Section 4 Outer Space and Security

1 Outer Space and Security

Nearly 60 years have passed since a satellite was launched into outer space for the first time in the history of mankind. In recent years, technology leveraging outer space has been applied to various areas. No state is allowed to own outer space, and it is freely available to all nations. Major countries thus make proactive efforts to use outer space.[1] For example, meteorological and observation satellites are used to observe weather as well as land and waters; communication and broadcasting satellites are used for the Internet and broadcasting; and positioning satellites are used to navigate aircraft and ships. These satellites have widely prevailed in social, economic, scientific, and other areas as essential infrastructure for the public and private sectors.

In major countries, military forces are actively involved in outer space activities and utilize a variety of satellites. There is no concept of national borders in outer space, meaning that the utilization of satellites enables the observation of, communication at, and positioning on any area on Earth. Thus, major countries make efforts to enhance the capabilities of a variety of satellites and launch them for the purpose of enhancing C^{4}ISR functions.[2] Such satellites include imagery reconnaissance satellites reconnoitering military facilities and targets, early warning satellites that detect the launch of ballistic missiles, satellites gathering radio wave information for military communications, communication satellites for military communication, and positioning satellites for navigating naval vessels and aircraft and enhancing the precision of weapons systems.

On the other hand, in January 2007, China conducted a test to destroy its aging satellite with a ground-launched missile. The resulting space debris[3] spread across the satellite's orbit, and came to be seen as a threat against space assets such as satellites owned by countries. Furthermore, countries including China and Russia are thought to also be developing anti-satellite weapons (ASAT) that do not directly hit and destroy a satellite by a missile, creating less space debris. For example, it has been noted that ASATs under development include an ASAT that approaches the target satellite using a "killer satellite" and utilizes a robot arm to capture the target satellite to disable its functions, as well as an ASAT that disables the functions of the target satellite by using a jammer to interfere with communications between the target satellite and the ground station.

Against this backdrop, since existing frameworks, including the Outer Space Treaty that prescribes the exploration and use of outer space, do not have provisions on avoiding the destruction of space objects and actions triggering space debris, international efforts have been under way recently for the creation of the International Code of Conduct for Outer Space Activities and the guidelines for "Long-term Sustainability of Outer Space Activities."[4] Moreover, countries are working on the Space Situational Awareness (SSA)[5] by monitoring the impact of accelerated solar activity on satellites, electronic equipment on Earth and threats caused by meteors reaching Earth, in addition to threats posed by anti-satellite weapons and space debris to space assets.

As the above illustrates, the risk to the stable use of outer space has become one of the critical security challenges countries face.

See Part III, Chapter 1, Section 2-6 (Responses in Space)

1 The Outer Space Treaty (The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies) that came into force in October 1967 defines such matters as the use of the Moon and other celestial bodies for peaceful purposes, the freedom in principle of exploration and use of outer space, and the prohibition of ownership. However, no clear international agreement has been reached on the definition of outer space, though according to one of the concepts, outer space is considered space located 100 km or further away from the Earth's surface.

2 The term "C^{4}ISR" stands for command, control, communication, computer, intelligence, surveillance, and reconnaissance. The 1991 Gulf War is considered "the first high-tech war conducted in outer space in the history of mankind."

3 Unnecessary artifacts orbiting around the Earth, including satellites no longer in use, upper stages of launch vehicles, parts, and fragments.

4 In 2007, the chairperson of the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS) proposed to discuss "the long-term sustainability of outer space activities" in relation to civil space activities, for the purpose of defining risk reduction for long-term sustainable activities and equal access to outer space. Based on this proposal, the Scientific and Technical Subcommittee of UN COPUOS set up a working group, which carries out discussions every year for establishing the guidelines. However, a final agreement has not been reached due to political disputes and a divergence of views over the adoption method of the guidelines.

5 In August 2015, Gen. John E. Hyten, Commander of the U.S. Air Force Space Command, stated, "Total number that we track is about 23,000 objects...we expect to be tracking 250,000 to 500,000 objects down to the size of my fist," describing that space debris constitutes a significant challenge.

