IAC—09—E8.4.9

International Space Cooperation in the Reform and Opening of China over the Past 30 Years

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I. Introduction

Space activities are complicated, with high risk and require high technologies. Thus, international cooperation is the inexorable trend in the development of space activities. The International Geophysical Year (IGY) of 1957–1958 marked the start of a cooperative and truly international effort in space activities. More than 60 states participated in the IGY, which resulted in a rapid increase in geographical studies and an invigoration of the whole field of solar–terrestrial physics. [②]Over the past half century, the international space cooperation promoted the development of space technology and international space law. Meanwhile, the improvement of international space law, especially with the adoption of Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries (hereinafter Cooperation Declaration), also further facilitated and regulated the international space cooperation.

China persistently supports activities involving the peaceful use of outer space, and maintains that international space cooperation should be promoted and strengthened on the basis of equality and mutual benefit, mutual complementarity and common development. At the Meeting Celebrating the 50th Anniversary of the China Aerospace Industry, Premier Wen Jiabao stressed that we should adhere to peaceful development and actively extend communication and cooperation in the aerospace field.[③] Since the Reform and Opening over the past thirty years, China has consistently carried out international space cooperation. Attention has been paid to inter-governmental bilateral and multilateral cooperation as well as to the cooperation with UN. Such cooperation gives boosts to the fast development of China's space activities and China now is in the rank of space powers in the world.

This paper includes three parts. The first part elaborates the fundamental

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② S. Zaman, *Building International Cooperation through ISY*, IEEE Technology and Society Magazine 1992,p.32-33.

③ Meeting Celebrating the 50th Anniversary of the Country's Aerospace Industry Held, news.xinhuanet.com/politics/2006-10/13/content_5201112.htm, viewed on February 2, 2009.

principles and policies of China's international space cooperation. The second part introduces the achievement and problems of China's international space cooperation over the past thirty years since the Reform and Opening. The third part analyzes the trend of China's international space cooperation and the measure to deal with this situation with the development of commercialization and privatization of space industry.

II. China's policies on international space cooperation

International cooperation of space activities should strictly abide the international law, including the UN Charter and Outer Space Treaty, with the purpose of the peaceful use of outer space and for the benefit of all mankind. According to the 1996 Cooperation Declaration adopted by the General Assembly of UN, the international cooperation of space activities should comply with the following principles: principle of accordance with the provisions of international law; principle for the interest of all states; principle of fair and reasonable; principle of modes that are considered most effective and appropriate; principle of taking into particular account the needs of developing countries; principle of considering the appropriate use of space applications and the potential of international cooperation; principle of strengthening the role of the Committee on the Peaceful Uses of Outer Space; and principle of wide participation. [④]

The White Papers of China's Space Activities in 2000 and 2006 both clarified the cooperation policies on China's international cooperation in space activities. The two White Papers manifested that the principles of China's space activities are consistent and stable. (1) The aim of international space cooperation is to peacefully develop and use space resources for the benefit of all mankind. (2) International space cooperation should be carried out on the basis of equality and mutual benefit, mutual complementarity and common development, and the generally accepted principles of international law. (3) The priority aim of international space cooperation is to simultaneously increase the capability of space development of all countries, particularly the developing countries, and enable all countries to enjoy the benefits of space technology. (4) Necessary measures should be adopted to protect the space environment and space resources in the course of international space cooperation. (5) The function of the United Nations Office of Outer Space Affairs (OOSA) should be consolidated and the outer space application programs of the United Nations should be backed up.[⑤]

The Chinese government adopted the following policies in developing international space cooperation: (1) Persisting in the independence and self-reliance policy, carrying out active and pragmatic international space cooperation to meet the needs of the national modernization drive and the demands of the domestic and international markets for space science and technology. (2) Supporting multilateral

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④ UN. Doc. A/RES/51/122: ANNEX to Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries.

