



Full Text: China's Space Program: A 2021 Per

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BEIJING — The State Council Information Office of the People's Republic of China published a white paper "Space Program: A 2021 Perspective" on Jan 28.

Following is the full text of the white paper:

China's Space Program: A 2021 Perspective

The State Council Information Office of the People's Republic of China

January 2022

Preamble

"To explore the vast cosmos, develop the space industry and build China into a space power is our eternal dream of President Xi Jinping. The space industry is a critical element of the overall national strategy, and China upholds the principle of peaceful exploration and utilization of outer space for peaceful purposes.

Since 2016, China's space industry has made rapid and innovative progress, manifested by a steady improvement in space infrastructure, the completion and operation of the BeiDou Navigation Satellite System, the completion of the earth observation system, steady improvement of the service ability of satellite communications and broad conclusion of the last step of the three-step lunar exploration program ("orbit, land, and return"), the first construction of the space station, and a smooth interplanetary voyage and landing beyond the earth-moon system by Tianwen-1 for the exploration of Mars. These achievements have attracted worldwide attention.

In the next five years, China will integrate space science, technology and applications while pursuing the new development philosophy, building a new development model and meeting the requirements for high-quality development on a new journey towards a space power. The space industry will contribute more to China's growth as a whole, and common effort with regard to outer space exploration and utilization, and to human progress.

We are publishing this white paper to offer a brief introduction to China's major achievements in this field and its main tasks in the next five years, in order to help the international community better understand China's space program.

I. A New Journey Towards a Strong Space Presence

1. Mission

The mission of China's space program is: to explore outer space to expand humanity's understanding of the cosmos; to facilitate global consensus on our shared responsibility in utilizing outer space for peaceful purposes; to safeguard its security for the benefit of all humanity; to meet the demands of economic, scientific and technological development, national security and social progress; and to raise the scientific and cultural levels of the Chinese people, protect China's national rights and interests, and build up its overall strength.

2. Vision

China aims to strengthen its space presence in an all-round manner: to enhance its capacity to better understand, access, efficiently use, and effectively manage space; to defend national security, lead self-reliance and self-strengthening efforts in science and technology, and promote high-quality economic and social development; to advocate peaceful governance of outer space, and pioneer human progress; and to make a positive contribution to China's socialist modernization and to peace and progress for all humanity.

3. Principles

China's space industry is subject to and serves the overall national strategy. China adheres to the principles of innovation-driven, coordinated, efficient, and peaceful progress based on cooperation and sharing to ensure a high-quality space industry.

- Innovation-driven development

China puts innovation at the core of its space industry. It boosts state strategic scientific and technological innovation, implements major space programs, strengthens original innovation, optimizes the environment for innovation, achieves industrial production as early as possible, and grows China's independent capacity to develop a space industry.

- Coordination and efficiency

China adopts a holistic approach in building its space industry. It mobilizes and guides different sectors to contribute to this key industry, and coordinates all relevant activities under an overall plan. It ensures that the government plays a greater role in promoting and guiding space science and applications, and it facilitates the growth of new forms of business for the industry. These measures aim to raise the quality and overall performance of China's space industry.

- For peaceful purposes

China has always advocated the use of outer space for peaceful purposes, and opposes any attempt to turn outer space into a weapon or battlefield or launch an arms race in outer space. China develops and utilizes space resources in a peaceful manner and takes effective measures to protect the space environment, ensures that space remains peaceful and clean, and ensures that its space activities benefit humanity.

- Cooperation and sharing

China always combines independence and self-reliance with opening to the outside world. It actively engages in international exchanges and cooperation, and expands global public services for space technology and products. China takes an active part in solving major challenges facing humanity, helps to realize the goals of the United Nations 2030 Agenda for Sustainable Development, and facilitates global consensus and common effort with regard to outer space exploration and utilization.

II. Development of Space Technology and Systems

China's space industry serves its major strategic needs, and targets cutting-edge technology that leads the way by the major space projects, the country has accelerated research into core technologies, stepped up their efforts and redoubled its efforts to develop space technology and systems. As a result, China's capacity to enter and return to space and its ability to engage in space exploration, utilization and governance have grown markedly along a sustained path.

1. Space Transport System

From 2016 to December 2021, 207 launch missions were completed, including 183 by the Long March carrier rockets. The total launch attempts exceeded 400.

The Long March carrier rockets are being upgraded towards non-toxic and pollution-free launch, and they are smarter boosted by modular technology. The Long March-5 and Long March-5B carrier rockets have been used for regular launches; Long March-8 and Long March-7A have made their maiden flights, with increased payloads.

China now provides a variety of launch vehicle services. The Long March-11 carrier rocket has achieved commercial launches from the sea; the Smart Dragon-1, Kuaizhou-1A, Hyperbola-1, CERES-1 and other commercial vehicles have been launched; successful demonstration flight tests on reusable launch vehicles have been carried out.