2 Trends in the Use of Space by Countries for Security Objectives

1 United States

The United States launched its first satellite, Explorer 1, in January 1958, following the satellite launches by the former Soviet Union. The country has since then proceeded with a variety of space activities in fields including military, science, and resource exploration, such as launching the world's first reconnaissance satellite and landing on the Moon. Today, the United States is the world's leading space power. The U.S. Forces clearly recognize the importance of outer space for their actions, and in this regard, actively utilize outer space for security purposes. In June 2010, the United States released the National Space Policy that presents the country's basic guidelines for space policy, including its objectives and principles. It specified guidelines on security space, civil space, commercial space, and international cooperation, among other sectors. In February 2011, the country also released the National Security Space Strategy (NSSS)[6] as the security guideline regarding outer space. Based on these strategic guidelines, the U.S. Department of Defense (DoD) has set the goal of maintaining and strengthening U.S. space superiority for security purposes, recognizing that the United States needs to prepare for the possibility of conflict extending into outer space.

From an organizational perspective, the National Aeronautics and Space Administration (NASA) is responsible for non-military space development in the United States, while the U.S. DoD works on space development from a national security perspective.

Major satellites used for military purposes include satellites for imagery reconnaissance, early warning, electronic / signals intelligence, communication, and global positioning, and their operations are wide-ranging.

2 Russia

Russia's space activities have been continuing since the former Soviet Union era. The former Soviet Union successively launched multiple satellites after it launched the first satellite in the history of mankind, Sputnik 1, in October 1957, and had the largest number of launched satellites in the world until the collapse of the former Soviet Union. The satellites included many military satellites, which enabled the country to compete against the United States for military expansion in outer space. Russia's space activities have declined since the former Soviet Union collapsed in 1991. However, the country has recently started to expand its activities once again.

Regarding the country's trends in security, the National Security Strategy of the Russian Federation, approved in December 2015, states that the U.S. deployment of weapons into outer space constitutes one of the factors undermining global and regional stability. The Military Doctrine of the Russian Federation, a document created in February 2010 to specifically define the principles of the National Security Strategy in the military field,[7] mentions that securing supremacy in outer space is one of the decisive factors in achieving the objectives of its armed forces.

From an organizational perspective, the Roscosmos State Corporation for Space Activities is in charge of space activities related to Russia's scientific and economic areas, while the Russian Ministry of Defence is involved in space activities for security purposes. The Russian Aerospace Forces[8] conducts actual space activities for military purposes, manages facilities for launching satellites, among other activities.

Major satellites launched by Russia are satellites for imagery reconnaissance, early warning, radio wave

6 This strategy presents the view that the current and future outer space environment is driven by three trends: (1) congestion caused by artificial objects including satellites; (2) contestation by potential adversaries; and (3) increasing competition with other countries. Based on this understanding, the NSSS identifies that the U.S. strategic objectives for outer space are to: (1) strengthen safety, stability, and security in outer space; (2) maintain and enhance the strategic national security advantages afforded to the United States by outer space; and (3) energize the space industrial base that supports U.S. national security. To meet these objectives, the NSSS states that the country will pursue the strategic approaches of (1) promoting responsible, peaceful, and safe use of outer space, (2) providing improved U.S. outer space capabilities, (3) partnering with responsible nations, international organizations, and commercial firms, (4) preventing and deterring aggression against space infrastructure that supports U.S. national security, and (5) preparing to defeat attacks and to operate in a degraded environment.

7 "The Military Doctrine of the Russian Federation" was revised in December 2014. It also states that the tasks of the armed forces include providing timely warning to the Supreme Commander-in-Chief of the Armed Forces of the Russian Federation of an air or space attack and deploying and maintaining space systems supporting the activities of the Russian Armed Forces. In addition, it refers to the need to establish air-space defense organizations.

8 According to the Russian Ministry of Defence, the Aerospace Forces were created by merging the Air Force and the Aerospace Defence Forces, and started performing its tasks in August 2015. The tasks of the Aerospace Forces include: (1) providing focused combat command to the air force; (2) conducting aerial and missile defense; (3) launching and controlling satellites; (4) warning about missile attack; and (5) monitoring of outer space.

information gathering, communication, positioning, and others, all of which are presumed to be used for security purposes. Currently, Russia is developing a new Angara carrier launch vehicle,[9] along with building a new launch site in Vostochny in the Far East.[10]

3 Europe

Regarding European outer space activities, France succeeded in launching its own satellite for the first time in 1965, following the former Soviet Union and the United States, and the United Kingdom succeeded in launching its own satellite for the first time in 1971. Italy and Germany used launch vehicles developed by the United States to own satellites in December 1964 and July 1965, respectively. On the other hand, the European Space Agency (ESA)[11] Convention signed in May 1975 established the ESA, which launched a satellite in 1979.