⑤ Part IV of China's Space Activities in 2006, www.gov.cn/jrzg/2006-10/12/content_410811.htm, viewed on February 5, 2009.

international cooperation on the peaceful use of outer space within the framework of the United Nations. (3) Attaching importance to the Asian-Pacific regional space cooperation and supporting space cooperation in other regions of the world. (4) Attaching importance to space cooperation with both developed and developing countries. (5) Enhancing and supporting research institutions, industrial enterprises and universities and colleges to develop international space exchanges and cooperation in different forms and at different levels under the guidance of relevant state policies, laws and regulations.[6]

In the international cooperation in space activities, the Chinese government continuously renders support to international exchanges and cooperation in space technology, space application and space science, with priority given to cooperation in the following areas: (1) actively promote multilateral cooperation in space technology and its application in the Asia-Pacific region, use space technology to promote the development of regional economy as well as environment and disaster monitoring and forecasting; (2) support Chinese space enterprises to provide international commercial satellite launching services on the basis of equity, fair and mutual beneficial; (3) support the use of China's mature space technology and its application to carry out cooperation with developing countries and provide services for them on the basis of reciprocity and mutual benefit; (4) support the international communication and cooperation in the area of environmental monitoring, space environment exploration, microgravity, space physics, and space astronomy. Attention should especially be paid to the international communication and cooperation in the area of microgravity fluid physics, space materials science, space life science, and space biotechnology etc. [7]

China's international space cooperation policies indicate that the international space cooperation undertaken by the Chinese government is within the framework of international space law of UN. According to the existing international space law, the peaceful use and exploration of space resource, for the benefit of all mankind and taking necessary measures to protect space environment and resources are clearly regulated in Outer Space Treaty and Outer Space Declaration. The Chinese government also sets these provisions as the fundamental principles of China's international space cooperation.

China's international space cooperation policies also manifest that the international space cooperation of China is all-dimensional and multi-tiered. In the policies, we can see that equal attention has been paid to multilateral and bilateral cooperation as well as to cooperation with UN and regional cooperation; to cooperation with developed countries as well as that with developing countries; to intergovernmental cooperation as well as to interagency cooperation.

China's international space cooperation policies also indicate that China's international space cooperation is pragmatic. In the international space cooperation, Chinese government fully recognizes that China is still a developing country. The gap of space technology between China and other space powers is obvious. Thus, China's

[6] Part IV of China's Space Activities in 2006, www.gov.cn/jrzg/2006-10/12/content_410811.htm, viewed on February 5, 2009.
[7] Part IV of China's Space Activities in 2006, www.gov.cn/jrzg/2006-10/12/content_410811.htm, viewed on February 5, 2009.

space cooperation mainly focuses on technology field. Meanwhile, attention also has been paid to the exploration of new cooperation mode for commercialization and marketing of space activities.

III. Achievements of China's international space cooperation over the past thirty years since the Reform and Opening

Since the middle of 1970s, China has carried out international cooperation in space technology, space application and space science in different forms, which have yielded many results.

Firstly, as a member of UN and standing member of the Security Council, China attaches great importance to multilateral cooperation under the framework of UN. First, China positively carried out cooperation with UNOOSA. In June 1980, China dispatched an observer delegation to the 23rd Meeting of UN COPUOS for the first time, and on November 3, 1980, China became a member of the committee. Since then, China has participated in all the meetings of UN COPUOS and the annual meetings held by its Science, Technology and Law Sub-committee. In 1983 and 1988, China acceded to the "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies," "Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space," "Convention on International Liability for Damage Caused by Space Objects, " and "Convention on Registration of Objects Launched into Outer Space," and has strictly performed its responsibilities and obligations.

Second, China supports and has participated in the UN space applications program. Since 1988, China has provided other developing countries every year with scholarships for long-term space technology training. In 1994, together with ESCAP, China hosted in Beijing the first Asian-Pacific regional "Ministerial Conference on Space Applications for Sustainable Development in Asia and the Pacific," and the "Beijing Declaration" issued after the conference has had a far-reaching influences. In September 1999, in collaboration with the UN and ESA, the Chinese government held in Beijing the "Symposium on Promoting Sustainable Agricultural Development with Space Applications." From July to August 2000, together with the OOSA of the UN and ESCAP, relevant departments of the Chinese government opened the Short-term Training Course for Asia-Pacific Multilateral Cooperation in Space Technology and Applications. Trainees from ten developing countries in the Asia- Pacific region attended the course.

