# Chapter 1

# Space Security: Global Trends and Japan's Efforts

Space has been drawing attention as a new security priority, given current circumstances in which, on account of the deepening global dependence on space systems, a new era has arrived, where the stable use of such systems can no longer be taken for granted.

The utilization of space is no longer something carried out solely by advanced countries and major countries. Today, even medium-sized and small countries, as well as nonstate actors (corporations, research institutions, etc.), have come to possess or operate satellites. And even when they do not possess or operate them, such countries and actors can enjoy their benefits through services provided by public institutions, corporations, and the like.

The military utilization of space by the United States is also deepening. After the Gulf War, the United States has intensified efforts to integrate the utilization of space in land, naval, and air operations. The military utilization of space is now expanding globally, with various European countries, China, India, and others, also devoting energy to acquire military satellites and dual-use satellites.

Meanwhile, the era is gradually ending in which the stable utilization of space systems could be taken for granted. An increasing number of objects are now in orbit, with operational satellites facing the growing risk of colliding with space debris and other satellites. Moreover, another potential source of instability is the existence of certain countries that are striving to develop counterspace capabilities for the purpose of obstructing the utilization of space by other countries. Accordingly, the countries depending on space systems are strengthening efforts to secure the stable utilization of them.

Ever since Japan passed the Basic Space Law in 2008, it has made earnest efforts toward space security. Above all, the new Basic Plan on Space Policy of January 2015 regards space security as a priority issue. Against this background, Japan Ministry of Defense and Self-Defense Forces (SDF) have begun to develop space capabilities: in 2016 and 2017, two next-generation X-band communications satellites will be launched, the first satellites ever owned by the ministry. Also, given the indispensable role to be played by space in defense cooperation between Japan and the United States, both countries have begun to cooperate in securing stability in the utilization of space.

## 1. Intensifying Global Dependence on Space Systems

### (1) Permeation of the Utilization of Space in Daily Lives

Satellites were originally launched by the United States and the Soviet Union during the Cold War to accomplish political and military purposes. Those two countries used manned space activities and planetary exploration as a means to display their national might to the world. A typical example was the Apollo Program of the United States, which was successful in landing humans on the moon. The two countries also launched various types of military satellites as well as dual-use satellites, employing them for nuclear deterrence and arms control.

Amidst that trend, the commercial utilization of space picked up activity in the 1980s, and has now come to pervade daily life. In 2014, the cumulative income of the worldwide satellite industry (satellite services, satellite manufacturing, launch industry, and sales of ground equipment) was around 203 billion dollars, multiplying 2.3 times in ten years.[1)] Of that, the largest portion—approximately 122.9 billion dollars[2)]—was accounted for by the satellite services revenues, which include the satellite communications business and the earth observation business. That figure represents a roughly 30 percent increase from 2009.[3)]

The next biggest segment after satellite services is ground equipment sales, registering some 58.3 billion dollars in income worldwide.[4)] Half of that amount is accounted for by consumer equipment for satellite navigation.[5)] The global positioning business expanded worldwide spurred by the opening of the Global Positioning System (GPS) to the private sector. GPS is a satellite positioning system whose development was originally initiated by the United States for military purposes. In 1983, though, owing to the shooting down of a Korean Air Lines passenger jet that had mistakenly entered Soviet airspace, President Ronald Reagan made the decision to open GPS up to the private sector to enable more accurate navigation.[6)] The United States had initially devised Selective Availability for civilian use, but President Bill Clinton put an end to that in 2000.[7)] Now, more than twenty years since the US Air Force (USAF) declared Full Operational Capability for the GPS constellation, the positioning, navigation, and timing (PNT) services provided by the system have become economic and social infrastructure worldwide (see Figure 1.1). Aside from the United States, other countries, such as Russia, the European Union (EU), China, India, and Japan are building their own satellite positioning systems covering the whole world or

**Figure 1.1. Uses of GPS**


*Source:* Partially modified from p. 23 of *Materials #1: Current Status and Issues of Space Development and Utilization,* Committee on National Space Policy, 3rd meeting, August 29, 2012.

specific regions. For that reason, it is believed that satellite positioning is bound to become an even more familiar service for people around the world.

### (2) Deepening of the Military Utilization of Space by the United States

Nonetheless, the utilization of space for military purposes did not wane with the progress of commercial purposes. With the Gulf War of 1991 as a turning point, the United States began using space for combat operations in earnest. As mentioned above, the primary usage of space during the Cold War era was to shore up nuclear deterrence and arms control, with its utilization for conventional combat operations having been rather limited. While the United States did make use of communications and weather satellites during the Vietnam War,[8] many military space systems were under development at the time. Meanwhile, during the 1970s and 1980s, when the development of military space systems progressed to a certain degree, the United States did not conduct new large-scale conventional wars with a regular army of a nation-state, thus lacking the opportunity to take advantage of space in a comprehensive fashion.

In contrast, the Gulf War represented the first time for the United States since the Vietnam War to mobilize large numbers of troops in a conventional war, and it gave that country plenty of opportunities to employ military space systems. As a matter of fact, the United States took advantage of various types of satellites to such an extent that the Gulf War was described as "the first space war."[9] The satellites it used included everything from reconnaissance satellites and remote sensing satellites to early warning satellites, military weather satellites, civil weather satellites, military communications satellites, commercial communications satellites, and navigation satellites.[10]

Symbolic of that trend was the utilization of early warning satellites. Though US early warning satellites had been primarily developed for the detection of launches of Soviet intercontinental ballistic missiles, they were used to detect launches of Scud missiles—tactical ballistic missiles—during the Gulf War.[11] Also, many soldiers carried commercial GPS receivers, as GPS enables effective movement in desert terrain with its scant topological features.[12] Thus, space systems began to represent an important element allowing individual soldiers at the front—not just the president, nuclear forces and intelligence agencies—to do their duties.

