

Basic Guidelines for Space Development and Use of Space

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With the establishment and enactment of the Basic Space Law in 2008, the development and use of space was provided to be conducted in accordance with the international agreements and in accordance with the principle of pacifism enshrined in the Constitution of Japan. Also, it was stipulated that the government of Japan would be responsible to take the necessary steps to promote measures that contribute to ensuring the peace and security of the international community as well as Japan's national security. Furthermore, the Strategic Headquarters for Space Development was established within the Cabinet in order to promote measures concerning the development and use of space in a comprehensive and systematic manner.

In light of the major change of environment introduced by the establishment of the Basic Space Law, the Ministry of Defense will consider the necessary steps to exploit possibilities for the development and use of space in new fields of security, in concert with the comprehensive and systematic development of space as deliberated by the entire government.

I. Trends of Space Development and Use

1. Significance of Space Development and Use for Defense Purposes

Due to the sophistication of military science and technology in recent years, the buildup of defense capabilities is increasingly focused on networking – the interactions of individual pieces of equipment and systems such as sensors, communication devices, command and control systems and various platforms (vehicles, vessels, aircraft, etc.) – to enable (a) sophisticated and accurate situational awareness covering a wide range, (b) real-time information sharing, (c) immediate command and control operations from remote places, and (d) precision guiding, etc., and thereby achieve systemization – maximizing of the equipment's performance as an ensemble.

For such networking and systemization of the equipment, it is extremely beneficial to take advantage of the nature of space, being a part of no national territory and is not bound by conditions such as topography, as well as to conventional systems and hardware set on the earth's surface. For the foreseeable future, the development and use of space will be absolutely necessary for defense purposes.

2. Examples of Space Development and Use for defense purposes

The sophistication of Earth observation technologies has enabled monitoring of the Earth's surface, including meteorological and ocean phenomena, and global exchange of radio waves in space. Against this backdrop, space development and use for defense purposes can be categorized into four major capabilities: information gathering, warning, and surveillance; communication; positioning, navigation and timing (PNT); and meteorological observation.

(1) Space-based information gathering, warning, and surveillance

Information gathering, warning, and surveillance by satellites can make use of diverse kinds of sensors such as optical sensors, synthetic aperture radar (SAR) sensors and infrared sensors, and is extremely beneficial in early detection of signs of various contingencies and in assessing the local situation to facilitate international peace cooperation activities.

(2) Space-based Communications

Satellite communications (SATCOM) can cover a wide range of area with a combination of relatively simple terrestrial infrastructure, and excels in broadcasting capability and invulnerability to natural disasters. It is one of the flexible means of communication as it is immune to communication jamming due to topography.

Also, as a new operational need, there is an increasing demand for accurate command and control

and prompt information sharing, which are essential for the smooth performance of duties among multiple units. SATCOM is a major piece of infrastructure in terms of meeting such needs.

(3) Space-based positioning, navigation and timing (PNT)

Space-based PNT system enables positioning regardless of time and place, free of terrestrial infrastructure. Its use is not limited to navigation control and location identification, but also includes improving targeting accuracy, monitoring and controlling battlefields, and synchronization, among other possibilities.

(4) Space-based meteorological observation

Meteorological satellites enable prompt, constant, and seamless gathering of meteorological information that may affect the activities and missions of SDF units inside and outside Japan.

3. Development and Use of Space for Defense Purposes by Other Countries

According to published materials, currently only the United States (US) is in possession of all capabilities listed in 2. above, while Russia seems to possess at least information gathering, warning and surveillance; communication; and PNT capabilities. Major European countries possess information gathering, warning and surveillance; and communication capabilities. China may possibly be engaged in the development and use of space in the areas of information gathering, warning and surveillance; communication; and PNT. European countries are currently promoting the Galileo Program aimed at developing PNT capabilities for non-military use. As such, various countries are committed to maintaining communication capabilities in the area of defense as well as to maintaining or acquiring information gathering, warning, and surveillance capabilities.