In the next five years, China will continue to improve the capacity and performance of its space transport system, speed up to upgrade launch vehicles. It will further expand the launch vehicle family, send into space new-generation carrier rockets and high-thrust solid-fuel carrier rockets, and speed up the R&D of heavy-lift launch vehicles to strengthen research into key technologies for reusable space transport systems, and conduct test flights in response to the growing need for regular launches, China will develop new rocket engines, combined cycle upper stage technologies to improve its capacity to enter and return from space, and make space entry and

2. Space Infrastructure

(1) Satellite remote-sensing system

The space-based section of the China High-resolution Earth Observation System has been largely complete, providing high-spatial-resolution, high-temporal-resolution and high-spectrum-resolution earth observation. China now provides land observation services, having launched the Ziyuan-3 03 earth resources satellite, the Huanjing Jianzai environmental disaster management, a high-resolution multi-mode imaging satellite, a hyper-spectral observation satellite and a number of commercial remote-sensing satellites.

In ocean observation, China is now able to view multiple indexes of contiguous waters around the globe on high-resolution images from the Haiyang-1C/1D satellites and the Haiyang-2B/2C/2D satellites.

China's ability to observe the global atmosphere has achieved a significant increase. Its new-generation Fengyun meteorological satellites in the geostationary orbit are able to perform all-weather, precise and uninterrupted monitoring and disaster monitoring to boost response capability. The successful launches of Fengyun-3D/3E provide coordinated morning, afternoon and twilight monitoring, and the Fengyun-2H satellite provides monitoring for countries and regions participating in the Belt and Road Initiative.

With further improvements to the ground system of its remote-sensing satellites, China is now able to provide satellite data receiving and quick processing services across the world.

(2) Satellite communications and broadcasting system

China has made steady progress in developing fixed communications and broadcasting satellite network, with more areas with greater capacity. The Zhongxing-6C and Zhongxing-9B satellites ensure the uninterrupted

of broadcasting and television services. The Zhongxing-16 and APSTAR-6D satellites, each with a 50Gbps capacity, that satellite communications in China have reached the stage of high-capacity service.

The mobile communications and broadcasting satellite network has expanded with the launch of the Tiantong-1 01 satellites, operating in tandem with the Tiantong-1 01 satellite, to provide voice, short message and data services to handheld terminal users in China, its neighboring areas, and certain parts of the Asia-Pacific.

The relay satellite system is being upgraded with the launch of the Tianlian-1 05 and Tianlian-2 01 satellite boost to capacity.

The satellite communications and broadcasting ground system has been improved, to form a space-ground network that provides satellite communications and broadcasting, internet, Internet of Things, and information services around the globe.

(3) Satellite navigation system

The completion and operation of the 30-satellite BeiDou Navigation Satellite System (BDS-3) represents the conclusion of the system's three-step strategy and its capacity to serve the world. BeiDou's world-leading services include positioning, navigation, timing, regional and global short-message communication, global search and rescue and satellite-based augmentation, and precise point positioning.

In the next five years, China will continue to improve its space infrastructure, and integrate remote-sensing, navigation, and positioning satellite technologies. It will:

- Upgrade its spatial information services featuring extensive connection, precise timing and positioning, and remote sensing;
- Develop satellites for geostationary microwave monitoring, new-type ocean color observation, carbon monitoring, terrestrial ecosystem, and atmospheric environmental monitoring;
- Develop dual-antenna X-band interferometric synthetic aperture radar (InSAR), land water resources and environment monitoring technology, for efficient, comprehensive earth observation and data acquisition across the globe;
- Build a satellite communications network with high and low orbit coordination, test new communications satellite commercial application, and build a second-generation data relay satellite system;
- Study and research navigation-communications integration, low-orbit augmentation and other key technologies for the next generation BeiDou Navigation Satellite System, and develop a more extensive, more integrated and smarter positioning, navigation and timing (PNT) system;
- Continue to improve the ground systems for remote-sensing, communications and navigation satellites.

3. Manned Spaceflight

The Tianzhou-1 cargo spacecraft has docked with the earth-orbiting Tiangong-2 space laboratory. With breakthrough technologies for cargo transport and in-orbit propellant replenishment, China has successfully completed the first of its manned spaceflight project.

The launch of the Tianhe core module marks a solid step in building China's space station. The Tianzhou-2 cargo spacecraft and the Shenzhou-12 and Shenzhou-13 manned spacecraft, together with the Tianhe core module they have docked, form an assembly in steady operation. Six astronauts have worked in China's space station, conducting extravehicular activities, in-orbit maintenance, and scientific experiments.

In the next five years, China will continue to implement its manned spaceflight project. It plans to:

- Launch the Wentian and Mengtian experimental modules, the Xuntian space telescope, the Shenzhou ma and the Tianzhou cargo spacecraft;
- Complete China's space station and continue operations, build a space laboratory on board, and have astr term assignments performing large-scale scientific experiments and maintenance;
- Continue studies and research on the plan for a human lunar landing, develop new-generation manned sp research key technologies to lay a foundation for exploring and developing cislunar space.