After the Gulf War, the United States began earnest efforts to integrate the utilization of space in land, naval, and air operations. In the bombing of Yugoslavia during the Kosovo conflict of 1999, the GPS-guided munition known as Joint Direct Attack Munition (JDAM) was employed in actual combat for the first time. JDAM was developed based on the lessons of the Gulf War, where bad weather conditions constrained the usage of laser and electro-optically guided munitions.[13] JDAM won high marks among the US military during NATO's Yugoslav bombing campaign, beset as it was by bad weather conditions in what was called a "war of weather."[14] Thereafter, GPS-guided munitions were extensively used in both the Afghanistan and Iraq operations, becoming major guided munitions on par with laser and electro-optically guided munitions.[15] Also, while the demand for satellite communications was 1 Mbps per 5,000 persons during the time of the Gulf War, it increased to 51.1 Mbps per 5,000 persons during the military action against Iraq in 2003.[16] GPS and communications satellites also enable the operation of long-endurance UAVs, heavily used in counterterrorism operations.[17] In that manner, operations would be practically impossible without space systems, with the military dependence of the United States on space deepening.

### (3) Global Expansion of the Military Utilization of Space

The United States is not the only country enthusiastic about the utilization of space for military purposes. With Russia recovering its national strength, it is once again actively engages in military space activities. Just as in the case of the United States, Russia operates a wide variety of military satellites and dual-use satellites, including everything from reconnaissance satellites and military communications satellites to navigation satellites, early warning satellites, and weather satellites. Since the beginning of the 2000s, particularly, it has again started to place priority on launching its Glonass navigation satellites. In 2011, it revived its system encompassing the whole world for the first time in fifteen years.[18] As of December 2015, the Ministry of Defence of the Russian Federation is said to be conducting the final tests before commencing the practical use of Glonass.[19]

Russia has been using these satellites in its operations in Syria, which began in September 2015. Russian Chief of the General Staff Valery Gerasimov, at a press conference held in November 2015, revealed that a total of ten imaging reconnaissance satellites, remote sensing satellites, and signals intelligence satellites are being used for reconnaissance in Syria, and that some of them had been repositioned to enable the support of military operations.[20] In addition, Russia has been using KAB-500S aerial bombs, Kalibr-NK/3M-14T surface ship-launched cruise missiles, Kalibr/3M-14 submarine-launched cruise missiles, and KH-101 air-launched cruise missiles—all capable of employing Glonass guidance—for the first time in Russia's operations.[21]

Aside from Russia, France has been the European country most active in utilizing space for military purposes. In addition to the imaging reconnaissance satellites and military communications satellites, already put into practical use, France has been launching demonstration satellites toward the actualization of signals intelligence satellites and early warning satellites. In 2020, it plans to launch three signals intelligence satellites for practical use.[22] Traditionally, France has laid stress on collecting information through satellites as a means to evaluate situations and carry out decision-making independently.[23] In the 1980s, it had planned its first imaging reconnaissance satellites for the purpose of collecting the necessary targeting information for the operation of its nuclear forces.[24] During the US- and UK-led military campaign against Iraq in 2003, France decided not to join the war mainly on account of information gathered from its imaging reconnaissance satellites.[25] More recently, it has independently

been gathering information on the situation in Ukraine through its own imaging reconnaissance satellites and dual-use earth observation satellites.[26] In addition, since the turn of the decade, France has stepped up its utilization of space at the operational and tactical levels. In 2010, it established the Joint Space Command for the support of military operations via satellites.[27] Indeed, it has employed reconnaissance satellites, dual-use earth observation satellites, and communications satellites in the operations in Libya, Mali, and the Central African Republic.[28]

Besides France, other European countries such as Germany, Italy, and Spain operate reconnaissance satellites, dual-use earth observation satellites, military communications satellites, and dual-use communications satellites.[29] Through its Private Finance Initiative, Britain is using military communications satellites owned and operated by a private corporation.[30]

Cooperation in the area of military space has also stepped up within Europe. France, which possesses imaging reconnaissance satellites equipped with optical and infrared sensors, is cooperating with Germany and Italy, which both have imaging reconnaissance satellites equipped with synthetic aperture radars (SARs).[31] France has also launched military communications satellites and dual-use communications satellites jointly with Italy.[32] Meanwhile, the EU has begun to work on the utilization of space for security purposes, and is launching earth observation satellites in addition to its Galileo navigation satellites.[33]

Elsewhere, in East Asia, China has been the country most active in utilizing space for military purposes. China believes that "information dominance" is the key to victory in contemporary wars, using lessons learned from other countries' wars, starting with the Gulf War, and has deemed space to be an indispensable element in that.[34] China launches a wide variety of satellites that are usable for military purposes. Among those, it has declared that the navigation satellite system "Beidou" shall be used for a dual purpose, and called attention to advances made in the system on the occasion of the parade held in September 2015 to commemorate the seventieth anniversary of the victory against Japan in 1945.[35] Positioning, navigation, and timing (PNT) services using Beidou started in the Asia-Pacific region in 2012,[36] and are slated to be usable worldwide around the year 2020.[37] China has adopted the position of wanting to step up its military usage of space in the future, and is said to be planning the launch of a technical demonstration satellite for an early warning satellite.[38] Furthermore, the missions

of its Strategic Support Force, newly established in December 2015, are believed to include operational support from space, in addition to cyberwar and electronic war capabilities.[39)]