In Europe, the EU, the ESA, and European countries are promoting their own unique space activities and are helping each other to implement space activities.[12]

The ESA signed a "framework agreement" with the EU in May 2004 to specify that they will collaborate to proceed with space development and hold regular minister-level council meetings. The joint council meeting held by the ESA and the EU in May 2007 approved the "European Space Policy."[13] The "European Space Policy" mentions improving synergy effects between space activities for civil and defense purposes, and the importance of implementing space activities based on coordinated efforts among member states and ensuring an internationally competitive space industry. The Policy identifies security as one of its areas of priority.

It is thought that in the future, "Galileo," a satellite positioning system planned by the EU and the ESA;[14] "Copernicus," an Earth observation program;[15] and the Multinational Space-based Imaging System (MUSIS),[16] a reconnaissance satellite project implemented by the European Defence Agency (EDA),[17] will be utilized for security in Europe.

4 China

China began work on space development in the 1950s, and in April 1970, the county launched its first satellite "Dong Fang Hong I," mounted on the transportation launch vehicle "Long March 1," using technology enhanced through its missile development. Additionally, the number of China's cargo rocket launches in 2016[18] totaled 22, the same as the United States, making it the most in the world for the first time.

China has thus far conducted activities such as manned spaceflight and lunar rover launches, and is aiming to construct its very own space station.[19] It is speculated that China's space development is intended to enhance national prestige and develop space resources.

With regard to the organizational setup, the State Administration for Science, Technology and Industry for National Defense, under the Ministry of Industry and Information Technology of the State Council, oversees industries related to space, nuclear technology, aviation, ships, and weapons. The China National Space Administration enforces the administrative control of the space area for civil and commercial purposes and represents the Chinese Government externally.

China's defense white paper "China's Military Strategy" (May 2015) states that outer space is a commanding height in strategic competition among all

9 In July 2014, the first launch of "Angara-1.2PP" was conducted successfully. In December 2014, "Angara-A5" successfully put a dummy satellite into orbit for the first time. The Angara launch vehicle is considered as the first large launch vehicle that Russia developed after the collapse of the Soviet Union. It is expected that the vehicle will be launching commercial as well as military satellites.

10 The new launch site is being built to replace the Russian-leased Baikonur Cosmodrome in Kazakhstan, and Russia aims to have the site fully operational by 2020. The first launch vehicle was launched in April 2016.

11 The ESA was established in May 1975 based on the ESA Convention targeting to establish a single European space organization focusing on the peaceful use of space research, technology, and application areas. The organization was formally established in October 1980.

12 In September 2000, the European Commission (EC) and the ESA created the European Strategy for Space that committed to pursuing Europe's coherent and effective space activities. The strategy envisioned that the EC would make political and strategic decisions on space policies and that ESA would function as the implementing organization. For the satellite positioning system "Galileo" currently in operation and the environmental and security monitoring program "Copernicus," the EU and ESA are complementing each other in carrying these projects forward, with the former mainly taking charge of the policy dimension and the latter the technical dimension.

13 The EC released the European Strategy for Space in October 2016.

14 In December 2016, initial services were launched with 18 satellites. Galileo is set to offer the services in conjunction with GPS because of the insufficient number of satellites. The system is expected to be fully operational by 2020 when all 30 satellites are in place.

15 New observation satellites called "Sentinels" are being launched to collect imagery necessary for conducting Earth observations. Sentinels are classified according to their purpose into: 1) all-weather satellite that takes images of land and ocean; 2) all-weather satellite capable of high-resolution land monitoring to provide imagery of vegetation, inland waterways, and coastal areas; and 3) satellite measuring land-and sea-surface temperature and topography. Four Sentinels are said to be in orbit as of November 2016.

16 The MUSIS was started by Belgium, Germany, Greece, France, Italy, and Spain. The organization was joined later by Poland in December 2010. This is a joint project succeeding such projects as "Helios 2" (a French military reconnaissance satellite), "Pleiades" (a French Earth imaging satellite used for military and civilian purposes), "SAR-Lupe" (a German group of military radar satellites), "COSMO-SkyMed" (an Italian constellation of Earth observation satellites), and "Ingenio" (a Spanish optical satellite).