4. Future Trends in the Development and Use of Space for Defense Purposes

It is supposed that the capabilities listed in 2. above will continue to play important roles for defense purposes. Nevertheless, there is a possibility in the future that the modality of development and use of space may change due to developments in the field of science and technology. For example, the issue of so-called space debris is becoming increasingly serious with the advancement of the development and use of space. As such, we are likely to see a heightening of interest on ensuring safety in the domestic development and use of space and on other matters. Therefore, sufficient monitoring is needed concerning the trends in development and use of space for defense purposes.

II. Current Situation and Challenges of Development and Use of Space

1. Information gathering, Warning, and Surveillance

In order to ensure the effective operation of defense capabilities in various situations, including effective responses to new threats and diverse contingencies, it is extremely important to detect signs of these situations in advance and conduct prompt and accurate gathering, analysis and sharing of information. It is also equally important to continue warning and surveillance activities in Japan's territorial waters and airspaces as well as the surrounding sea and air spaces on a daily basis, and gather and process information necessary for defense. Use of space is regarded as a powerful tool for reinforcing information gathering, warning, and surveillance capabilities.

(1) Imagery information gathering capability

[Current situation]

Satellites with imagery information gathering capability fall into two categories: optical satellites that photograph images using optical sensors and SAR satellites that synthesize images using radar reflection from the Earth's surface. Taking advantage of both by combining them interactively will be effective since SAR satellites, thanks to radar technology, can gather imagery information during

the night or in cloudy conditions that optical satellites have difficulty handling.

Therefore, the Ministry of Defense has been using various high resolution commercial imagery satellites in an all-round manner, including IKONOS (optical satellite) and TerraSAR-X (SAR satellite) for imagery information gathering.

Also, there is the Information Gathering Satellite (IGS), a system composed of optical satellites and SAR satellites, which has been introduced by the inter-ministerial effort of the government for the purpose of crisis management, including response to security contingencies and large-scale disasters. The Ministry of Defense has also been making appropriate use of the IGS for various information analyses. In addition, Japan has also been on track for developing and operating civil imagery satellites.

Meanwhile, the US is currently developing small satellites that can shorten the preparation time needed for launching. Although these satellites have only limited features and are short-lived, they will be useful in responding to a sudden failure of the satellites in space as well as in monitoring a certain region intensively in the time of emergency.

[Issue]

High resolution commercial imagery satellites used by the Ministry of Defense excel in cost-effectiveness and resolution, but embody a potential risk that necessary images may not be gathered on a timely basis. On the other hand, there is a plan to improve the performance of the IGS, as well as the interagency initiative to promote the development and use of space in a comprehensive and systematic manner. In light of these factors, the Ministry of Defense needs to work on enhancing its imagery gathering capability, including the performance of the IGS.

Also, from the perspective of supplementing the IGS, use of the small satellites should be considered based on the needs of the Ministry of Defense, while taking into account the R&D trends in the US, technical feasibility, and other factors.

Furthermore, sophistication of imagery satellites for civil use, such as the Advanced Land Observing Satellite (ALOS), opens up possibilities for using these data for a wide range of purposes. Thus it is necessary to consider how these data can be utilized effectively, as well as to build an appropriate framework for the public use of these data by addressing points of concern from the perspective of national security, in accordance with the Basic Plan for the Advancement of Utilizing Geospatial Information (approved by the Cabinet on April 15, 2008).

(2) Radio wave information gathering capability

[Current situation]

The Ministry of Defense has been monitoring military communication radio waves passing over Japan's territory and other kinds of radio waves, including those transmitted from weapons systems, but the scope of monitoring is currently limited due to the nature of radio waves and other factors. Radio wave information gathering satellites are supposed to be possessed by the US, Russia, and other countries, and are regarded as being effective, but the circumstances of their operation has not been made clear.

[Issue]

For the monitoring of radio waves, it is necessary to establish a standing monitoring system against the target area in times of peace in order to meet the needs of constant surveillance and tracking on a daily basis. This will require considerable funds and manpower. Also, further study is needed to clarify the nature of radio waves transmitted through the ionosphere.