Traditionally, India has actively used space for civil and commercial purposes, but since the late 2000s, it has been focusing on the utilization of space for military purposes as well. In 2009, it launched its first-ever SAR reconnaissance satellite.[40)] In 2013 and 2015, additionally, India launched two military communications satellites (one each year).[41)] The Indian Regional Navigation Satellite System—the first satellite of which was launched in 2013—is also meant for military use.[42)]

Australia, while not in possession of any military satellites itself, has also been active in utilizing space for military purposes. The country has jointly procured and is currently using the Wideband Global SATCOM system operated by the USAF.[43)] Also, the Australian military is using a dedicated transponder hosted on a commercial communications satellite "Intelsat 22" launched in 2012.[44)] The US military is using the same transponder, and the Australian military, in return, has gained access to the Mobile User Objective System of the US Navy.[45)]

South Korea, which depends on other countries' space agencies as well as on corporations for its launches, has possessed multiple-purpose earth observation satellites since 1999.[46)] In July 2015, the South Korean Air Force established a space operations center.[47)] The country's military is said to be contemplating the launch of five reconnaissance satellites by 2022.[48)]

Besides those, in the Middle East, Israel has had reconnaissance satellites since 1988.[49)] Furthermore, nations in Africa and South America have progressed in the possession and use of earth-observation and communications satellites, with the number of countries potentially using space for military purposes likely to steadily increase.

## 2. The Arrival of an Era in Which Space Utilization Can No Longer Be Taken for Granted

### (1) Space Congestion and the Development of Counterspace Capabilities by Various Countries

Amidst the deepening global dependence on space systems, an era has arrived in which the stable utilization of such systems can no longer be taken for granted.

One cause of that is the increasing congestion of objects in orbit around the earth. Between 2000 and 2010, the number of manmade objects orbiting the earth (sized ten centimeters or more in diameter) more than doubled, increasing from approximately 9,600 to approximately 22,000.[50] Additionally, as of 2015, they numbered more than 23,000.[51] Of those, the number of operational satellites amounted to around 1,300, with the rest being satellites no longer in operation, rocket bodies, fragments, and other objects.[52] For example, as space debris traverses along low-earth orbits at a speed of some seven to eight kilometers per second, even small fragments measuring around one centimeter in diameter can cause catastrophic damage to satellites through collisions.[53]

The number of objects in orbit has rapidly increased since the late 2000s, mainly on account of two major debris-producing incidents in 2007 and 2009 that will go down in the history of space development. In 2007, China destroyed one of its old weather satellites that had been in low earth orbit, at an altitude of 860 kilometers, thereby producing almost 3,400 pieces of space debris (just counting those measuring ten centimeters or more in diameter).[54] In 2009, an American satellite and Russian satellite collided with each other—the first time ever that two orbiting satellites did so—producing around 2,200 pieces of debris, just counting those fragments having a diameter of ten centimeters or more.[55] In the next few decades, it is believed that those pieces of space debris will continue to orbit the earth.

## Satellite Destruction and the Problem of Space Debris

The destruction of satellites in orbit produces large quantities of space debris. To date, three countries have done so: the former Soviet Union (Russia), the United States, and China. Between 1968 and 1982, the former Soviet Union conducted twenty satellite destruction tests, thereby producing more than 700 pieces of space debris, just counting those measuring ten centimeters or more in diameter.[56] However, it declared a moratorium on such tests in 1983,[57] and has not destroyed a satellite since.

In 1985, the United States conducted one satellite destruction test, producing 285 pieces of space debris (just counting those measuring ten centimeters or more in diameter).[58] Commander John E. Hyten of the USAF Space Command, reflecting upon that test at a later date, has mentioned that more space debris was produced than had been expected.[59] In 2008, the United States also destroyed one of its reconnaissance satellites that had become uncontrollable

shortly after launch,[60] thus producing 174 pieces of space debris (just counting those measuring ten centimeters or more in diameter).[61] The United States has emphasized that the destruction of that satellite was a one-time mission, having conducted it as a safety measure.[62]

China succeeded in a satellite destruction test for the first time in 2007. It was the most severe debris-producing event in the history of space development. A point of focus from now on will be whether or not China continues to emphasize the development of destructive antisatellite (ASAT) weapons. The threshold for China's use of such weapons is rising, as the country itself is deepening its dependence on space systems. In 2015, China surpassed Russia to become the country with the second-largest number of operational satellites worldwide (as of August 31, 2015, the United States had 549, China 142, and Russia 131).[63] The Chinese version of a space station will be completed in 2022, with Chinese taikonauts expected to spend long periods in space.[64] In such a case, constraints will be placed on the usage of kinetic-energy weapons producing large amounts of space debris.

Another reason for the arrival of an era in which the utilization of space can no longer be taken for granted is the advancing development of counterspace capabilities by various countries. Such capabilities are defined as weapons aimed at preventing others from utilizing space. Besides those ASAT weapons aimed at satellites in orbit literally, there are also those that target communications links between satellites and earth stations. Counterspace capabilities in themselves are nothing new, with the United States and the Soviet Union having conducted R&D and tests on them during the Cold War era, with some deployments actually carried out. Nevertheless, there are two reasons for the increasing attention given to the issue of counterspace capabilities in recent times: first, the fact that the capabilities to hamper the utilization of space has proliferated beyond the United States and Russia, and second, the fact that the dependence on space systems has intensified globally, heightening the value of such systems both offensively and defensively.

