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Objectives concerning the running of the operations to be achieved by Japan Aerospace Exploration Agency
(Mid to Long-term Objectives)
(Draft)

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Cabinet Office
Ministry of Internal Affairs and Communications
Ministry of Education, Culture, Sports, Science and Technology
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* III.3, III.4, III.5, IV.1, IV.2, IV.3, V and VI are categorized as groups of specific projects.

This document sets forth the objectives concerning the administration of the operations to be achieved (“mid to long-term objectives”) of national research and development agency, Japan Aerospace Exploration Agency (“JAXA”), pursuant to Article 35-4-1 of the Act on General Rules of Incorporated Administrative Agencies (Act No. 103 of 1999, “the Act”).

I. Position and role of JAXA in the policy system

Pursuant to the Act on the Japan Aerospace Exploration Agency (Act No. 161 of 2002, “Act on JAXA”), JAXA is responsible for promoting academic research in universities, improving the level of space and aeronautical science and technology and conducting space development and utilization in comprehensive management of projects including academic research of space science, basic and fundamental R&D of space aeronautics, and development, launch, tracking and maneuvering of artificial satellites.

In regard to the R&D and utilization of space, Article 19 of the Act on JAXA stipulates that mid to long-term objectives of JAXA shall be determined or changed according to the Basic Plan on Space Policy. In regard to the aviation, preferential R&D operations are specified in the Research and Development Plan corresponding to the 5th Science and Technology Basic Plan (February 2017, CST's Subdivision on R&D Planning and Evaluation, Ministry of Education, Culture, Sports, Science and Technology (MEXT), “R&D Plan”).

The importance of R&D and utilization of space and aviation in Japan can be summarized as follows: The space is currently used for information gathering, positioning and command and control and plays an important role as the basis of national security, and at the same time, it is also taking hold as the infrastructure of public lives and social and economic activities in such fields as positioning, communication and broadcasting, meteorological observation and disaster management while R&D of space utilization becomes essential to realize a safe, secure and affluent society, and contributes to solving global issues and creating mankind’s intellectual properties. As the space development and utilization are increasingly correlated with national growth and development in the future, Japan needs to make efforts for R&D and space utilization more than ever. Aviation is expected to be one of growing industries in Japan, and relevant R&D must be linked with technological progress and creation of innovative technologies useful for improving safety, environmental adaptability and economics to strengthen Japan’s international competitiveness and make significant advancement of the aviation industry in Japan.

The Japanese government and JAXA have aimed mainly to enhance the standard of

space science and technology in the first and second medium-term objective periods. Accordingly, the technological progress has reached to the stage of a wide use of technologies in real term in the third medium-term objective period, and space development and utilization has come to be tied directly with the national growth and development. Throughout this transition, JAXA has attained a great deal of satisfactory results contributing to the development and operation of rockets and satellites, development of manned space and progress of space science and exploration, aviation science technology and aerospace industry as the main player in the aerospace policies of Japan. It has the world's best R&D capability, technology and knowledge. Accordingly, JAXA is expected to take a leading role in a broader range of fields by actively making plans and proposals to society and producing new value in the 4th mid to long-term objective period, in which the government commits itself to further making use of aerospace technology in the national security and private sectors.

The role of JAXA in various plans, particularly in the Basic Plan on Space Policy and R&D Plan, can be consolidated as follows according to the above-mentioned definition of JAXA, requirements of R&D and utilization of space and aviation, and expectations for JAXA:

1. Policy scheme to achieve the goals in the space policy (role in the Basic Plan on Space Policy)

In the Basic Plan on Space Policy (decided by the Cabinet on April 1, 2016) based on the Space Basic Act (Act No. 43 of 2008), "Assurance of space security," "Promotion of civilian space utilization" and "Maintenance and strengthening of Japanese space industry, science and technology infrastructure" are three policy objectives specified in the space policy in Japan. Actual approaches and roadmaps for achieving these objectives have been announced.

JAXA is defined in the Basic Plan on Space Policy as "the core implementation agency which technically supports the government entirely for space exploration," requiring to improve technological strength through basic R&D, implement relevant projects and disseminate outcomes to society to achieve three policy objectives and roadmap.

The subsequent sections describe the role of JAXA to achieve policy objectives for every objective.