4. Deep Space Exploration

(1) Lunar exploration

Achieving relay communications through the Queqiao satellite, the Chang'e-4 lunar probe performed huma landing on the far side of the moon, and conducted roving exploration. The Chang'e-5 lunar probe brought samples from the moon, marking China's first successful extraterrestrial sampling and return, and the com step lunar exploration program of orbiting, landing and return.

(2) Planetary exploration

The Tianwen-1 Mars probe orbited and landed on Mars; the Zhurong Mars rover explored the planet and le mark there. China has achieved a leap from cislunar to interplanetary exploration.

In the next five years, China will continue with lunar and planetary exploration. It will:

- Launch the Chang'e-6 lunar probe to collect and bring back samples from the polar regions of the moon;
- Launch the Chang'e-7 lunar probe to perform a precise landing in the moon's polar regions and a hopping shadowed area;
- Complete R&D on the key technology of Chang'e-8, and work with other countries, international organiza to build an international research station on the moon;
- Launch asteroid probes to sample near-earth asteroids and probe main-belt comets;
- Complete key technological research on Mars sampling and return, exploration of the Jupiter system, and
- Study plans for boundary exploration of the solar system.

5. Space Launch Sites and Telemetry, Tracking and Command (TT&C)

(1) Space launch sites

Adaptive improvements have been completed at the Jiuquan, Taiyuan and Xichang launch sites, with new l installed at Jiuquan for the commercial launch of liquid fuel rockets, and the Wenchang Launch Site enteri has formed a launch site network covering both coastal and inland areas, high and low altitudes, and variou satisfy the launch needs of manned spaceships, space station modules, deep space probes and all kinds of s addition, its first sea launch site has begun operation.

(2) Space TT&C

China's leap from cislunar to interplanetary TT&C communications, with growing space-based TT&C capabilities, has made significant progress. Its space TT&C network has improved to form an integrated space-ground TT&C network with security, reliability, quick response, flexible access, efficient operation and diverse services. TT&C missions and Tianzhou spacecraft series, Tianhe core module, Chang'e lunar probe series, and Tianwen-1 Mars probe have been completed successfully. TT&C station networks for commercial satellites are growing quickly.

In the next five years, China will strengthen unified technical standard-setting for its space products, and

- Further adapt the existing launch site system to better serve most launch missions, and make launch sites reliable and more cost-effective to support high-intensity and diversified launch missions;
- Build commercial launch pads and launch sites to meet different commercial launch needs;
- Improve the space TT&C network in terms of organization, technology and methodology, grow the capacity to integrate space- and ground-based TT&C resources, and build a space TT&C network providing ubiquitous connections;
- Coordinate the operation and management of the national space system for greater efficiency;
- Strengthen the deep-space TT&C communications network to support missions probing the moon and Mars.

6. Experiments on New Technologies

China has launched a number of new technological test satellites, and tested new technologies such as the capabilities of new-generation communications satellites, very high throughput satellites' telecommunication payload, satellite-ground high-speed laser communications, and new electric propulsion.

In the next five years, China will focus on new technology engineering and application, conduct in-orbit tests of materials, devices and techniques, and test new technologies in these areas:

- Smart self-management of spacecraft;
- Space mission extension vehicle;
- Innovative space propulsion;
- In-orbit service and maintenance of spacecraft;
- Space debris cleaning.

7. Space Environment Governance

With a growing database, China's space debris monitoring system is becoming more capable of collision warning and event perception and response, effectively ensuring the safety of in-orbit spacecraft.

In compliance with the Space Debris Mitigation Guidelines and the Guidelines for the Long-term Sustainable Space Activities, China has applied upper stage passivation to all its carrier rockets, and completed end-of-life disposal of the Tiangong-2 and other spacecraft, making a positive contribution to mitigating space debris.

Progress has been made in the search and tracking of near-earth objects and in data analysis. A basic space environment monitoring system is now in place, capable of providing services in space climate monitoring, early warning, and forecasting, and providing broader applications.

In the next five years, China will continue to expand its space environment governance system. It will:

- Strengthen space traffic control;
- Improve its space debris monitoring system, cataloguing database, and early warning services;
- Conduct in-orbit maintenance of spacecraft, collision avoidance and control, and space debris mitigation, stable and orderly operation of the space system;
- Strengthen the protection of its space activities, assets and other interests by boosting capacity in disaster information protection, and increasing invulnerability and survivability;
- Study plans for building a near-earth object defense system, and increase the capacity of near-earth object cataloguing, early warning, and response;
- Build an integrated space-ground space climate monitoring system, and continue to improve relevant services to respond to catastrophic space climate events.