In that environment, China is viewed as the country most enthusiastically developing counterspace capabilities. As mentioned above, China believes that information dominance is the key to victory in contemporary wars, with space dominance comprising an indispensable component of that.[65] Counterspace capabilities are a means by which space dominance can be acquired. In its satellite destruction test of 2007, China employed a kinetic-energy ASAT weapon; specifically, it was believed to be the SC-19, a derivative of the DF-21C ballistic

missile, capable of reaching a satellite in low earth orbit.[66] Although the test involving the destruction of a satellite happened only once, in 2007, China is thought to have repeatedly carried out test launches of the SC-19 thereafter.[67]

China is also believed to be currently developing the DN-2, another kinetic-energy ASAT weapon.[68] Some point out that the reach of the DN-2 may extend to satellites in geostationary earth orbit.[69] A rocket launched in 2013, which China announced was for atmospheric observation,[70] is believed to have actually been a test launch of the DN-2.[71] Additionally, China is said to have performed the test launch in October 2015 of an ASAT weapon known as the DN-3, which also uses kinetic energy.[72] Besides those, China is believed to possess such counterspace capabilities as directed energy weapons and jammers.[73]

Spurred by the Chinese satellite destruction test in 2007, India started to demonstrate an interest in ASAT weapon development.[74] In 2012, V. K. Saraswat, director general of India's Defence Research & Development Organisation at the time, announced that the successful test launch of the country's Agni-V ballistic missile opened the way for the development of ASAT weapons in the future.[75]

In East Asia, aside from those developments, North Korea possesses jammers. Between 2010 and 2012, the country repeatedly conducted GPS jamming in the vicinity of the North-South Military Demarcation Line.[76] In the jamming incident of 2012, GPS disorders were experienced by 1,016 aircraft flying in the vicinity as well as by 254 shipping vessels.[77]

The United States and Russia, moreover, have continued their development of counterspace capabilities. One reason for Russia's continued development of such capabilities, it is said, has been to equip itself against the future deployment of America's space-based ballistic missile defense system.[78] In 2009, Russia conducted a test which trained an aircraft-loaded Sokol Eshelon laser on a satellite.[79] In November 2015, Russia is said to have succeeded for the first time ever in test launching the Nudol, a kinetic-energy ASAT missile.[80] Meanwhile, it has already deployed jammers.[81]

While the Barack Obama administration of the United States had originally been reluctant to refer to the term "space control" itself, it has changed its posture in recent years. The reason for that is its new perception of the need to deny space utilization by hostile parties, bearing in mind the ramped-up activity by other countries in the operational and tactical utilization of space. In March 2014, the US Department of Defense (DOD) released its *Quadrennial Defense Review (QDR)*

*2014*, according to which an initiative will be accelerated to counter the space-based intelligence, surveillance and reconnaissance (ISR) activities of hostile parties and their space-enabled precision strikes.[82] The *Fiscal Year 2016 Budget Overview*, released by the USAF in February 2015, clearly mentions increased investments in space control, including an upgrade and procurement of the Counter Communication Systems used for jamming satellite communications.[83] The United States has also declared that it would jam civil GPS signals in target areas during times of emergency (wartime), so as to deny GPS usage by hostile forces.[84]

Also, the USAF's Future Operating Concept, released in September 2015, mentions the need to counter the operational usage of space by hostile parties.[85] At the same time, the same document states that the response to enemies' space use needs to take into consideration the influence on the space environment and the striking of a balance.[86] That is a clear statement by the USAF of its emphasis on means not involving physical destruction. For countries with a high dependency on space systems—and not just the United States—the focus from now on will be how to obstruct an enemy's utilization of space without producing collateral effects.

Moreover, another way to obstruct others' utilization of space is to destroy their related earth-based assets (e.g., satellite control facilities, user terminals, launch sites, etc.) through attacks by conventional military forces, as well as to conduct cyberattacks on the computers used for satellite control and data processing. In 2007 and 2008, remote sensing satellites of the United States suffered cyberattacks,[87] and in 2014, the data network of American civil weather satellites experienced one as well.[88] Additionally, the ability to carry out rendezvous and proximity operations (RPO) in orbit can also be employed by killer satellites. As Chinese and Russian RPO tests are not necessarily transparent, these activities have incited controversy over their intentions.[89]

### (2) Major Countries' Actions to Secure the Stable Utilization of Space

Now that an era has arrived in which the utilization of space cannot be taken for granted anymore, the major space-faring nations—that is, those that possess and operate many satellites—are putting priority on working toward achieving stability in the utilization of space. The most fervent country in that regard has been the United States, the background to which is its strong concern about

changes in the environment surrounding the utilization of space. In 2011, Secretary of Defense Robert Gates and Director of National Intelligence James Clapper presented Congress with America's first-ever National Security Space Strategy (NSSS). According to the NSSS, one perception of the strategic environment pertaining to the utilization of space is the fact that "space is increasingly contested."[90]

Based on that perception, the Obama administration has tried to secure the stable utilization of space by reinforcing multi-layered deterrence in space, resilience of space capabilities, and space situational awareness (SSA). The multi-layered deterrence of the United States consists of four layers.[91] The first is the strengthening of international norms related to space activities. By fostering norms treating satellite destruction as an irresponsible act, the United States aims to raise the threshold for performing such actions.[92] Ever since then-Secretary of State Hillary Clinton announced the support of the United States in 2012 for a proposal put forward by the EU for an International Code of Conduct for Outer Space Activities, the United States has proactively engaged in the issue.[93]

The second layer of the multi-layered deterrence of the United States is the formation of a coalition, aiming to raise the threshold for an entity considering an attack on America's utilization of space by creating a situation in which such an attack would be perceived as a hostile act by not just the United States but also its allies. In September 2014, the United States, the United Kingdom, Canada, and Australia concluded a memorandum of understanding concerning combined space operations.[94]

The third layer of the multi-layered deterrence of the United States is the strengthening of resilience of space capabilities, to be mentioned below. The idea is to apply deterrence by denial—an element of deterrence theory—in space, forcing the enemy to think that an attack would not produce the desired effect.