Third, the issue of space debris is a big challenge to further expansion of space activities. The relevant departments of China pay great attention to the problem, and have carried out research on this issue with related countries since the beginning of the 1980s. In June 1995, CNSA acceded to the Inter-Agency Space Debris Coordination Committee. China will continuously make efforts to explore, together with other countries, ways and means to mitigate and reduce space debris, and promote international cooperation on this issue. In the COPUOS, China actively

promoted the establishment of space debris working group and the draft of Space Debris Mitigation Guidelines. In June 2007, China supported the adoption of the Guidelines submitted by the Scientific and Technical Subcommittee.

In addition, China has participated in multilateral cooperative projects, such as "Committee on Earth Observation Satellites," "World Weather Monitoring," "UN Decade of Disaster Mitigation, "and "International Solar-Terrestrial Physics."

Finally, the Chinese government also positively supports non-governmental multilateral cooperation in terms of supporting non-governmental agencies to carry out academic cooperation with International Astronautical Federation and International Institute of Space Law. In 2004, Space Law Conference was held in Beijing by China Institute of Space Law and International Institute of Space Law.

Secondly, the Chinese government always takes bilateral cooperation as the main form of China's international space cooperation. Since 1985, China has successively signed inter-governmental or inter-agency cooperative agreements, protocols or memorandums, and established long-term cooperative relations with a dozen countries, including the United States, Italy, Germany, Britain, France, Japan, Sweden, Argentina, Brazil, Russia, Ukraine and Chile. Bilateral space cooperation is implemented in various forms, from making reciprocal space programs and exchanges of scholars and specialists, and sponsoring symposiums, to jointly developing satellite or satellite parts, and providing satellite piggyback service and commercial launching service.

In the aspect of cooperation with developed countries, in 1993, a Sino-German joint venture - EurasSpace GmbH - was established, and a contract on the development and manufacture of Sinosat-1 was signed with DASA and Aerospeciale in 1995. Sinosat-1, which was successfully launched in 1998, was the first cooperative project on satellite development between the Chinese and European aerospace industries. On March 26, 2007, witnessed by the Presidents of both countries, the administrator of China National Space Administration and the head of the Russian Space Agency signed the "Cooperative Agreement between the China National Space Administration and the Russian Space Agency on joint Chinese-Russian exploration of Mars". It determines that both countries will jointly carry out exploration on Mars and its satellite in 2009.

Besides, China has some cooperative discussion with America on moon exploration and earth science. In September 2006, Griffin, head of NASA visited China and the cooperation between the two parties is still under discussion. But in the area of international space law, China and USA signed three agreements, namely the Memorandum of Agreement on Satellite Technology Safeguards, Memorandum of Agreement on PRC commercial launch services; Memorandum of Agreement on Liability for Satellite Launches; Memorandum of Agreement Regarding International Trade in Commercial Launch Services. These agreements provided legal basis for the access of China's rocket into the international market.

In the aspect of cooperation with developing countries, the collaboration between China and Brazil on the project of an earth resources satellite has set a good model for the developing countries in South-South Cooperation in the space technology field.

The cooperation between China and Brazil began with the China-Brazil Earth Resources Satellite program. Later, both parties signed the Protocol on Research and Production of the Earth Resource Satellite in 1988. The first such satellite was successfully launched by China on October 14, 1999. In addition to cooperation on complete satellites, China and Brazil are cooperating in the areas of satellite technology, satellite application and satellite components. After 15 years' cooperation, the Chinese and Brazilian governments signed supplementary protocols on the joint research and manufacturing of satellites 02B, 03 and 04 to further the cooperation between the two countries. Besides the research and manufacturing of the second generation of China-Brazil Resources Satellites, the two parties will examine the feasibility of jointly research and manufacturing of a geo-stationary meteorology and communication satellite, and will cooperation in the commercialization of space industry. CNSA handed over the CBERS-02B to Brazil on January 24, 2008. [8]