(3) Early warning capability

[Current situation]

Japan's ballistic missile defense (BMD) system can detect, track, and intercept ballistic missiles flying to Japan in space using its radar network (terrestrial and naval radars). Even more effective responses will be possible if ballistic missiles can be detected immediately after launch. Therefore, Japan is working on improving the reliability of the BMD system by connecting early warning information on ballistic missiles obtained from the US with the Japan Aerospace Defense Ground Environment (JADGE), the SDF's automatic warning and control system.

[Issue]

An early warning capability that can detect ballistic missiles immediately after launch is significant from the viewpoint of further improving the reliability of the BMD system, since it supplements the role played by Japan's FPS-5 radars and other sensors' information.

However, a satellite system with early warning capability will be required to unfailingly detect the act of launching as well as the launch position, launch time, and launch direction immediately after the launching of a ballistic missile, and to report about it in an extremely short time. From the technical side, it is essential to minimize false detections by developing sensors immune to the effects of atmosphere and clouds that are best suited for the missiles' infrared radiation properties, and by preparing a database on the effect on infrared waves by the infrared properties of each missile, and meteorological phenomena of clouds and the atmosphere. It must be taken into account that building such a system including database development and sensor optimization require years of strenuous efforts.

According to the US Missile Defense Agency, there is a program aimed at using advanced infrared sensors, etc., to enable them to not only detect missile launches but also identify and track ballistic missile in space, and promptly relay the information about the target to the terrestrial surveillance sensors and interception systems. The precision of interception is expected to be further improved if such technology is put to practical use.

(4) Other considerations for the future

The Ministry of Defense and the Self-Defense Forces (SDF) have been conducting warning and surveillance on a continuous basis in the sea and air spaces surrounding Japan, using vessels, airplanes, ground facilities, etc. However, more seamless warning and surveillance capabilities will be required for effective response to new threats and diverse contingencies.

The use of satellites may bolster Japan's warning and surveillance capabilities, but there remains a number of technical challenges for high-resolution and seamless monitoring over a wide area. Consideration is needed from the viewpoints of urgency of need, technical hurdles, alternatives (division of roles with unmanned aerial vehicles [UAV], etc.), and cost effectiveness.

2. Communications

[Current situation]

The Ministry of Defense and the SDF have been using the Ka and Ku bands (high-capacity communication) for communicating with ships, sending images from helicopters, and for other purposes, utilizing commercial (general-purpose) high-speed SATCOM services. The X band (mid-capacity communication) of the Superbird Satellites is used exclusively by the Ministry of Defense for communication with ships, aircrafts, etc.

[Issue]

The communication needs of the SDF have been increasing as is the case of general communication demand, requiring quick transmission of images, video, and other data in various situations including communication with high-speed mobile objects. It is necessary in the future to improve the capacity of SATCOM upon estimating SDF's communication requirements.

3. Positioning, Navigation and Timing (PNT)

[Current situation]

The SDF uses only the US's Global Positioning System (GPS) satellites in its positioning equipment. Their usages include positioning, precision guiding, navigation and aviation control, and timing.

In particular, military codes are employed in the equipment developed by the US for military purposes, including guided missiles that require highly precise positioning information. Civilian codes are used in other equipment.

Currently, the US is suspending to degrade the accuracy of civilian codes. As a result, precision on par with that of military codes is ensured for civilian codes as well.

[Issue]

The Ministry of Defense and the SDF also use military codes for equipment such as guided missiles that require highly precise positioning information. There is no particular issue to be addressed as long as the US is operating the code.

On the other hand, there is a concern in the future that a situation such as system trouble for civilian code may affect positioning, navigation, and aviation control by the Ministry of Defense and the SDF. In light of this, consideration is needed on expanding the use of military codes.

The vulnerability of the GPS to jamming, etc., has also been pointed out. In this regard, airplanes, for example, use the GPS for aviation in combination with the Inertial Navigation System (INS) and other systems, making it possible for them to continue flight without the GPS. As such, we need to continue to maintain and developing means that do not depend on the GPS.

4. Meteorological observation

[Current situation]

The Ministry of Defense and the SDF have been obtaining meteorological satellite images of inside and outside Japan as weather information helpful for the operation of units.