**Signing of the memorandum of understanding on combined space operation** (US Strategic Command photo)

The fourth layer of the multi-layered deterrence is possessing the capabilities to respond to attacks. The DOD Directive on

Space Policy, revised in 2012, clearly states that such responses would not necessarily be limited to space, nor would they be limited to military responses.[95] For instance, in the military action against Iraq in 2003, the United States rendered GPS jammers inactive through aerial bombings.[96] Also, the Future Operating Concept of the USAF envisions a scene in which cyberattacks would be inflicted against the source of enemy laser attacks on satellites in order to render such attacks ineffective.[97]

Simultaneously, the United States is currently working on strengthening its resilience of space capabilities in case deterrence fails.[98] That effort aims at the maintenance of necessary functions, even when the utilization of space has been somewhat restricted, so that missions can continue to be carried out. The USAF is moving forward with the concept of building disaggregated space architectures based on such thinking.[99] In the aggregated space architectures that are currently employed, a limited number of large satellites carry the maximum payload size, meaning that the loss of the usage of any particular satellite would have a great effect. For that reason, the USAF is attempting, to the maximum extent possible, to simplify individual satellites and spread out their payloads to multiple platforms or systems. The DOD's examinations are currently taking place to employ such a concept in the Weather Satellite Follow-on program, the first launch of which is targeted for around 2020, as well as in the successor satellites of the Advanced Extremely High Frequency System and the Space Based Infrared System, both planned for the mid-2020s.

The enhancement of SSA lies at the foundation of the multi-layered deterrence of the United States in space and the strengthening of the resilience of space capabilities. If and when a certain satellite can no longer be available, it is necessary first to ascertain whether it is a result of a collision with space debris or an intentional act of obstruction. The United States is thus endeavoring to upgrade its space surveillance capabilities. In July 2014, it launched two Geosynchronous Space Situational Awareness Program satellites; the satellites operate near-geosynchronous orbit and reconnoiter objects there.[100] In 2016, the joint operation is scheduled to begin of an optical telescope and a radar for space surveillance that have been relocated from the United States to Australia, for the purpose of reinforcing the space surveillance network in the southern hemisphere.[101] In the second half of 2018, the initial operation is slated to begin of a space surveillance radar called the Space Fence,[102] which will replace the Air Force Space

Surveillance System (formerly the Space Fence) that went out of service in 2013.[103] The new radar will be able to track approximately 200,000 man-made objects in space,[104] and represents the most important capability upgrade in near-earth SSA in the nearly half a century.[105]

In addition, the US DOD is promoting the utilization of SSA data owned by other satellite operators. The United States Strategic Command has concluded SSA Sharing Agreements with other governments, international organizations, and commercial entities that own and operate satellites. As of January 2016, such agreements have been signed with ten governments (Australia, Japan, Italy, Canada, France, South Korea, United Kingdom, Germany, Israel, and Spain), two international organizations (the European Space Agency and the European Organisation for the Exploitation of Meteorological Satellites), and fifty-one commercial entities.[106] Not only will the United States provide SSA data to its partners in the agreements, but it also expects to receive such information from them as well.

The US efforts to secure the utilization of space have now reached a new stage. At a speech delivered in September 2014, Commander John E. Hyten of the USAF Space Command demonstrated his new awareness by saying that space is now not just a contested domain, but also a threatened, warfighting domain.[107] That is believed to reflect the Strategic Portfolio Review (SPR) regarding space that the DOD conducted in the summer of 2014.[108] The aim of the SPR is to draw up a new strategy needed to create a posture that can deal with threats in space and even respond to the extension of a war into space.[109]. The SPR has positioned space mission assurance as a new key concept,[110] the central thrust of which is the maintenance of the functions necessary for the completion of a warfighting mission even with the existence of a threat in space. Also, based on the SPR, the DOD plans to spend 5 billion dollars on activities termed “space protection” between fiscal 2016 and fiscal 2020.[111] The DOD has begun to reinforce its coordination with the intelligence community in that regard, with operational experimentation and testing of the Joint Interagency Combined Space Operations Center commencing in October 2015.[112]

As seen so far, the United States is fervently progressing with its efforts for the stable utilization of space. Meanwhile, other nations have taken the initiative in drawing up new international rules for space activities. Also, countries besides the United States are going forward with their own SSA and anti-jamming measures, albeit at a gradual pace. As far as the drawing up of international rules

is concerned, China and Russia have proposed an arms control treaty at the Geneva Conference on Disarmament (CD). Both countries had proposed The Treaty on Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force Against Outer Space Objects in 2002, 2008 and 2014,[113] but the United States pointed out fundamental flaws in these proposals.[114] As proceedings at the CD operate on a consensus format, the Sino-Russian treaty proposal has no prospect of entering the stage of negotiation. Elsewhere, the EU has been playing the leading role in consultations and negotiations to deal with the proposal for an International Code of Conduct for Outer Space Activities, lying outside the framework of the CD and the United Nations (UN). In July 2015, the EU's European External Action Service organized the first meeting for multilateral negotiations.[115]

As far as SSA is concerned, Russia has the second strongest capability in the world after the United States. Based on data gathered by the Russian Space Surveillance System (RSSS), composed of multiple radars and optical telescopes, the country is organizing a database related to satellites in orbit.[116] Russia is planning to enhance the capability of the RSSS.[117]