Besides, China also has cooperation with Nigeria and Venezuela. In May, 2007, China successfully exported NIGCOMSAT-1, a civil communication satellite to Nigeria and launched it into outer space. It marked that the package commercial satellite service supported by rockets, satellites and ground launch provided for international customers came to a successful conclusion. The official in-orbit delivery of Venezuela 1 Telecom Satellite and related ground measure and control system by China to Venezuela took place on January 11, 2009. It marked the success of complete satellite export by China to Venezuela. China not only carried out successful space cooperation with Venezuela, but also trained space technology staffs for Venezuela. [9]

Thirdly, regional space cooperation has been promoted. On the one hand, China attaches great importance to space cooperation in the Asia-Pacific region. In 1992, China, Thailand, Pakistan and some other countries jointly sponsored the "Asian-Pacific Multilateral Space Technology Cooperation Symposium" and advocated to establish an Asia-Pacific Multilateral Space Cooperation Organization. In 2001, the preparatory work for the establishment of Asia-Pacific Space Cooperation Organization was initiated. On October 28, 2005 the signing ceremony of the Asia-Pacific Space Cooperation Organization (APSCO) Convention was held in Beijing, and APSCO was officially established on December 16, 2008. There are seven member states of APSCO, namely China, Bangladesh, Iran, Mongolia, Pakistan, Peru and Thailand. Indonesia and Turkey are the Signatory States of APSCO. The objective of the organization is to promote the multilateral cooperation of member states in space science, technology and its application, as well as to assist member states in such areas as space technological research and development, applications and training. The establishment of APSCO promoted the development of space technology and its application in Asia-Pacific region and is a successful example of China's space cooperation in Asia-Pacific region. [10]

On the other hand, China actively carried out cooperation with ESA. The

[8] Handover of CBERS-02B to Brazil, http://www.cnsa.gov.cn/n615708/n620168/n2259528/167288.html, viewed on February 2, 2009.
[9] In-orbit delivery of Venezuela Telecom Satellite, http://www.cnsa.gov.cn/n615708/n620172/n677078/n751578/167206.html,, viewed on February 2, 2009.
[10] Inauguration of APSCO, http://cpc.people.com.cn/GB/64093/64094/8530503.html , viewed on February 2, 2009.

cooperation of the Double Satellite Plan and the Cluster Plan completed the world's first joint, synchronous six-point exploration of the Earth's space. This is the first cooperation program between China and ESA on space science exploration. Later, both parties implemented the "Dragon Program". On May 24, 2007 the first meeting between China and the Space Cooperation Steering Committee of European Space Agency (ESA) was held in headquarter of ESA, which is located in Paris. Both sides signed China-EU Space Cooperation Actuality and Cooperative Plan Protocol, which stipulates distinctly the fields and direction of cooperation between both sides, and established four work groups, i.e. Science and Exploration Work Group, Microgravity Work Group, Education Work Group, and Earth Observation Work Group. Additionally, both sides reached an agreement upon the protocol on surface supporting for Chang'e-1 Satellite, and agreed to accelerate wider and further space cooperation between the European and China through complementing one another with the advantages each possesses.[11]

The reason for international space cooperation is that space activities require high technology and high investment. Thus, the main objective of international space cooperation is to develop space technology and space capability, and to solve the financial matter through space cooperation or commercialization. On this point, the practice of China's international space cooperation indicates that China has made great achievements.

Firstly, while promoting the application of space technology in developing countries through international space cooperation, China also benefits from the cooperation. After the Wenchuan earthquake disaster, Japanese Space Agency provided us the Radar Satellite Image of disaster area taken by Japan ALOS Remote Sensing Satellite.

Secondly, China found out a cooperation pattern suited to China's situation. When collaborating with developing country - Brazil, China successfully found a South-South cooperation pattern with developing countries. Under the framework of APSCO, China progressively explores and summarizes a new mode and mechanism for regional space cooperation.