III. Developing and Expanding Space Application Industry

To serve the economy and society, China has promoted public and commercial application of its satellites and space technology, growing the industry towards greater efficiency.

1. Boosting Public Services with Satellites

The service capacity of satellite applications has markedly improved. The significant role of satellites is seen in disaster prevention and mitigation, management of emergencies, and climate change response, and also felt in social management and public services, urbanization, coordinated development, and poverty eradication. The space industry helps to improve people's lives.

The satellite remote-sensing system has been used by almost all departments at national and provincial levels for emergency monitoring of over 100 major and catastrophic natural disasters around the country. It provides services for thousands of domestic users and over 100 countries, having distributed over 100 million scenes of data.

The communications and broadcasting satellite network has made direct services available to over 140 million people in China's rural and remote areas, provided returned data for over 500 mobile phone base stations, and ensured emergency communications during the responses to the forest fire in Liangshan, Sichuan province, to the flood in Zhengzhou, Henan province and to other major disaster relief work.

The BeiDou Navigation Satellite System has guaranteed the safety of over seven million operating vehicles, positioning and short message communication services to over 40,000 seagoing fishing vessels, and offered positioning services for the freighting of supplies and tracking of individual movement for COVID-19 control and construction.

In the next five years, under the overarching goal of building a safe, healthy, beautiful and digital China, we will promote the integration of satellite application with the development of industries and regions, and space information technology generation information technology such as big data and Internet of Things. We will also extend the integrated application of remote-sensing satellite data on land, ocean and meteorology, advance the construction of infrastructure for the application of the BeiDou Navigation Satellite System, satellite communications, and the ground communication system, and improve our capacity to tailor and refine professional services. All these efforts will help to achieve the

carbon dioxide emissions and carbon neutrality, to revitalize rural areas, and to realize new-type urbanization development between regions and eco-environmental progress.

2. Space Application Industry

The commercial use of satellite technology is thriving, which expands the applications market for government and individuals. A group of competitive commercial space enterprises are emerging and realizing industrial operation. A variety of products and services such as high-accuracy maps using remote-sensing data, full data processing, and application software are improving the service to users in transport, e-commerce, traffic products, assessment of disaster losses and insurance claims, and the registration of real estate.

The ability to commercialize satellite communications and broadcasting services has further improved. Four television channels in China were launched and TV viewers now have access to over 100 HD channels. Internet is available on board ocean vessels and passenger aircraft. Tiantong-1, a satellite mobile communication system, is in commercial operation.

The satellite navigation industry has witnessed rapid growth as evidenced by sales of over 100 million chips for the BeiDou system. Its industrial applications have been widely introduced into mass consumption, the shared daily life. Achievements in space technology have helped traditional industries transform and upgrade, support industries such as new energy, new materials and environmental protection, enabled new business models in cities, smart agriculture and unmanned driving to grow, making a great contribution to building China's science and technology, manufacturing, cyberspace and transport.

In the next five years, China's space industry will seize the opportunities presented by the expanding digital and digital transformation of traditional industries, to promote the application and transfer of space technology to innovative business models and the deep integration of space application with digital economy, more efforts will expand and extend the scope for applying satellite remote-sensing and satellite communications technology to the industrialized operation of the BeiDou Navigation Satellite System. This will provide more advanced, equal quality products and convenient services for all industries and sectors and for mass consumption. New business models upscaling the space economy such as travel, biomedicine, debris removal and experiment services will be developed in the industry.

IV. Research on Space Science

China's research on space science focuses on scientific questions such as the origin and evolution of the universe and the relationship between the solar system and humanity. It has launched programs to explore space and conduct advanced research on basic theories, and incubated major research findings.

1. Research on Space Science

(1) Space astronomy

The Dark Matter Particle Explorer (DAMPE) Satellite obtained the precise measurements of the energy spectra of cosmic ray electrons, protons and the GCR helium. The Huiyan (Insight) Hard X-ray Modulation Telescope was successfully launched; it has since discovered the strongest magnetic field in the universe and obtained a panoramic view of a binary explosion process. The Xihe observation satellite was successfully launched, which obtained multiple spectroscopic images at different wavelengths in the H α waveband.

(2) Lunar and planetary science

Led by its lunar exploration program, China has achieved significant advances in the comprehensive survey of lunar geology and subsurface structure, in dating the lunar magmatic activity, and in analyzing its mineralogical and chemical elements. In planetary exploration, China has built a deeper understanding of the geological evolution of Mars, conducting analysis of its surface structure and soil and the composition of its rocks.

(3) Space earth sciences

Zhangheng-1, also known as the China Seismo-Electromagnetic Satellite, helped to obtain data on and build up the global geomagnetic field and the in situ data of ionosphere parameters. A high-precision global carbon flux monitoring satellite using the data from the Chinese Global Carbon Dioxide Monitoring Scientific Experimental Satellite, is under development.