In Europe, Britain, France, Germany, and Norway also oparate space surveillance radars.[118] In addition, the EU started preparing space surveillance and tracking (SST) services in 2014 utilizing space surveillance assets of its member countries.[119] In North America, Canada also started operating a space surveillance satellite in 2014.[120] Those countries have all deepened their cooperation with the United States on SSA; in April 2014, the six countries of the United States, Britain, Canada, Australia, France, and Germany held a SSA Tabletop Exercise (SSA TTX).[121] The second SSA TTX was held in October 2015, with Japan participating for the first time.[122]

In East Asia, China established a space debris monitoring center within the China National Space Administration in June 2015.[123] In 2015, India initiated its Multi Object Tracking Radar to monitor low earth orbit.[124] South Korea, meanwhile, plans to establish an electro-optical satellite surveillance system within its air force by 2019.[125]

China and South Korea are also working on countermeasures to deal with the jamming of satellite-based positioning. In 2013, China announced that the Satellite Navigation Center of the People's Liberation Army National University of Defense Technology had succeeded in developing an electromagnetic shield

that would protect Beidou system from jamming.[126] South Korea, in response to GPS jamming by North Korea, as mentioned above, is developing a ground-based radio navigation system called eLoran.[127] By 2016, eLoran will commence initial operation across the country's entire territory, with full operation expected to begin in 2018.[128]

As for pending international issues toward the stable utilization of space, one challenge is how to proceed with the making of rules for space activities. At the aforementioned meeting for multilateral negotiations for the International Code of Conduct for Outer Space Activities, differences of opinions clearly emerged between the participating countries about what should be included in the code of conduct as well as where negotiations to work out the details should be held in the future.[129] A major focus from now on will be whether or not negotiations can proceed on an international code of conduct while involving as many countries as possible. Another important challenge is how to reinforce SSA. Internationally enhancing the ability to swiftly detect and pinpoint the source of the intentional obstruction of the utilization of space is expected to serve as an effective deterrent against such actions. In addition, it will become important for allies and friendly countries to develop a posture in which related capabilities can be accommodated among each other when obstructions—either intentional or unintentional—impose constraints on the utilization of space, as well as one in which a joint response can be made to deal with intentional interferences.

## 3. Japan's Space Security Policy

### (1) Changes Wrought by the Passage of the Basic Space Law

From the outset of its space development activities, Japan had banned the utilization of space for military purposes. Before the country passed a basic law concerning activities in space, the National Space Development Agency Law of 1969, legislated to establish the National Space Development Agency of Japan (NASDA) specified that outer space was to be used for "exclusively peaceful purposes."[130] In diet resolutions and government statements made thereafter, it was pointed out that the term "peaceful purposes" in the Law referred to "nonmilitary purposes."[131] Both the NASDA, operating under the Science and Technology Agency and promoting space development in areas with practical benefit, and the Institute of Space and Aeronautical Science, operating under the

Ministry of Education and responsible for space exploration in academic fields, pursued nonmilitary space development according to that interpretation. Those guidelines for space development were continuously adhered to by successive versions of the Basic Plan on Space Development formulated by the Space Activities Commission, which was set up in 1968 to deliberate national space policy comprehensively.

Despite the way Japan's space development started, it also became possible at the end of the 1970s and later, as the utilization of space became increasingly familiar to society as a whole, to utilize space for security purposes in certain fields of activity—such as satellite communications and remote sensing—that had become common to society (the so-called generalization theory). Nonetheless, Japan's security-related organizations continued to maintain self-restraint by not developing and operating its own satellites. For that reason, Japan's space activities aimed at security during those years were mostly conducted in the realm of intelligence, by purchasing satellite images generally available, then interpreting them professionally and using them as intelligence information.

A turning point, however, was reached when Japan found itself unable to detect signs of the launch of North Korea's Taepodong long-range ballistic missile in 1998. After that incident, Japan decided to develop and operate Information Gathering Satellites. That signified the country's security-related organization's transformation from being merely a passive user of satellites to an active operator.

While Japan thus incrementally expanded its utilization of space for security purposes, the level of those activities could hardly compare with that of the more advanced space-faring nations. For that reason, momentum grew in Japan toward the carrying out of the country's space development and utilization in abidance with international law, while remaining consistent with the principles of the Japanese Constitution. That spurred moves to shift away from the kind of space development hitherto centered on R&D and instead toward the utilization of space fully conscious of user needs, including those in the realm of security.

In 2007, Diet members of the ruling parties at the time—the Liberal Democratic Party and the New Komeito—submitted a bill for a Basic Space Law to the House of Representatives, but it remained under deliberation without moving any further. The following year, the leading opposition party, the Democratic Party of Japan, joined the other two parties in support of the bill, with all three resubmitting a joint bill, which went through deliberations in both the lower and upper houses. It

was finally passed and became law.[132] Despite the opposition control of the House of Councillors, generally causing gridlock in government, the fact that the bill was passed without a hitch indicates that a suprapartisan consensus had formed between the ruling and opposition parties at the time, to the effect that Japan as a whole ought to conduct space development, within which security would constitute an important element. That is why no serious obstacles blocked space development even amidst the turbulent political environment of the following years, which saw the Japanese administration change several times.