Thirdly, in international space cooperation, China progressively finds out a new mode for commercialization of China's space activities. In the 2002 Protocol between China and Brazil, both parties agreed to share the benefit of satellite. The issue of Intellectual property rights protection, trade issues concerning satellite launches and flight insurance in space cooperation are regulated in the protocol.

IV. Some Problems of China's international space cooperation and China's measures for the problems

Though China has made great achievements in satellite export, space technology and space commercialization over the past thirty years, the practice of China's international space cooperation indicates that many aspects need to be improved.

[11] China-EU Space Agreement Signed for Further Cooperation, http://www.cnsa.gov.cn/n615709/n620682/n639462/102448.html , viewed on February 2, 2009.

Firstly, the cooperation mechanism of China's international space cooperation needs to be improved. In the bilateral cooperation mechanism, China and Brazil established regulations on benefit sharing and intellectual property protection in the 2002 Protocol, these regulations are quite principle and need to be improved. [12]

In the construction of regional cooperation mechanism, though the APSCO Convention made regulations on financial arrangement, IPR and disputes settlement, as a newly established organization, its cooperation mechanism needs to be improved in practice.

Secondly, the scope of China's international space cooperation needs to be expanded, especially in the area of cooperation with space powers. On the one hand, the cooperation area needs to be expanded as most of China's space cooperation is short term research cooperation and launch cooperation. The practice of China's international space cooperation over the past thirty years since the reform and opening indicates that China's space cooperation mainly focuses on commercial launch of satellites, cooperation on commercial satellite and regional exchange on space technology. The cooperation of joint business operation has not been started. Even in the cooperative research area, the cooperation is limited in satellite research technology, the transfer and import of other technology and the cooperation in legal field are still in the early stage of development.

On the other hand, most partners of China's space cooperation are such developing countries as Nigeria, Venezuela, etc. The cooperation with space powers such as USA, France, and Japan is not enough. Even under the framework of APSCO, USA, Japan and India are not included in the cooperation scope. Thus the effect of this organization's cooperation is quite limited.

For these reasons, during the international space cooperation in the future, China should improve the cooperation policies and mechanism in the following aspects.

Firstly, in the improvement of China's space policies, we should locate the international space cooperation to improve the development of space technology, to gain great economic benefit and safeguard national security. Space activities are originally for military purposes. Thus, an important objective of a country's space technology and cooperation is to maintain national security. Part 8 of the new US National Space Policy issued by the White House on October 6, 2006 manifests that the United States Government will pursue, as appropriate, and consistent with U.S. national security interests, international cooperation with foreign nations and/or consortia on space activities that are of mutual benefit and that further the peaceful exploration and use of space, as well as to advance national security, homeland security, and foreign policy objectives.[13] This policy clearly set national security and interests as the main objective of international space cooperation.

With the commercialization and privatization of space activities, international space cooperation should pay more attention to enhance the development of space technology and national economy. The new space policy of USA also sets the

[12] Zhao Yun, Commercialization of Space and New Development of Space Law, Intellectual Property Press, 2008, p. 209,210.

[13] US announced new space policies, http://www.cnsa.gov.cn/n615708/n620172/n620646/n661309/152851.html, viewed on February 6, 2009.

improvement of US economy competitive power as the primary objective of US space activities. Article 6 of Japan's Basic Space Law adopted in 2008 also indicated that the international space cooperation of Japan should actively promote international cooperation in the field of Space Development and Utilization, and promote diplomatic activities in the field of Space Development and Utilization, play an active role in international society through space development and utilization and contribute to the chance of benefit maintenance in international society. From this point, we can see that benefit maintenance is the main objective of Japanese international space cooperation.

Therefore, in China's future international space cooperation, it is necessary to strengthen the cooperation with developing countries. But such cooperation is supportive and for the requirement of supporting national diplomatic policies. The main value of international space cooperation should be to improve space technology, to benefit national economy and safeguard national security.