1.1. Ensuring national security in space

In an increasingly severe national security environment in Japan, the effective use of

space is considered to be essential for strengthening the national security capability. While the importance of space security is increasing, threats and risks against the stable use of space, such as increasing space debris and antisatellite attacks, are also escalating. Assuring the stable use of space is a pressing need. Accordingly, the policy objectives of the Basic Plan on Space Policy include the assurance of stable use of space and strengthening of national security capability using space, with actual approaches and roadmaps.

The contributions of JAXA are, therefore, to assure the stable use of space through R&D for improving space situation awareness and take measures against the threats and risks of space debris as well as cooperation with the government for international rulemaking on space utilization. Strengthening of national security capability through R&D is also included in the contribution of JAXA to increase the use of space systems of positioning, communications and information gathering for Japan's foreign and security policies, and the stable operation of space transportation system to help achieve these objectives.

1.2. Promotion of space utilization in the civil sector

As global issues including energy and climate change have become serious, the role of space systems, characterized with its "broadness" and "broadcasting" nature, is increasing for solving these global issues. Advanced space technologies and data are very useful for creating new value across the whole industry in Japan. Accordingly, the use of space is included in the policy objectives of the Basic Plan on Space Policy for solving global issues, realizing a safe, secure and affluent society, and creating related new industries, with actual approaches and roadmaps.

Based on these objectives, JAXA will provide support for solving global issues using remote sensing satellites and other space systems more actively, and improving public lives by using these systems in the event of large-scale disasters. It also contributes to creating new services and industries by improving satellite technologies and stable supply of satellite data, managing and supplying big data intended for the use in a wide variety of industries, and making various other efforts to increase space utilization in collaboration with the government and private sectors. For this purpose, coordination with the Geospatial Information Utilization Policy will be considered.

1.3. Maintenance of and enhancement to the platform for scientific technology and the space industry

Public demand constitutes the majority of the space equipment market in Japan, and

in such a restricted market, sufficient profits cannot be expected, to say nothing of low international competitiveness and instability of space industry infrastructure. In addition, advanced R&D for forming an organic cycle of application needs and technological seeds and use of outcomes in national security and industrial promotion are also needed. Accordingly, the maintenance and strengthening of the base of space industry and science and technology infrastructure are included in the policy objectives of the Basic Plan on Space Policy to obtain new value, with actual approaches and roadmaps.

Based on these objectives, JAXA will contribute to expanding new demand using satellites to maintain and strengthen the space industry infrastructure for self-governing space activity and improving the international competitiveness in the space industry of Japan. For this purpose, it will promote international cooperation with other nations in collaboration with the government and private sectors. It will also contribute to maintaining and strengthening the science and technology infrastructure responsive to the need and perspective of improving national security capability, industrial promotion, living standard, and the development of space science and exploration.

2. Role in regards to aeronautical sciences and technology in the Research and Development Plan

In regard to aviation science technologies, JAXA is expected to play a role of promoting R&D in response to social demand, R&D of advanced technologies that determine the direction of future generations, and R&D of basic technologies allowing the sustainable development of the aviation industry in Japan and improvement of international competitiveness of Japan according to the R&D Plan.

(Appendix 1) Policy system chart

II. The Period for the Medium to Long-term Objectives

The mid to long-term objective period is seven years from April 1, 2018 to March 31, 2025.

III. Detailed program to achieve the goals in the aerospace policy Detailed program to achieve the goals in the aerospace policy

“The maximization of R&D achievements and quality improvement of the other operations” are stipulated in Article 35-4-2 of the Act. III.1 and III.2 describe environmental changes and policies in regard to the efforts made for the matters specified in III.3 and subsequent sections. The evaluation of the agency is, therefore,

made after III.3. This section covers the space projects to achieve space policies, cross-cutting R&D, and aviation science technologies, respectively, as the major projects of JAXA according to the "Guidelines on Objectives Formulation of the Incorporated Administrative Agencies" (decided by the Minister of Internal Affairs and Communications, September 2, 2014).

Evaluation is based on the relevant evaluation criteria and indicators listed in Appendix 2, in consideration of international standards and social situation, etc.