[Issue]

At the current moment, meteorological information needed for the operation of units is obtained from existing meteorological satellites and terrestrial weather observation networks controlled by the Ministry of Defense and the SDF. Nevertheless, the next-generation Geostationary Meteorological Satellites (Himawari-8 and 9) should also become a source of necessary information.

5. Protection of Satellites, etc.

[Current situation]

In January 2007, China conducted an experiment to destroy a worn out satellite by directly hitting it with a so-called anti-satellite weapon launched from the Earth. This has produced a large volume of space debris, hindering space activities in orbit.

[Issue]

To ensure the safe and stable development and use of space, and to respond to the future trends of development and use of space by other countries, we need to consider steps to protect our satellites and other measures with an eye to cost effectiveness and technological feasibility.

Meanwhile, we need to proactively consider measures to safeguard information, etc., from intelligence activities of other countries using satellites, such as artificial fog or smoke screens generated on the Earth, for example.

6. Measures for Supporting the Safe Development and Use of Space

(1) Launch system

[Current situation]

The Ministry of Defense and the SDF do not possess the capability to launch and control satellites nor the technological expertise relating to launch vehicles. Other ministries, governmental agencies, and private companies are proposing research on an air launch system.

[Issue]

Concerning the launch system, the Ministry of Defense needs to consider building cooperative relations for securing affordable and reliable systems, in cooperation with other ministries and institutions that possess launch vehicles, launch sites, launch systems, and other assets or technological expertise.

Air launch systems generally have a limited payload. The necessity of a launch system using SDF aircraft must be considered in a way that encompasses the need to launch small satellites among other ministries, etc.

(2) Space Situational Awareness (SSA)

[Current situation]

The Ministry of Defense and the SDF do not possess the capability to monitor the space environment such as the state of solar winds and ionization layers that may cause satellite system troubles, nor faculty to monitor space debris that may cause physical damages by colliding with satellites.

It is said that the Space Surveillance Network (SSN) managed by the North American Aerospace Defense Command (NORAD), a bi-national US and Canadian organization, Russia's Space Surveillance System (SSS), and other systems have regularly monitored space debris of relatively large sizes and satellites by using terrestrial radar and optical observation facilities.

[Issue]

For space situational awareness and observation, a comprehensive and systematic initiative must be considered by the government as a whole, in a way that will also encompass the effective use of various capabilities possessed by the Ministry of Defense and the SDF, the Japan Aerospace Exploration Agency (JAXA), and other institutions, in order to ensure the safe and stable development and use of space in both the public and private sectors.

7. Measures for Effective and Efficient Development and Use of Space

(1) Exchange and Cooperation with Other Ministries and Institutions

[Current situation]

(i) Exchange between the Ministry of Defense and other Japanese institutions

Generally, research activities of the Ministry of Defense mainly involve applied research that

directly leads to the development of equipment, etc. Due to such characteristics, introduction of useful basic research outputs from outside institutions is expected to be greatly conducive to streamlining the Ministry's R&D. Therefore, the Ministry has been proactively promoting exchanges with other institutions in Japan that possess advanced technology in the civil and academic fields. However, such exchanges are extremely limited in the area of development and use of space, which is also the case in the non-technical areas such as the operation of satellites.

(ii) Dual use

Various capabilities of satellites, which were mostly used only for military purposes in the past, have recently been popularized as dual-use technologies with the development of high-resolution commercial imagery satellites, as well as the introduction of the IGS for crisis management, including responses to large-scale disasters and other contingencies.

In the case of Europe, the European Space Policy adopted by the EU in 2007 emphasizes the need for synthesis between civilian and military entities as well as interoperability between civilian and military users. Also, Israel is said to have been conscious of dual use technologies from the initial stage of satellite development, as exemplified by the common designs of commercial and military components.

In Japan, there is no precedent for the involvement by the Ministry of Defense in space programs of other ministries, excepting the involvement in the IGS.

[Issue]

(i) Exchange between the Ministry of Defense and other Japanese institutions

For the Ministry of Defense to efficiently cultivate space-related technologies and obtain data and information, it must consider exchanges with other institutions in Japan possessing abundant technological knowledge, technological bases, and related facilities, etc., in space-related areas. Such exchanges are expected to elevate Japan's technological standards by generating interconnectedness and synergy between defense technologies and civilian technologies, thereby catalyzing dynamic technological cycles and applications.