Secondly, the mode of international space cooperation should be improved and its field be expanded to promote China's international space cooperation heading toward cooperative business operation and research. After the cold war, the international space cooperation is no longer limited to technological issues. The main objective of cooperation turned to exploit market for space product. Thus, cooperative business operation and cooperative exploration become more and more important. The transfer of space technology from military use to civil and commercial use is a vital method to space industry's long-term development. In this way, while gaining sufficient financial support, this industry can apply advanced technology to social production and civil life. USA, Russia, Europe and Japan all take international cooperation as an important method to promote the civil and commercial use of space industry.

At present, the mode of China's international space cooperation is program cooperation. Thus, in the future, efforts should be made to explore the cooperation mode of joint business operation and accelerate the pace of commercialization of our space industry through joint business operation.

Thirdly, space industrial group should play a more important role in international space cooperation. The features of space technology industry are as follows: developing very fast, upgrading fast, exploration and research fees are quite high, risk is very high. And space countries have their own strong point. Thus, establishing large multinational space industrial group can reduce the risk, gain more profit, and is beneficial to utilize and introduce advanced technology and the access of space products into international market.

Large transnational space industrial group has been an important cooperation model in international space cooperation. For example, Russia and USA established a joint venture LKEI, using Russian Proton Rocket to provide launch service for other countries and multinational corporation. Its clients include such famous corporation or multinational company as US Hughes Co., Motorola, Pan-American, private international communication companies, etc. Russia and German also established Eurockot to carry out Rockot Program and launch middle and small sized satellites.

Though China set up a joint venture with German in 1993, it is still far from the purpose of introducing finance and technology, and of seizing international space market. Therefore, in the future, the role of space industrial group in international space cooperation should be strengthened.

Through the cooperation of space industry with space powers, we can solve the problem of high investment and reduce the risk. We can also promote the pace of commercialization of space industry through international cooperation and get chance to access the international market.

Fourth, the management mechanism of China's international space cooperation should be improved. The penetration of international space cooperation demands a scientific management mechanism. Major space powers all set up international space cooperation agencies to strengthen international space cooperation. Early in 1989, USA established a space council headed by Vice President to elaborate, amend and implement space policies of USA and supervise the enforcement of those policies by related agencies, to coordinate the space policies and activities of the Department of National Defense, NASA, and commercial space agencies, to coordinate with other states on space technology. [14]According to Japan's Basic Space Law, Japan also established a strategy department for space exploration to formulate space exploration program and policies to promote international cooperation in space technology.

In 1993, China also established CNSA to manage space industries and keep their stable, orderly, health and coordinated development, and to carry out international exchange and cooperation on behalf of Chinese governmental organization or leaders. [15]Since China has no Space Law to regulate its space activities, the coordination of domestic agencies and departments as well as the relationship with the Department of Foreign Affairs and the Bureau of Technology and Industry for National Defense in international space cooperation should be clarified through the international cooperation management mechanism and national legislation.

V. Conclusion

Since the Reform and Opening in China over the thirty years, China has established fundamental principles and policies confirming to China's situation on international space cooperation. China actively participated in international space cooperation under the framework of UN and set an example for South-South Space Cooperation among developing countries. China also established a model for regional space cooperation.

However, the mechanism and scope of China's international space cooperation need to be further improved and expanded. On the one hand, the cooperation area needs to be expanded as most of China's space cooperation is short term research cooperation and launch cooperation. On the other hand, most partners of China's space cooperation are such developing countries, China need to expend the cooperation with space powers.

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[14] Li Zhiqiang, Li Chuanbao, Lin Di, Analysis on Policies of Foreign Countries on International Cooperation in Space Technology and its Revelation to China. Science & Technology Progress and Policy, Oct. 2004.

[15] Function of CNSA, http://www.cnsa.gov.cn/n615708/n620168/n620175/index.html, viewed on February 6, 2009.

At the same time, in order to promote China's international space cooperation, China should improve the national space cooperation policies, expanded the mode and area of international space cooperation, fully play the role of large scale space industry in such cooperation, and perfect the management mechanism of international space cooperation.