(4) Space physics

With the help of Mozi, the world's first quantum communication satellite, China has carried out experiments based on quantum teleportation and entanglement distribution over thousand kilometers, on gravitational induced quantum entanglement, and on entanglement-based secure quantum cryptography over thousand kilometers via a trusted relay. It has also launched the Taiji-1 and Tianqin-1 satellites to support the space gravitational wave detection program.

In the next five years, China will continue with the research and development of programs such as the satellite-based gravitational wave detection, the Einstein Probe, the advanced space-based solar observatory, the panoramic view of the sun and the earth, and the high precision magnetic field measurement satellite for solar wind and magnetosphere interaction, and the high precision magnetic field measurement satellite for subjects of the extreme universe, ripples in time and space, the panoramic view of the sun and the earth, and habitable planets. China will continue to explore frontier areas and research into space astronomy, heliosphere and planetary science, space earth sciences, and space physics, to generate more original scientific findings.

2. Science Experiments in Space

With the help of the Shenzhou spacecraft series, the Tiangong-2 space laboratory, and the Shijian-10 satellite, China achieved mammalian embryonic development in space and in-orbit verification of the world's first space cell culture. This expanded the understanding of the mechanisms behind particle segregation in microgravity, pulverized material preparation, and achieved research findings in space science of international standing.

In the coming five years, China will make use of space experiment platforms such as the Tiangong space station, the lunar probe series, and the Tianwen-1 Mars probe to conduct experiments and research on biology, life, materials, to expand humanity's understanding of basic science.

V. Modernizing Space Governance

The Chinese government has been proactive in developing the space industry, through policy measures and plans for space activities. Better alignment between a well-functioning market and an enabling government, clarifying the roles of both, endeavoring to create a favorable environment for the growth of a high-quality space industry.

1. Enhancing Innovation

In order to create a new configuration in which the upper, middle and lower industrial chains are coordinated, small and medium-sized enterprises advance in an integrated way, China is building a strategic force of space technology, encouraging original innovation by research institutes and bringing together enterprises, universities and end-users in creating and applying new technologies. A technological innovation alliance is being established in key areas of space science.

A number of major space and science projects are in place to promote the leapfrog development of space science technology, which spearheads overall technical advances.

China is making forward-looking plans for strategic, fundamental and technological breakthroughs in space, integrating the application of new-generation information technology in the space sector, and accelerating application of advanced and especially revolutionary technologies.

The secondary development of space technologies will be further reinforced to put research findings into industrial application and boost the economy.

2. Strengthening Basic Industrial Capabilities

The space industry will continue to improve its integrated and open industrial system comprising system integrators, specialized contractors, market suppliers, and public service providers, and covering all links from research

To strengthen the industrial and supply chains of its space industry and transform and upgrade the basic industry, China will optimize the industrial structure and upgrade R&D, manufacturing, launch operations and services, further integrate industrialization with information technology, and build intelligent production lines and institutes.

3. Expanding Application

China will improve the policies for its satellite application industry, including coordinating public interest and demand, integrating facilities and resources, unifying data and product standards, and streamline the channel utilization. It is committed to improving satellite application services with unified standards and customized

China will move faster to grow its satellite application market, where various market entities are encouraged to add new products. By creating new application models, China is fostering a "space plus" industrial ecosystem and emerging strategic industries related to space.

4. Encouraging Commercialization

China has formulated guidelines on commercializing its space industry. It will expand the scope of government support of space products and services, grant relevant enterprises access and sharing rights to major scientific research equipment, and support these enterprises in joining the R&D of major engineering projects. It will establish market access to space activities, to ensure fair competition and the orderly entry and exit of participating enterprises.

China will optimize the distribution of the space industry in the national industrial chain, and encourage all participating enterprises to engage in satellite application and the transfer and transformation of space technology.

5. Promoting Law-Based Governance

To promote law-based governance of the space industry, China will speed up the formulation of a national space law to establish a legal system with this law at the core. This will include studying and formulating regulations on satellite navigation, strengthening the management of satellite navigation activities, revising measures for the registration of space objects, and regulating the sharing and use of space data and the licensing of civil space launches. It will also study and formulating regulations on the management of satellite frequency and orbit resources, and strengthen the coordination and registration of these resources to safeguard the country's legitimate rights and interests in space. China has strengthened research on international space law, and actively participated in formulating International Telecommunication Union standards and international rules regarding outer space, maintaining the international

outer space based on international space law, and contributing to a fair and reasonable global governance of outer space.

6. Strengthening Team-Building

China will step up its efforts to become a world center for talent and innovation in space science, and create conditions for the development of professionals and the expansion of their ranks. It will improve the personnel management mechanism - fostering a pool of strategic scientists, leading and young scientists, and teams with strong innovation and cultivating a large number of outstanding engineers, top technicians championing fine craftsmanship, and entrepreneurs with a sense of social responsibility. China will improve its personnel management mechanism to guide the rational flow of professionals. It will also upgrade incentives with greater rewards and stronger support to strengthen specialty disciplines in universities to cultivate a reserve force of aerospace personnel.