17 The European Defence Agency (EDA) was established in 2004 to improve Europe's defense capabilities for crisis management purposes and to execute and maintain security and defense policies.

18 The number of cargo rocket launches in 2016 was 22 in the United States, 22 in China, 17 in Russia, 11 in Europe, 7 in India, 4 in Japan, and 1 in Israel. This marked the first time that China surpassed Russia in launches.

19 The National Medium- and Long-Term Program for Science and Technology Development published by the State Council of China in February 2006 positions space station construction, lunar exploration, and high-resolution Earth observation systems as specific critical projects in the aerospace area.

parties. Meanwhile, China asserts that its activities in outer space constitute "peaceful use of outer space," and underscores that China is "opposed [to] the weaponization of and arms race in outer space, and [will take] an active part in international space cooperation." China also commits to "[keeping] abreast of the dynamics of outer space, deal with security threats and challenges in that domain, and secure its space assets." In addition, "China's Space Activities in 2016," China's white paper on space activities released in December 2016, presents a vision to "build China into a space power" and for "the realization of the Chinese Dream." It also presents a schedule of launches[20] up to 2020, and emphasizes international cooperation and the peaceful use of space. On the other hand, the white paper also notes that China will satisfy its needs for security, which does not deny the country's military use of space.

China is indeed actively using space for information collection, communications,[21] and positioning for military purposes.[22] Since September 2015, China has publicized a series of decisions on military reforms, and in January 2016, the establishment of the Strategic Support Force was announced. While the details of the Force's tasks and organization have not been revealed, it is suggested that it is in charge of outer space, cyber, and electronic warfare. Additionally, China successfully launched a number of all new Long March series cargo rockets[23] and has stated that it is developing a cargo rocket capable of carrying extra heavy payloads. Carrier launch vehicles are developed and manufactured by Chinese state-owned enterprises, which are thought to be also developing and manufacturing ballistic missiles. It is expected that China will pursue space development through close collaboration between the public sector, military, and private sector. Moreover, it is regarded that China is focusing also on the development of satellite ground stations. China opened its very first satellite data receiving station outside of China near Kiruna in Sweden in December 2016. It is noted that this receiving station located in the Arctic Circle offers many security advantages,[24] such as ease of receiving data obtained by Earth observation satellites in sun-synchronous orbit (including photo reconnaissance satellites). Also, China is considered to have become one of the space powers through investments, research and development, and introduction of technologies from the United States and other countries. It has been suggested that China could threaten U.S. information superiority in outer space in the future.[25] Furthermore, China continues to develop ASATs. In January 2007, China conducted a test using a ground-launched missile that destroyed its own satellite. In July 2014, China tested an anti-satellite missile not involving the destruction of a satellite.[26] It is also suggested that China is developing directed-energy weapons,[27] including "killer satellites," jammers, and laser beams.

20 In addition to lunar exploration, it also cites the launch of worldwide services for the BeiDou Navigation Satellite System, Mars exploration, asteroid exploration, and Jupiter exploration.
21 In August 2016, China launched the world's first quantum science satellite called Mozi that will be carrying out a proof-of-concept mission for quantum communication between space and a ground station. In general, quantum communication is considered to be a highly secure mode of communication that makes eavesdropping and cryptanalysis virtually impossible.
22 By December 2012, the BeiDou Navigation Satellite System officially started its services covering most of the Asia-Pacific region. It is reported that the BeiDou system has already started to be mounted on navy vessels, government vessels belonging to maritime law enforcement agencies, fishing boats, among other vessels. BeiDou offers not only positioning services but also interactive short message features. It is suggested that these features make it possible to centrally capture and share, in real time, the position and other data related to vessels of other countries that Chinese navy vessels have detected, and improve information gathering capabilities on the ocean and other areas.
23 In September 2015, China succeeded in its first launch of Long March-6 (for launching small satellites) and Long March-11 (for instantaneous launching of solid-fuel small satellites). China also succeeded in launching Long March-7 (for launching "Shenzhou" manned spacecraft) in June 2016 and Long March-5 (for launching large satellites) in November 2016. It also announced plans to launch Long March-9 (for launching ultra-large satellites), which aims to achieve capability to launch 100-ton payload into low orbit, by around 2030.
24 Generally, Earth observation satellites in sun-synchronous orbit (including photo reconnaissance satellites) transmit data when they fly over the country of origin. Therefore, these satellites can only transmit data several times per day, making transmission efficiency poor. Setting up a satellite ground station in the Arctic Circle or Antarctic Circle will increase transmission efficiency and short lead time because the satellite will fly over the satellite ground station every time it orbits.
25 According to the annual report of the U.S.-China Economic and Security Review Commission of November 2015.
26 The February 2015 "Worldwide Threat Assessment" of the U.S. Director of National Intelligence notes that in July 2014, China tested an anti-satellite missile not involving the destruction of a satellite. In addition, it states that China has satellite jamming capabilities and is making progress on an anti-satellite system.
27 According to the U.S. DoD's "Annual Report to Congress: Military and Security Developments Involving the People's Republic of China" of May 2015, China continues to develop a variety of capabilities, including directed-energy weapons and electronic countermeasure systems (jammers), designed to limit or prevent the use of space assets by adversaries during a crisis or conflict.