Consideration is also needed for exchanges and cooperation with regard to operation, including the launch system and the SSA, etc.

(ii) Dual use

Since the development and use of space requires enormous budgets, they must be implemented as efficiently and effectively as possible. Considering this requirement, it is important to adopt dual-use technologies for the Ministry of Defense's development and use of space, by incorporating the perspective of defense into the space programs of other ministries. This must be promoted under a comprehensive and systematic initiative of the government as a whole promoted by the Strategic Headquarters for Space Policy. For example, multi-wavelength optical sensors, which are expected to be useful in resource exploration and other searches by satellites, can be applied to defense purposes in the future for improving identification function.

(2) Dialogues, exchanges, and cooperation with other countries

[Current situation]

The Ministry of Defense has been holding dialogues and cooperating with the US in space-related initiatives, mainly in the area of BMD.

In Europe, there is a mutually complementary relationship founded by cooperation among countries, as exemplified by a program for several countries to share optical and radar imagery satellites for

joint use and operation.

Furthermore, the US has been constructing the Wideband Global SATCOM (WGS) constellation with the cooperation of other countries. The participating countries are supposed to be able to use the WGS constellation with lower costs compared to developing the original SATCOM network.

[Issue]

Although the Ministry of Defense's effort in terms of dialogue and cooperation has so far been concentrated in specific areas such as BMD, the effort must be expanded to cover overarching issues concerning space. Consideration is needed for the modality of international dialogue, exchange, and cooperation, in order to benefit from interactions with the countries with abundant records of achievements.

8. Human Resources and Organization of the Ministry of Defense and the SDF for Development and Use of Space

[Current situation]

The Ministry of Defense's plan for JFY2009 for advancing consideration on new developments and uses of space include the reinforcement of the space policy team of the Defense Policy Division (Defense Policy Bureau) and the establishment of the Space Technology Planning Office at the Advanced Defense Technology Center of the Ministry's Technical Research & Development Institute (TRDI).

[Issue]

It would be essential to have human resources and organization with expertise in space, if the SDF were to fully operate the space-related systems, etc. Consideration is needed for recruiting and nurturing human resources and for establishing new specialized organizations, etc., in light of the defense needs.

III. Basic Guidelines for Development and Use of Space

1. Basic Concept

Following the establishment and enactment of the Basic Space Law, the Ministry of Defense will advance considerations beyond the framework of the traditional generalization theory concerning new development and use of space in the area of security, under the interactive, concerted effort of the government as a whole.

Japan will promote a comprehensive and systematic initiative based on its national strategy spelled out in the Basic Plan for Space Policy (hereinafter, the "Basic Plan"), which clarifies its medium- and long-term policy on the development and use of space. The Ministry of Defense is also expected to make necessary contributions by cooperating and taking initiatives in these efforts.

Furthermore, the Ministry of Defense and the SDF need to consider space policy, not excluding the possibility of specific project formulation, in the future vis-a-vis cost effectiveness, technological feasibility, and other factors. Consideration will be made in light of the Ministry's Defense Posture Review underway, and with an eye to the revision of the National Defense Program Guidelines (NDPG) and the forthcoming formulation of the new Mid-Term Defense Program.

(1) Priority areas

It is important that the development and use of space by the Ministry of Defense and the SDF are promoted with consideration to the following points, in light of their relation to Japan's basic security policy, the role of defense capabilities, and other factors.

- (i) Securing of information superiority is indispensable in light of Japan's basic security policy founded on the principle of an exclusively defense oriented policy.
- (ii) Under the new security environment, in order to deploy defense capabilities effectively in various situations, including effective response to new threats and diverse contingencies, it is essential to detect signs of these contingencies in their early stages and promptly relay and share gathered information.
- (iii) In addition to full-scale aggression, in order for the SDF to respond quickly to new threats and diverse contingencies, it is extremely important to constantly monitor Japan's territorial waters and airspace as well as the surrounding sea and air space, and to gather and process information necessary for defense.
- (iv) From the perspective of streamlining Japan-US bilateral responses and enhancing joint operation capabilities, it is important to ensure accurate transmission of command and order, and speedy information sharing.
- (v) The smooth operation of units, etc., dispatched overseas for international peace cooperation activities and other purposes requires accurate handling of information gathering on the ground and information sharing between units, etc.