7. Promoting Space Education and Culture

China will continue to hold events to celebrate its Space Day, promote education on space knowledge and culture, and hold World Space Week and National Science and Technology Week, and through Tiangong Classroom and other means to promote the culture and spirit embodied in the development of the atomic and hydrogen bombs, missiles, satellites, manned spaceflight, lunar probes and the BeiDou Navigation Satellite System in the new era. The nation will guide the young people to develop an interest in science, to create and explore the unknown, and to disseminate scientific knowledge among the general public.

China will protect its major space heritage and build more space museums and experience parks to popularize space culture and provide education. It will encourage the creation of space-related literary and art works to promote space culture.

VI. International Cooperation

Peaceful exploration, development and utilization of outer space are rights equally enjoyed by all countries. All countries should work together to build a global community of shared future and carry out in-depth exchanges and cooperation in outer space on the basis of equality, mutual benefit, peaceful utilization, and inclusive development.

1. Basic Policies

China's basic policies on international exchanges and cooperation are as follows:

- Safeguarding the central role of the United Nations in managing outer space affairs; abiding by the Treaty of Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies; upholding the guiding role of relevant UN principles, declarations and resolutions; actively participating in international rule-making regarding outer space; and promoting greater sustainability of space activities;
- Strengthening international exchanges and cooperation on space science, technology and application; working with the international community to provide public products and services; and contributing to global efforts to address common challenges;
- Strengthening international space cooperation that is based on common goals and serves the Belt and Road Initiative, ensuring that the space industry benefits the Initiative's participating countries, especially developing countries;
- Supporting the Asia-Pacific Space Cooperation Organization (APSCO) to play an important role, and giving priority to cooperation under the BRICS and Group 20 mechanisms and within the framework of the Shanghai Cooperation Organization;

- Encouraging and endorsing the efforts of domestic research institutes, enterprises, institutions of higher learning and organizations to engage in international space exchanges and cooperation in diverse forms and at various levels with relevant policies, laws and regulations.

2. Major Achievements

Since 2016, China has signed 46 space cooperation agreements or memoranda of understanding with 19 countries and four international organizations. It has actively promoted global governance of outer space, and carried out cooperation in space science, technology and application through bilateral and multilateral mechanisms. This has yielded fruitful results.

(1) Global governance of outer space

- China participates in consultations on issues such as the long-term sustainability of outer space activities, and utilization of space resources, and the prevention of arms race in outer space. Together with other parties, it has held discussions on space exploration and innovation, and advanced the Space2030 Agenda of the UN.
- China supports the work of the Beijing office of the United Nations Platform for Space-based Information Management and Emergency Response, and has participated in the activities of the International Committee for Space-based Navigation Satellite Systems in an in-depth manner. It has joined international mechanisms such as the Space Planning Advisory Group and the International Asteroid Warning Network.
- China plays its role as the host country of APSCO, and supports the organization's Development Vision 2030.
- China has strengthened international exchanges on space debris, long-term sustainability of outer space and other issues through mechanisms such as the Space Debris Work Group of China-Russia Space Cooperation Sub-Workshop, Sino-US Expert Workshop on Space Debris and Space Flight Safety.
- China supports the activities of international organizations such as the International Telecommunication Union, Earth Observations, Inter-Agency Space Debris Coordination Committee, Consultative Committee for Space Data Systems, International Space Exploration Coordination Group, and the Interagency Operations Advisory Group.

(2) Manned spaceflight

- China has carried out gamma-ray burst polarization monitoring research with the European Space Agency, established a space laboratory, conducted human body medical research in a micro-gravitational environment with the Shenzhou-11 manned spaceflight mission, carried out joint CAVES training and maritime rescue drills with the International Astronaut Centre.
- China has completed the selection of the first batch of international space science experiments to be conducted on the Chinese space station, and conducted technological cooperation and exchanges with Germany, Italy and Russia on space science experiments and the development of space station sections.

(3) BeiDou Navigation Satellite System

- China has coordinated the development of China's BeiDou Navigation Satellite System and the United States GPS, Russia's GLONASS system, and Europe's Galileo system. It has carried out in-depth cooperation with them in the fields of compatibility, interoperability, monitoring and assessment, and joint application.
- China has pressed ahead with international standardization of the BeiDou system, which has been included in the standards systems of the International Electrotechnical Commission and many other international organizations in fields such as navigation, timing and positioning.

aviation, maritime affairs, international search and rescue, and mobile communications.

