed for Thailand [by China] on its request." In addition, "30 delegates from 8 signatory states to . . . APSCO watched the dual-launch of [the satellites from] Taiyuan . . . on September 5-6, 2008."[22] After the launch, Chinese Vice Premier Hui Linagyu sent a congratulatory note to the satellite developers, stating that the satellites would provide an important means for China to forecast and assess natural disasters. He never mentioned APSCO, Thailand, or the SMMS.[23] Similarly, when the satellites were declared operational in March 2009, the China Academy of Space Technology (CAST), which developed both spacecrafts, made no mention of either APSCO or SMMS, noting only that the Chinese Ministry of Civil Affairs and Ministry of Environmental Protection would receive data from the satellites.[24]

Conversely, Iranian and Thai press reports seemed to suggest Iran's deep involvement in developing the satellite hardware. After the Chinese launch, Iranian Telecommunications Minister Mohammed Soleimani announced that the satellite, presumably *Huanjing-1A*, was a joint research satellite of China, Iran, and Thailand and that "the three countries had worked together on the satellite which . . . was equipped with cameras."[25] A separate claim in the Thai press, quoting the Information and Communications Technology Minister Mun Patanotai, noted that this

satellite was the long-awaited SMMS mission developed largely by Thailand and Iran but also involving China, Pakistan, Mongolia, Bangladesh, and South Korea.[26] Thai scientists had evidently helped build the Ka-Band Experimental System (KABES) for the SMMS.

As the SMMS satellite launch illustrates, APSCO's emergence represents an important development in the globalization of space technology. From China's perspective, the organization is an effective way to expand its use of "soft power" into the developing world. APSCO's framework enables it to establish close ties to developing markets and underscores the regional authority and prestige of Chinese science and technology. There are a host of strategic considerations at play as well. The existence of parallel and somewhat overlapping organizational mechanisms led by Japan and India, and Chinese sensitivity to cooperation with these mechanisms, suggest that China's continuing commitment to APSCO is intertwined with larger issues of political and economic influence in Asia. At this point, APSCO has a far bigger profile than its competitors, partly because it is the only one of these multilateral organizations that advocates the creation of actual space technology. The others are directed only towards training and data use. APSCO's avowed goal of creating a series of SMMS under cooperative agreements suggests a model that may eventually echo that of the European Space Agency rather than the many UN-based data-sharing agencies that currently facilitate space cooperation on an international level.

For its member nations, APSCO possesses no unifying mandate. Some nations, such as Iran and Pakistan, see it as a means to master the development of complex space technologies that would undoubtedly benefit their own domestic space programs. Notwithstanding APSCO's claim that it enforces strict rules on technology transfer, the use of transferred technology for military and intelligence applications is not altogether impossible and, in fact, quite likely. Other less developed countries find APSCO beneficial because they lack the resources to effectively use data from space-based systems. Bangladesh and other nations have also found Chinese propositions attractive because the opportunity costs of cooperating with India outweigh the cultural affinities that tie South Asian nations together. In this respect, one might also perceive China's leadership of APSCO as strategic jockeying for influence on the Asian stage, rather than the global one.

Overall, APSCO represents a set of fresh challenges. For China, it is but one aspect of its growing global reach and influence in scientific and technical matters. It is undoubtedly a vehicle to advance Chinese national and strategic interests, both through the projection of "soft power" and through the construction of an international image as a space power deeply interested in peaceful cooperation. For its member states, it serves a number of different functions: APSCO is a useful forum for access to high developmental technology, and it represents an effective way to acquire technical competence in sensitive areas of technology. In this sense, APSCO has potentially serious implications for technology transfer and proliferation, which will undoubtedly have repercussions in the near future.

NOTES

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