Considering the above points, C4ISR (see Note) capability must be enhanced; the latter for the sake of prompt and accurate information gathering, real-time information sharing and command-and-control. The Ministry of Defense will focus on (i) information gathering, warning, and surveillance and (ii) communication, as the priority areas for the near term in promoting development and use of space. This focus reflects the expectation that use of space will be an effective means to strengthen capabilities in information gathering, warning, and surveillance and communication, in combination with existing communication infrastructure and UAVs, etc.

Note: C4ISR is the collective term for "Command, Control, Communication, Computer, Intelligence, Surveillance, Reconnaissance."

Priority areas of development and use of space will be reviewed as necessary, in light of the outcome of the Defense Posture Review underway in the Ministry of Defense.

(2) Points to consider in promoting space use

The Ministry of Defense can take initiative in developing equipment that is strictly used for defensive purposes. Meanwhile, equipment that is expected to also be useful for other ministries will be developed under the interactive, concerted effort of the government as a whole, in light of the applicability of communication, information gathering, and other capabilities using satellites in various areas including security, as well as the need for the efficient and effective development and use of space.

The world's most cutting-edge technologies must be sought in order to use space for security purposes. To this end, it is important that the Ministry's R&D also encompass utilization of civilian technologies, keeping in mind the progress of effective dual-use for civil and defense purposes. As such, the Ministry will also proactively promote the employment of capabilities of private entities. Meanwhile, establishment of production and technological infrastructure for space activities required for Japan's security must be advanced with consideration for their relation to production and technological infrastructure in the closely linked area of defense.

(i) Building cooperative relationship with the civilian sector through interactive cooperation

The Ministry will deepen cooperative relationships with the civilian sector under the interactive, concerted efforts of the government as a whole, in light of new initiatives for the development and

use of space in the area of security, following the establishment and enactment of the Basic Space Law. It will also consider the need for comprehensive and systematic initiatives on the development and use of space, as well as the progress of dual use between the defense and civilian sectors in Europe and other regions.

(ii) Promoting exchanges with other institutions

Cooperation between the Ministry of Defense and other Japanese institutions (related ministries, independent administrative corporations, universities, etc.) in civilian and academic fields that possess advanced technology has not necessarily been sufficient. From now on, the Ministry will promote exchanges with other Japanese institutions, based on technological knowledge, technological bases, related facilities, and other assets accumulated from the past.

In particular, cooperative relationships will be built with government-affiliated research institutions in an appropriate manner, in light of the result of deliberations at the Strategic Headquarters for Space Policy on the modality of institutions and administrative organization concerned with development and use of space, and other matters.

2. Measures to Promote Development and Use of Space

(1) Satellites with imagery information gathering capability

For effective response to new threats and diverse contingencies, it is extremely important for national security to use satellites with imagery information gathering capability, in order to monitor military trends in the region surrounding Japan on a daily basis and to detect signs of these contingencies at an early stage.

Therefore, in addition to the use of commercial satellites, the Ministry of Defense and the SDF may consider having their own imagery satellites. However, operation of satellites requires considerable cost and manpower. There is also the possibility of functional overlap between these satellites and the IGS, and the latter will continue to shoulder an important role in providing necessary information for national security with improved performance (even if the Ministry of Defense owns a satellite, its capacity is bound to about the same as that of the IGS in the foreseeable future). In addition to such factors, we need to take into view the overall initiative of the government. At the current moment, the following measures are determined to be more necessary:

- Enhance the capability of the IGS (such as improving the resolution performance), for which Japan has accumulated experience in development, maintenance, and operation, to further improve the quality and quantity of available image data and enhance the complementarity with commercial satellites through the MOD;
- Consider technological feasibility and cost effectiveness of increasing the unit number of IGS (increasing the frequency of observation), in addition to operation-responsive small satellites.