Changes of situation surrounding JAXA and a resulting comprehensive direction JAXA sets out to promote these projects are described in these sections, and the objectives of individual projects follow according to the defined direction.

1. Changes in the environment surrounding JAXA

Changes of situation surrounding JAXA are listed below according to the position and role of JAXA in the policy system, summarized in Chapter I.

- Space is used as the security platform for information gathering, positioning and command and control. Space systems are an essential part of the modern security. As the importance of space in security increases, an increasing number of nations have become active in space, making space congested and threats and risks of space debris heightened. The need for assuring the stable use of space is, therefore, increasing.

  As globalization advances and economic activities across the world become more vigorous, solutions for emerging global issues as backlashes, including energy, climate change, environment, food and large-scale disasters, and efforts for tackling international challenges such as sustainable development goals (SDGs), are critically important. To realize a safe and secure society, countermeasures for frequent disasters of late and efforts of disaster management and mitigation are essential.
- Public demand accounts for the majority of the space equipment industry in Japan, and the scale of operation is not large enough for international competitiveness compared with overseas companies which take a lead. In the West, new ventures have entered into the market and rapidly grown using their advantages like prompt business judgment, short development cycles and cost-competitiveness while receiving public support for technological transfer. These emerging players have made severe international competition severer. Furthermore, a number of business operators in the space using industries have emerged in the West, and they use the information and communication technologies such as artificial intelligence (AI),

Internet of Things (IoT), and big data to provide solutions using satellite data for issues in various fields. In contrast, there are few such business operators in Japan. As satellites are getting more compact and cheaper, some business operators start new businesses on communication and earth observation networks using several small satellites. Another business operators plan nonconventional, totally new businesses such as orbit services to remove space debris, or space journey and space resource exploration. In Japan, two space acts[1] were enacted in November 2016 according to the progress of space activity in private sectors. "Vision 2030 for the Space Industry" was launched in May 2017 with the aim of expanding the space industry and market as a whole. The environment for private business operators to start space operations as the primary players is being put into place. The space industry is expected to be more active in the future, suggesting that it is important for JAXA to meet international demand, in addition to domestic demand, by further promoting the space industry and strengthening international competitiveness for developing new markets. According to the Science and Technology Basic Plan, national R&D agencies are increasingly expected to transfer their R&D outcomes and realizing social implementation by improving open innovation systems. JAXA is also required to meet these needs.

- In the field of space science and exploration, developing nations like China and India, as well as private enterprises, have increasingly gained power, posing a threat to Japan for its presence and technical superiority in this field. Under such circumstances, the international presence of Japan should be maintained by continuously producing the world's best research outcomes in this field. In this regard, it is also effective for Japan to participate in the next large international joint program, in which cooperative international space exploration plans are under discussion, and out of key technologies essential to build the space exploration infrastructure, strategically select a target technology which potentially gives Japan advantages, or a technology having a large propagation effect and required to be developed in the future.
- In the field of aviation science technology, the international aircraft markets have dramatically grown, and in Japan, the aviation industry is an important growing industry, and the aviation science technology is regarded as one of critical technologies for national strategy. In regard to the present private aircraft,

[1] The Act on Launching Artificial Satellites and Managing Satellites (Satellite Act, Act No. 76 of 2016), and the Act on Securing Proper Handling of Satellite Remote Sensing Records (Remote Sensing Records Act, Act No. 77 of 2016)

improvements are required in safety, environmental adaptability including low noise, and economics such as fuel efficiency. Also required is to maintain and strengthen advanced technologies to improve aviation science technology over a long period of time as well as basic technologies required for sustainable development of the aviation industry. Accordingly, JAXA needs to contribute to promoting the aviation industry and strengthening international competitiveness by immediately obtaining technologies that make Japan superior to other nations.

2. Policy on programs of JAXA

According to changes of situation surrounding JAXA, four policies are specified based on the objectives of aerospace policies indicated in the Basic Plan on Space Policy and R&D Plan in addition to continuous implementation of actual measures suggested in the Basic Plan on Space Policy and R&D Plan during this mid to long-term objective period.

(1) Realization of a secure and safe society and ensuring security

JAXA should take the lead and promote international efforts to assure the stable use of space. This includes comprehensive efforts that meet the needs in the field of security including the contribution to the assurance of space system function (mission assurance), and efforts for maintaining and strengthening R&D and infrastructure for realizing a safe and secure society.

