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\* この記事は、調査及び立法考査局内において、国政審議に係る有用性、記述の中立性、客観性及び正確性、論旨の明晰（めいせき）性等の観点からの審査を経たものです。

\* 本文中の意見にわたる部分は、筆者の個人的見解です。

## Chapter 1 **Ethical, Legal, and Social Issues in the Use of Outer Space**

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It is easy to imagine that as the use of outer space increases, situations will arise that existing legal frameworks and ethical standards will not be able to deal with. This is similar to the case of social implementation of other new science and technology. In addition, as more and more private companies enter the space industry, there will be greater demand for a stable and predictable regulatory framework to reduce future business uncertainties. However, it is difficult for a single country to decide on the laws and regulations for space utilization alone, and successful international negotiations will require explanations based on ethical norms. Thus, space utilization requires not only a legal framework but also ethics. Furthermore, public support is essential for exploration of space resources and human spaceflight because of the large budgets involved. It is also necessary to develop future scenarios for space utilization, identify the associated ethical, legal, and social issues (ELSI) at an early stage, and strategically consider approaches to address these issues. To that end, this paper provides an overview of domestic and international trends in space law, space ethics, and public opinion on space.

## Chapter 2 **Current Situation and Issues of Space Transportation System in Japan**

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The space business is expanding due to efforts by private companies, and this report focuses on the space transportation systems, especially rockets, which is the foundation of the space business.

The major countries and regions for rocket development and launches are the United States, China, Europe, Russia, Japan, and India, but SpaceX in the United States has been successfully carrying out launches at low prices. In Japan, development is underway on the flagship H3 rocket and private sector rockets.

Japan's main issues related to rocket launches include the cost reduction of rocket development and launches, the development of spaceports, and space travel.

Japan's rocket development and launching business is expected to face severe competition in the business sector, as the independence of space activities is required from the viewpoint of national security.

## Chapter 3 Possibilities and Problems of Satellite Constellations

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In recent years, “satellite constellations”, in which many small satellites are launched into low orbit and operated as a system, have attracted attention as a method of utilizing space. Services that utilize satellite constellations in the private sector include satellite broadband communications and earth observation services. Those services are anticipated to contribute to solving various global issues and related industries are expected to grow significantly.

As the business environment related to space is undergoing major changes, the Japanese government is working to support start-up companies involved in satellite constellations and to develop optical satellite communications. On the other hand, there are concerns about space congestion and environmental pollution in the upper atmosphere as problems with satellite constellations.

## Chapter 4 The Utilization of Observation Data Obtained by Satellite Remote Sensing

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Remote sensing is a technology to acquire information about the type, quantity, composition and condition of an object, as well as the distance to the object, by observing the reflection and scattering of electromagnetic waves, radiation, etc. from a remote location or at a distance from the object. Satellites are equipped with a variety of sensors to observe the Earth’s atmosphere, oceans, and land areas. The utilization of observation data obtained by satellite remote sensing (satellite observation data) has been attracting attention from the perspective of solving social issues and creating new businesses.

However, in Japan, there are problems related to the utilization of satellite observation data, such as data continuity, insufficient high-frequency observation data, data access issues including expertise and cost barriers, weakness of solution services, and lack of stable demand until a business is established. In order to tackle these problems, efforts are being made, especially to support satellite businesses and solution development businesses, and to improve the functionality of satellite data platforms.

In the business use of satellite observation data, users have choices worldwide. As the number of satellites in the world increases, Japan’s satellite observation data, satellites, and sensors will continue to require distinctive features or selling points to be selected by users.

## Chapter 5 **U.S. Policy for Supporting R&D-intensive SMEs and Startups: Small Business Innovation Research Program**

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In the U.S., the Small Business Innovation Research Program (SBIR) has operated for 40 years since 1983, supporting R&D-intensive small and medium-sized enterprises (SMEs). SBIR provides grants to SMEs in a phased manner to solve technical problems that government agencies face or promote R&D to solve societal issues. A feature of SBIR is that government agencies not only subsidize R&D but sometimes serve as a market for new technologies. SBIR has repeatedly been comprehensively evaluated, received high marks, and gained broad political support. However, there have been continuing debates over “SBIR mills,” a group of SMEs that have repeatedly received large numbers of grants from SBIR but have not necessarily been successful in commercialization.

## Chapter 6 **Developments of Organizations Related to Space Security**

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Recent space policies of various countries, including Japan, have closely linked the use of space with national security, and there is a growing recognition of space from the perspective of national security.

In the United States, a major reorganization has taken place with the establishment of the United States Space Force as a new Armed Force and the United States Space Command as a new Combatant Command. France, the United Kingdom, Germany, and Japan are also establishing new organizations for space security.

While the trends in each country are similar in that organizations specializing in the space domain are being created within armed organizations, differences can be observed in the size and positioning of these organizations.

## Chapter 7 **Technologies and Rules for Dealing with Space Debris: For Sustainable Use of Outer Space**

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Spacecraft wreckage and fragments are called “space debris.” Space debris orbits around the earth at such a high speed that even debris of only a few centimeters in size can cause fatal damage to a satellite in operation when they collide. The amount of space debris has been increasing due to spacecraft exploding or being intentionally destroyed, and is expected to continue to increase unless appropriate measures are taken. The reduction of space debris is an urgent issue for sustainable use of outer space.

In order to deal with the space debris problem, technologies to observe and monitor space debris are being developed, as are technologies to avoid collision or protect against space debris. In addition, technologies are being developed to prevent satellites from becoming space debris by removing them from orbit when they are no longer in operation, and to remove space debris that already exists in orbit. However, there are no specific rules for reducing space debris under international law. Countries involved in space exploration have addressed the issue by developing guidelines.