The Ministry of Defense will proactively engage in discussions for improving the abovementioned capabilities and developing the necessary operation postures.

Also, concerning the effective use of data from ALOS and other satellites for civilian use, the Ministry of Defense will handle data processing and search systems, data management structures, and considerations for the public use of said data from the viewpoint of national security, under the interactive, concerted effort of the government as a whole.

(2) Satellites with radio wave information gathering capability

Concerning satellites with radio wave information gathering capability, the Ministry of Defense

must confirm the efficacy of its use by conducting studies on technological feasibility, collectable radio wave information, and other matters, after fully examining its comparative advantage and division of roles with alternative means, as well as its cost effectiveness and other points of concern. To this end, the Ministry will seek scientific elucidation of radio wave properties in space under the interactive, concerted effort of the government as a whole.

(3) Satellites with early warning capability

Early warning information is required not only for the BMD system but also for other ministries from the perspective of civil protection and gathering information. Furthermore, satellites with such capability are useful in monitoring disasters such as wildfires, volcanic activities, and aircraft accidents, space situational awareness such as rocket launches, and other information gathering, due to the advantage of highly sensitive infrared sensors. The US employs early warning satellites in these areas as well. Since satellites with such a capability can be used for multiple purposes including BMD, their employment must be considered on a broad basis and R&D advanced under the interactive, concerted efforts of the government as a whole.

The Ministry of Defense and the SDF will employ defense-related technologies hitherto accumulated to consider further R&D of high-sensitive infrared sensor which plays a crucial role in the early warning capability in advance.

(4) Satellites with satellite communication capability

The optimal method for improving satellite communication capability in the future (use of general-purpose commercial satellites and defense-dedicated satellites, shared use with other ministries and private institutions, and use of capabilities of private operators) will be considered upon clarifying communication requirements (coverage, capacity, network integration, sustainability, etc.) and with consideration to the stability of use, form of operation (joint operation, international peace cooperation activities, etc.), cost-effectiveness, including lifecycle cost, and other points of concern.

Responses to high-capacity communication will be considered upon estimating future communication requirements.

(5) Launch system

Launch systems do not necessarily have to be defense-use only. In light of the need for affordable and highly reliable facility, the Ministry of Defense will also pay attention to the R&D projects and other initiatives promoted by other ministries. It will also consider developing air borne launch systems, in the context of the future trend of Micro/Nano satellites.

(6) Developing human resources, organization, and technological base; securing budget

Space development and use generally require investments in a range of areas including satellites possessing various capabilities, launch vehicles, launch sites, organization for controlling satellites, facilities and professionals for analyzing data from satellites, as well as advanced science and technology to enable the development and use of space as our frontier. It is impossible to develop the necessary human resources, organization, and technological base all at once, requiring us to develop them in an effective and efficient manner in light of our defense needs.

Furthermore, the best effort must be made for securing the necessary budget for promoting security measures in the forthcoming Basic Plan and the Ministry's measures related to the development and use of space.

(7) Securing autonomy and cooperating with other countries

It is desirable to secure autonomy in operational and technological aspects in a way that will meet our defense needs, in developing defense capabilities through development and use of space to achieve excellent flexibility and high performance.

On the other hand, given the limited technological knowledge and assets possessed by the Ministry of Defense and the SDF in the area of development and use of space, we need to consider the way for broad-based cooperation with other institutions, including the possibility of technological cooperation with technically advanced countries, in addition to cooperation with Japanese institutions.

In particular, the US has a considerable lead in this field. We therefore need to pay close attention to the initiatives taken by the US Department of Defense on development and use of space and their joint projects with other countries. Based on this knowledge, we must consult with the US on future bilateral cooperation and other issues.

We will also interact proactively with other countries in dialogues and exchanges, as a part of defense exchanges, from the perspective of confidence-building.

(8) Response to future trends in development and use of space in the area of defense

The Ministry of Defense and the SDF will consider new areas of development and use of space, such as protective measures for satellites and space situational awareness (SSA), in light of the trends of development and use of space in other countries. At the same time, due consideration should be given to the discussions at the UN and other organizations to prohibit arms races in space.