- China has increased the BeiDou system's global service capacity by establishing BeiDou cooperation for the League of Arab States and the African Union, completing the first overseas BeiDou center in Tunisia, and satellite navigation cooperation with countries such as Pakistan, Saudi Arabia, Argentina, South Africa, Alg

(4) Deep-space exploration

- China launched the international lunar research station project together with Russia, and initiated the Sir Data Center for Lunar and Deep-space Exploration. It is working with Russia to coordinate Chang'e-7's lunar exploration mission with Russia's LUNA-Resource-1 orbiter mission.

- In the Chang'e-4 lunar exploration mission China cooperated with Russia and the European Space Agency technology, and with Sweden, Germany, the Netherlands and Saudi Arabia on payloads. It has launched in onboard payload cooperation in the Chang'e-6 lunar exploration mission.

- In the Tianwen-1 mission, China's first Mars exploration project, China cooperated with the European Space Agency engineering technology, and with Austria and France on payloads. It has established a Mars probe orbit determination mechanism with the United States, and launched international onboard payload cooperation in its asteroid mission.

- In the fields of lunar and deep-space exploration, China cooperated on TT&C with the European Space Agency, Namibia, and Pakistan.

(5) Space technology

- Together with relevant partners China has developed and successfully launched the China-France Oceanic China-Brazil Earth Resources Satellite O4A, and the Ethiopian Remote-Sensing Satellite. It has launched the Satellites (SSS) for APSCO. It is jointly developing the MisrSat-2 remote-sensing satellite.

- China completed the in-orbit delivery of the Pakistan Remote-Sensing Satellite (PRSS-1), Venezuelan Remote-Sensing Satellite (VRSS-2), Sudan Remote-Sensing Satellite (SRSS-1), and the Algerian Communications Satellite (ACSAT-1).

- China has provided satellite carrying or launching services for countries including Saudi Arabia, Pakistan, Canada, and Luxembourg.

- China has conducted space product and technology cooperation with countries including Russia, Ukraine, Argentina, Pakistan, and Nigeria.

- China has helped developing countries boost their space science and research. It has built satellite research infrastructure with countries including Egypt, Pakistan and Nigeria. It has pressed ahead with the construction of the Road Initiative Space Information Corridor, and opened China's space facilities to developing countries.

(6) Space applications

- China has established an emergency support mechanism for disaster prevention and mitigation for international Fengyun meteorological satellites, and data from China's meteorological satellites have been widely used in many regions.

- China has signed cooperation agreements for the BRICS Remote-Sensing Satellite Constellation, cooperated with the European Space Agency on earth observation satellite data exchange, and built the China-ASEAN Satellite

Offshore Service Platform and the Remote-Sensing Satellite Data-Sharing Service Platform. It has worked in Thailand, Cambodia, and Myanmar to build the Lancang-Mekong Space Information Exchange Center.

- China has built satellite data receiving stations with countries including Bolivia, Indonesia, Namibia, Thailand, and Africa.
- China actively participates in the mechanism of the International Charter on Space and Major Disasters, providing remote-sensing data totaling 800 scenes and adding eight new on-duty satellites (constellations) to the satellite constellation, thereby improving the international community's capacity for disaster prevention and mitigation.
- China actively provides satellite emergency monitoring services. It has initiated emergency monitoring in major disasters in 15 countries. For instance, in response to the severe drought in Afghanistan and the dam collapse in 2018, and to the cyclone that struck Mozambique in 2019, it provided monitoring services for the authorities in these countries.
- China released its GEO Strategic Plan 2016-2025: Implementing GEOSS. It served as the rotating chair of the International Geostationary Earth Observations in 2020 and promoted the construction of a global earth observation system.
- China participates in the international Space Climate Observatory platform, promoting China's best practices and technology to address climate change, and facilitating international cooperation on space climate observation.

(7) Space science

- Using science satellites including Wukong, Mozi, Shijian-10, and Insight, China has conducted joint science experiments with countries including Switzerland, Italy, Austria, the United Kingdom, and Japan.
- China co-developed and successfully launched the China-Italy Electromagnetic Monitoring Experiment Satellite, continued the joint development of the Sino-European Panoramic Imaging Satellite for Solar Wind and Magnetospheric Interaction, Sino-French Astronomic Satellite, and China-Italy Electromagnetic Monitoring Experiment Satellite. It has joined countries including Italy and Germany in developing and calibrating the payloads of satellites such as the space-based solar observatory, Einstein Probe, and enhanced X-ray timing and polarimetry observatory.
- Using the China-Brazil Joint Laboratory for Space Weather, it co-built the space environment monitoring platform for South America.

(8) Personnel and academic exchanges

- China has taken part in the activities organized by the International Astronautical Federation, International Space Research, International Academy of Astronautics, and International Institute of Space Law. It has hosted the Global Space Exploration Conference, the 13th Meeting of the International Committee on Global Navigation Satellite Systems, the United Nations/China Forum on Space Solutions: Realizing the Sustainable Development Goals, the International Aviation and Aerospace Forum, the Zhuhai Forum, the International Summit on BDS Applications, and the Fengyun Satellite User Conference.
- China has helped developing countries train professionals. Through the Regional Centre for Space Science and Technology Education in Asia and the Pacific (China) (Affiliated to the United Nations), it has trained almost 1,000 space professionals for more than 60 countries, and established the "Belt and Road" Aerospace Innovation Alliance and the Association of Sino-Russian Technical Universities. It has also promoted personnel exchanges in remote-sensing and navigation technology through the International Training Program and other channels.