Specifically, support will be provided for the government to accomplish mission assurance in the whole space systems and make international rules for space utilization in collaboration with the Ministry of Defense and other security related agencies for the stable use of space systems, and efforts are made to ensure and improve space situation awareness, and tackle space debris measures. Efforts for promoting the use of space systems for positioning, communications and information gathering in security include: R&D of satellite positioning fundamental technology for the development of worldwide satellite positioning technology, R&D for enhancing satellite communications including optical inter-orbit communications technology useful for improving survivability and transmission of large amount of data, R&D of advanced earth observation satellites and satellite data utilization for maritime domain awareness, disaster preparedness and management, and solutions for global issues, and consistent R&D (commissioned projects) of information gathering satellites. Consistent operation of core rockets and development of new core rockets (H3 rocket) are promoted for continuously ensuring and improving self-sustaining

space transportation capability. Also promoted are the efforts of establishing a system for continuous and stable exchange of expertise and sharing of information to strengthen ties with the Ministry of Defense and other security related agencies.

(2) Growth in space utilization and promotion of industry

JAXA should take the lead in improving space utilization including new business creation in cooperation with private sectors and by giving technical support and advice. Also, JAXA should promote R&D for strengthening international competitiveness of the space industry.

Specifically, efforts are made to increase space utilization and industrial promotion by reinforcing joint projects with private business operators, promoting open innovation, providing opportunities for space demonstration, and expanding the use of Japanese Experiment Module "KIBO." Extensive use of data is also intended for creating new services and industries and finding solutions for global issues by delivering satellite data that meets the needs of users, and improving the usability of data. Efforts to strengthen international competitiveness in space industry and maintain and strengthen the industrial infrastructure include the R&D of H3 rockets and next-generation communications satellites in addition to the cooperation with the government to provide space related measures. In light of reinforcing human resources infrastructure in the space industry in Japan, efforts to improve the mobility of personnel such as personnel exchange with private sectors are promoted.

(3) Producing the world's highest results as well as maintaining and improving Japan's global presence in space science and exploration fields

JAXA should promote space science for creating the world's best scientific outcomes, and improve the international presence of Japan through space exploration and manned space activities.

Specifically, holding a leading position in international space exploration is aimed for by conducting the projects specified in the Basic Plan on Space Policy in collaboration with other agencies, and R&D required for space exploration while using open innovation for international space exploration.

The science and technology infrastructure is also maintained and strengthened in light of a long-term view with proactive R&D for creating innovative technological seeds.

(4) Promoting the aviation industry and enhancing our global competitiveness

JAXA should promote R&D in response to social demand for improving the safety, environmental adaptability and economics of aircraft including next-generation models to promote the aviation industry in Japan and strengthen international competitiveness, and R&D of basic technologies leading to advanced technologies that determine the direction of future generations and sustainable development of the aviation industry.

Specifically, support is provided for expanding the aviation industry in Japan and strengthening international competitiveness through R&D of next-generation engine technologies and low-noise airframe technologies, R&D of silent supersonic aircraft integration technologies for the future, and improvement of basic technologies including numerical simulation.

JAXA intends to lead society with science and technology, change organizations to produce new value and contribute to achieving the objectives of aerospace policies by taking specific measures indicated in the Basic Plan on Space Policy and R&D Plan, and contribute to achieving the objectives of aerospace policies making above-mentioned efforts and policies, and actively planning and proposing with outcomes kept firmly in mind. To achieve the objectives, the outcomes must be maximized by suitable role sharing and cooperation with inside and outside organizations including the financial aspect.

Actual objectives are set forth based on four policies in the subsequent sections.

3. Implementation of space projects to achieve the goals in the space policy scheme

The projects mentioned below are implemented based on JAXA's policies described in the preceding section. These projects will be carried out in a flexible manner according to changes of situation in security, industrial trends, science and technology and international circumstances in the future.

3.1. Satellite positioning systems

Satellite positioning largely contributes to security and has gained significant importance for supporting public lives in addition to social and economic activities. Because of its importance, major nations including Japan have developed, improved and upgraded satellite positioning technologies of their own, making international competition fiercer. Now it is an important social infrastructure, but threats and risks like jamming are also on the increase. Stronger survivability is required for providing stable positioning information.