5 India

India's space development promotes space programs aimed at social and economic development in line with the 5-year national plan. The country's 12th Five-Year Plan[28] focuses on non-military projects including communication, positioning, Earth observation (e.g., disaster monitoring, resource exploration, and weather observation), transportation systems, space science, and spinoff promotions.

The Indian Space Commission (ISC) determines the country's space policy under the leadership of the Prime Minister and assumes responsibility for preparing space development budgets and implementing space development programs. The Department of Space, managed by the ISC, oversees the Indian Space Research Organisation (ISRO), which implements space development policy following the country's space policy, develops and launches launch vehicles, and develops and manufactures satellites.

In April 2016, India operated a positioning satellite that can position itself around India[29] as well as launched an Earth observation satellite, which are said to be used also for security purposes. In February 2017, India successfully launched a satellite launch vehicle loaded with 104 satellites, marking the largest number ever carried on a single rocket in the world.[30] In the future, the country plans to implement planetary explorations and conduct manned spaceflight.[31]

6 Republic of Korea

The Republic of Korea (ROK) is considered to have started full-scale space development from the latter half of the 1990s. The ROK carries out space activities based on the three key plans it established in November 2013, namely: the "Mid- and Long-Term Plan for Space Development (2014-2040),"[32] which plans to move up the first launch of launch vehicles manufactured by the ROK[33] to June 2020;[34] the "Space Technology Industrialization Strategy," which prompts the private sector to lead space development; and the "Revision of the Korean Rocket Development Plan," which outlines the use of ROK-made launch vehicles and the ROK's own development of planetary and space exploration satellites and high orbit satellites.

On the security front, the ROK's Defense White Paper published in December 2012 states that the ROK would secure a space surveillance system and other mechanisms for developing the Air Force into an aerospace force, and establish a Satellite Surveillance Control Group in order to secure air and space operational capabilities.

On the organizational front, the Korea Aerospace Research Institute leads research and development as an implementation agency. Furthermore, the Korea Agency for Defense Development is engaged in the development and use of various satellites.

Major satellites used by the country include imagery reconnaissance and communication satellites. The ROK relies on other countries to launch its satellites.

28 The 12th Five-Year Plan covers the period between April 2012 and March 2017.
29 In April 2016, India succeeded in launching the seventh satellite constituting the Indian Regional Navigation Satellite System (IRNSS), which completed the deployment of the constellation.
30 All 104 satellites were launched and placed into polar orbit at the same time. They comprised India's roughly 700 kg Cartosat-2D Earth observation satellite and 103 small satellites weighing less than about 10 kg each (1 each from Israel, Kazakhstan, the Netherlands, Switzerland, and the UAE, 2 from India, and 96 from the United States).
31 In December 2014, the ISRO succeeded in the test launch of a large launch vehicle carrying an unmanned capsule.
32 In January 2013, for the first time on its third attempt, the ROK successfully launched the space launch vehicle "Naro (KSLV-1)" that was developed based on the first stage of the Russian Angara rocket.
33 The ROK had planned to launch a test space rocket in December 2017, but has postponed this launch until October 2018 due to technical issues.
34 The Mid- and Long-Term Basic Plan for Space Development (1996-2015) released in 1996 is considered to be the ROK's first space plan.