The Basic Space Law that was passed is based on six fundamental principles, namely, peaceful utilization, the improvement of people's lives, industrial promotion, the development of human society, international cooperation, and environmental-friendliness. One of the measures falling within the purview of those principles is security, leading to the shift away from the traditional principle that only allowed the nonmilitary usage of space, and toward the global standard that accepts nonaggressive usage. Specifically, Article One of the law stipulates that Japan's activities in space will contribute to international peace, with Article Two stating that international law and the principles of the Constitution will be conformed to, and Article Three specifying that such activities will be conducive to the peace and security of international society as well as the security of Japan. While abiding by the Japanese Constitution, then, there is a common understanding that international law, including the UN charter, shall be applicable to matters involving outer space.[133] Although Paragraph Four of Article Two of the UN Charter bans the use of force, Article Fifty-one recognizes, as an exception, the use of individual or collective right of self-defense in case of an armed attack, thus allowing the national exercise of the right of self-defense in space as well. That has enabled Japan, too, to utilize space for nonaggressive purposes, just as is the case on the ground. Additionally, a review of the governing ministries and agencies of the Japan Aerospace Exploration Agency (JAXA) has expanded that jurisdiction to include not only the Ministry of Education, Culture, Sports, Science and Technology and the Ministry of Internal Affairs and Communications, but also the Cabinet Office and the Ministry of Economy, Trade and Industry. It can be further expanded to include other ministries and agencies as the necessity arises.[134]

### (2) Development of Japan's Basic Plan on Space Policy, and National Security

The two Basic Plans on Space Policy that were established in 2009 and 2013, respectively,[135] do not specify the usage of space for security to a very high degree. While clearly mentioning the need to reinforce the functions of Information Gathering Satellites, those plans only went so far as to suggest verification and review as far as early warning technology is concerned. Still, they did contain several harbingers of a shift toward the security-related utilization of space, by mentioning about information sharing and command and control by the SDF, and the utilization of navigation satellites for security purposes would be deliberated in the future.

The Basic Plan on Space Policy, drawn up by the Strategic Headquarters for Space Policy for the purpose of advancing policies and measures related to space development and utilization in a comprehensive, planned fashion, outlines Japan's basic guidelines for activities in space.[136] The first Basic Plan was established in June 2009. It outlines governmental policy for the immediate five-year period thereafter, while eyeing the ensuing decade as well.[137] Some three and a half years later, in January 2013, the second Basic Plan was established, with the same time framework in mind as the first Basic Plan.[138] The third Basic Plan, established in January 2015, was drawn up two years after the decision of the second Basic Plan, probably because of the emphasis on the smooth development and utilization of space while remaining consistent with the National Security Strategy that had been adopted in December 2013. The third plan stresses security aspects more than the previous two plans.

Article Twenty-four of the Basic Space Law specifies that the Strategic Headquarters for Space Policy draws up the Basic Plan on Space Policy. Also, the Committee on National Space Policy—a consultative group for the prime minister that is composed of external experts—is to conduct investigations and deliberations on important matters concerning the policy for the development and utilization of space, including the Basic Plan on Space Policy, as well as guidelines for expense estimates. The committee, which was set up in July 2012 based on the Cabinet Office Establishment Act, has announced policy proposals and opinions concerning matters dealing with space development and utilization.[139] For example, the interim report of the committee's Basic Policy Task Force clearly called for the strengthening of Japan's utilization of space for security purposes,

as well as for intensified security-related cooperation between Japan and the United States in space so as to further solidify the Japan-US alliance. Such views can be regarded to have been reflected to a considerable extent in the third Basic Plan on Space Policy.[140)]

As its awareness of the current environment, the third Basic Plan starts out by mentioning the importance of security in the development and utilization of space.[141)] Above all, it points out the prominence of related activities by advanced space-faring nations, such as the United States, Europe, Russia, and China.

In its third Basic Plan, Japan, too, given the formulation of the National Security Strategy to replace the Basic Policy on National Defense of 1957, has paid consideration to the development and utilization of space in a way conducive to national security for the purpose of operation of the SDF and accurately identifying various circumstances.[142)]

In addition, in light of the role played by the deterrent force of the United States in the Asia-Pacific region, several items related to security considerations have been positioned by the Basic Plan as areas for cooperation between Japan and the United States in outer space. For instance, they include satellite positioning, SSA, maritime domain awareness (MDA), and guidelines for the treatment of remote sensing data.[143)]

Moreover, in view of the growing concern by countries around the world about such problems as space debris, the Basic Plan points out the need to work toward the stable utilization of space.[144)] It also points out the need to appropriately consider the future framework for space development and utilization, in light of the country's not having linked industrial promotion and security so far, given the unique characteristic of Japan's space development and utilization to date of not having actively utilized space for security purposes.[145)]

Based on the above considerations, the third Basic Plan states three security-related areas, to be described below. The first is the perspective of maintaining outer space as a safe area. For the continued stable utilization of space—be it for security purposes or otherwise—it is necessary to make sure that space itself is in a safe condition to use. The third Basic Plan ensures greater resilience by the strengthening of coordination in terms of satellite function with allies and others, hosted payloads, the utilization of commercial satellites, the development of small, responsive satellites, and the complementary use of ground-based systems.

Moreover, the Basic Plan calls for SSA data to be shared with foreign countries

to avoid excessive space debris, as well as for efforts to be made to establish the rule of law aiming at securing safety in space, with cooperation to be made in drawing up the International Code of Conduct for Outer Space Activities as proposed by the EU.[146)]

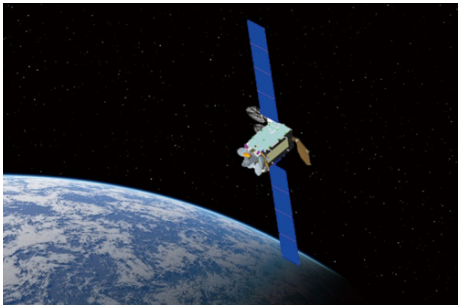


**Illustration of X-band defense communications satellite** (Japan Ministry of Defense)

The next security-related area stated by the third Basic Plan is the use of outer space to make the country more secure, calling for the reinforcement of space systems for the purpose of positioning, communications and information-gathering. Specifically, it says that such a capability can be strengthened through the following activities: (1) carrying out deliberations to enhance the Quasi-Zenith Satellite System, Japan's proprietary space system, which would permit sustainable positioning that does not need to rely on other countries' systems, (2) launching next-generation X-band defense communications satellites, which are superior in terms of resilience and information security, and (3) enhancing Information Gathering Satellites.