- China has promoted scientific and technological exchanges in the fields of space science, remote sensing and space exploration through the China-Europe Space Science Bilateral Meeting, the China-EU-ESA Dialogue on Space Technology and the Dragon Programme - a joint undertaking between ESA and the Ministry of Science and Technology.

3. Key Areas for Future Cooperation

In the next five years China will be more open and active in broadening bilateral and multilateral cooperation and will engage in extensive international exchanges and cooperation in the following key areas:

(1) Global governance of outer space

- Under the framework of the United Nations, China will actively participate in formulating international rules on outer space, and will work together with other countries to address the challenges in ensuring long-term sustainable space activities.

- China will actively participate in discussions on international issues and the development of relevant mechanisms in those in the fields of space environment governance, near-earth objects monitoring and response, planet protection, space traffic management, and the development and utilization of space resources.

- China will cooperate in space environment governance, improve the efficiency of space crisis management and comprehensive governance, conduct dialogue with Russia, the United States and other countries as well as international organizations on outer space governance, and actively support the construction of APSCO's space observatory.

(2) Manned spaceflight

- China will employ its space station to conduct space-based astronomical observations, earth science and life science experiments under conditions of microgravity.

- China will promote more extensive international cooperation in astronaut selection and training, joint flight and space exploration fields.

(3) BeiDou Navigation Satellite System

- China will continue to participate in the activities of the UN's International Committee on Global Navigation Satellite Systems and promote the establishment of a fair and reasonable satellite navigation order.

- China will actively improve compatibility and interoperability of global satellite navigation systems such as the BeiDou Navigation Satellite System and other such systems as well as satellite-based augmentation systems.

- China will prioritize cooperation and exchanges, and share with others mature solutions, on the application of the BeiDou Navigation Satellite System, thereby boosting the socio-economic development of partner countries.

(4) Deep-space exploration

- China will advance cooperation on the international lunar research station project. It welcomes international countries to participate in the research and construction of the station at any stage and level of the mission.

- It will expand cooperation in the fields of asteroid and interplanetary exploration.

(5) Space technology

- China will support cooperation on satellite engineering and technology. It will complete the joint research of MisrSat-2, and launch the SVOM (Space-based multiband astronomical Variable Objects Monitor), and Electromagnetic Monitoring Experiment Satellite 02. It will press ahead with follow-up cooperation in the Resources Satellites program.

- China will engage in cooperation on space TT&C support. It will continue to cooperate with the European the field of TT&C support, and further advance the building of ground station networks.

- China will support international cooperation on commercial spaceflight, including:

(a) launching services;

(b) technical cooperation on whole satellites, on sub-systems, spare parts, and electronic components of sa vehicles, on ground facilities and equipment, and on other related items.

It will give priority to developing communications satellites for Pakistan and to cooperating on the constru Pakistan Space Center and Egypt's Space City.

(6) Space applications

- China will promote global application of data from Chinese meteorological satellites, support the provisio China-France Oceanography Satellite to the World Meteorological Organization, and promote global shari application of the data obtained by Zhangheng-1, China's seismo-electromagnetic satellite.

- China will press ahead with the construction of the Belt and Road Initiative Space Information Corridor, ε cooperation on the application of remote-sensing, navigation, and communications satellites.

- China will press ahead with the construction of the data-sharing service platform of APSCO.

- China will advance the construction and application of the BRICS remote-sensing satellite constellation.

- China will participate in the construction and use of the Space Climate Observatory.

(7) Space science

- By means of the deep-space exploration project, and using extraterrestrial samples and exploration data, joint research in fields such as the space environment and planetary origin and evolution. Through the Uni scientific data obtained by the Chang'e 4 satellite will be made available to the international community.

- China will boost joint R&D on space science satellites and research subjects such as dark matter particles, activities and their influence, and spatial gravitational wave.

(8) Personnel and academic exchanges

- China will conduct personnel exchanges and training in the space industry.

- China will hold high-level international academic exchange conferences and forums.

Conclusion

In today's world, a growing number of countries are seeing the importance of space and are investing more programs. Space industry around the world has entered a new stage of rapid development and profound tr will have a major and far-reaching impact on human society.

At this new historical start towards a modern socialist country, China will accelerate work on its space industry concept of a global community of shared future, it will work actively with other countries to carry out international exchanges and cooperation, safeguard outer space security, and strive for long-term sustainability in activities in space. By doing so, China will contribute more to protecting the earth, improving people's wellbeing, and social progress.

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