The final emphasis of the third Basic Plan is on space cooperation, with special stress put on coordinating and cooperating with the United States, as Japan's National Security Strategy holds that security cooperation in space with that country will improve the deterrent force of the Japan-US alliance and its ability to deal with situations.[147)] It makes clear mention of coordination between the GPS run by the United States and the Quasi-Zenith Satellite System that Japan has started to build as a satellite positioning system, as well as the pursuit of cooperation in such areas as SSA and MDA. In addition, it also states the reinforcement of cooperation with countries with which Japan shares common values and strategic interests, specifically naming such cooperation partners as Europe, Australia, India, and the countries of Southeast Asia.[148)]

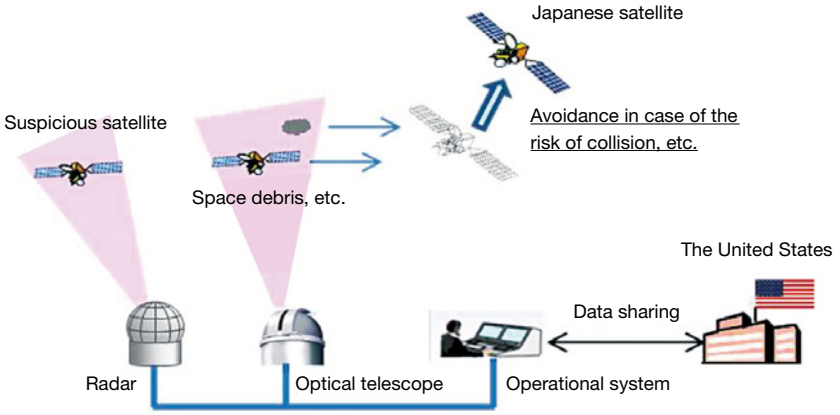
### (3) International Cooperation in Space Security

The utilization of space for security purposes, which is necessary for Japan to ensure its security, is not something the country can accomplish by itself. The first

item that ought to be considered in that regard is deepening cooperation in space with the United States within the Japan-US security framework. For example, as far as SSA is concerned, Japan can augment and supplement the segment of the US global surveillance network that lies within East Asia, one effective approach being the construction of an SSA system based on Japan-US coordination. Related appropriations for that have been sought in the budgetary request for fiscal 2016 as well.[149] The format and number of SSA sensors to be developed will become clarified in the overall design of the system that is planned for fiscal 2016 (see Figure 1.2).

Also, there are ways for the United States and Japan to mutually cooperate in MDA, which aims to develop appropriate methods to deal with maritime security, the securing of safe navigation, and appropriate responses to natural disasters and environmental pollution. Currently, all large shipping vessels are required to be equipped with an Automatic Identification System (AIS), which transmits such basic information as identification signals, position, and speed. However, since AIS uses the very high frequency band for radio waves, it is only able, on land, to receive signals from vessels lying within fifty kilometers or so from shore. If the radio waves are received in space, taking advantage the fact that radio waves also extend in the vertical direction, it will become possible to ascertain globally the

**Figure 1.2. Conceptual illustration of Japan's space surveillance system**




*Source:* Japan Ministry of Defense, *Japan's Defense and the Budget—Overview of Fiscal 2016 Budgetary Request*, December 24, 2015, p. 13.

position of ships sending out AIS signals. Although the United States has led efforts in the field, Japan's JAXA and others are also actively engaging in tests,[150] meaning that in the future, cooperation between Japan and the United States may enable law-enforcement agencies and others to detect and track the movements of a variety of shipping vessels, combined with other kinds of data besides AIS.[151]

Cooperation with Europe is also important for Japan's space security. The EU's proposal for an International Code of Conduct is conducive toward the confidence building between space-faring nations. Japan has actively participated in multilateral Open-ended Consultations concerning this code of conduct, and has also conducted outreach activities with other countries in the Asia-Pacific.

In the world today, there are only a handful of countries capable of manufacturing space equipment (such as satellites and launch vehicles) as well as constructing related ground systems: the United States, Europe, Japan, India, Israel, Russia, China, and so forth. The world does not want tensions to arise and confrontation to deepen among those countries. Moving forward, space systems will increasingly come to be seen as global public goods. From that perspective, it is desirable as well for international cooperation to occur between Japan, the United States, and Europe on the one hand and China and Russia on the other. However, given that tense relations on the ground can easily influence activities in space, it will not be easy for such cooperation to deepen. As far as Russia is concerned, there is room for a certain degree of international cooperation to grow, since that country also participates in the International Space Station. Meanwhile, the current situation of cooperation with China is one that has made little progress, since that country has developed space activities on its own after having received technological assistance from Russia. On the other hand, there are areas where cooperation is possible, such as in the area SSA, which benefits all countries operating in space. An emphasis on common interests such as that—for example, a proposal by Japan to China for space cooperation—is expected to lead toward the development of greater confidence-building.

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Chapter 1 authors: Yasuhito Fukushima (lead author, Sections 1 and 2),
Yasuaki Hashimoto (Section 3)