Quasi-zenith satellite systems developed in Japan also cover Asia and Oceania. Strategic and continuous upgrading of positioning technologies is essential to extensively leverage the technologies inside and outside Japan with technological trends and internal and external needs taken into consideration.

JAXA will contribute to fostering the positioning system in Japan through R&D of satellite positioning fundamental technologies which will lead to the upgrading of positioning systems and implementation of high-precision positioning services while taking into account the worldwide development of satellite positioning technologies, needs of public and private sectors and necessity of overseas operations for ensuring national security and contribution to industrial promotion.

3.2. Satellite remote-sensing

Various social issues may be addressed by conducting, operating and using R&D on advanced remote sensing satellites. The objectives of maritime domain awareness and early warning capacity using satellites are defined in III.3.6.

Quick delivery of accurate satellite data that meets the need for disaster management and responses to disaster prevention agencies and local government as information directly tied to disaster mitigation and useful for judgment, such as the issue of evacuation call, contributes to realizing a safe and secure society in addition to saving human lives and protecting properties. Use of satellite data for land management and marine observation also contributes to realizing a safe and secure society. Delivery of appropriate satellite data overseas will help reduce damage from disasters in that region and build mutual support and reciprocal relation with other nations.

Satellite data is intended to be used as judgment or evaluation criteria for the action to counter climate change by delivering suitable satellite data to internal and external users as a part of measures for solving global issues including climate change and promoting cooperation for climate change remedies and international cooperation based on the government policies.

Use of satellite data will be promoted by improving its usability through R&D of satellite data processing and analysis using AI and other innovative technologies in proactive collaboration with private sectors and government, with future contributions such as the addition of value to existing businesses and creation of new services and industries in mind, to promote industries and expand public use of satellite utilization.

Various data, obtained from satellites, will be managed and delivered as big data in an appropriate manner for use in a variety of industries in collaboration with the public and private sectors according to the government policies and overseas trends. R&D of

advanced satellite related technologies including the integration of satellite functions will be conducted based on the government policies. These efforts will contribute to expanding space utilization and industrial promotion.

3.3. Satellite communication

While the importance of satellite communications in security is increasing as a means of information sharing effective for prompt judgment and command of security related agencies, threats and risks of interception and jamming of communication are also swelling. To ensure stable communication, confidentiality and survivability of communication are indispensable. Satellite communication has become a necessity in public lives and social and economical activities, and upgrading of satellite communication technologies is demanded to cope with recent large capacity communication. Commercial communication satellite markets account for the majority of international satellite markets, and are expected to grow due to increasing demand in developing nations. Overseas deployment of communication satellite systems can largely contribute to the economic growth of Japan, but Japan lags behind western nations when it comes to international competitiveness in the development of large capacity communication satellite technologies, and its market share of commercial communication satellite is small. The trend of new businesses using small satellite communication networks may need to be kept under close observation.

Advanced R&D of satellite communication technologies will be conducted from the perspective of national security and industrial promotion. In an attempt to understand world-class technical development, business trends and utilization needs, such R&D will be managed under suitable role sharing of public and private sectors including National Institute of Information and Communications Technology (NICT) in collaboration with not only manufacturers but satellite communication service providers, who are end users. These efforts for establishing a leading-edge and innovative satellite communications system and improving international competitiveness in satellite communication technologies will contribute to boosting the share of private business operators in Japan in the international commercial satellite markets in the 2020s.

Large-capacity data transmission will be put into practice through R&D and demonstration of optical inter-orbit communication technologies with the confidentiality of data transmission in mind for assuring national security and contributing to industrial promotion.

3.4. Space transportation system

In terms of assuring national security, space transportation systems are indispensable for self-governing launching of requisite satellites at the time of need. Space transportation capability must be maintained in a seamless way by continuously maintaining and developing core rockets and relevant industrial infrastructure.

In regard to the present H-IIA/H-IIB rocket, the world's best launch success rate and on-time launching rate should be maintained by continuously increasing reliability, maintaining basic technologies, and managing launch facilities and equipment, and satellite launch demands inside and outside Japan should surely be met.

Development of H3 rocket meets more diversified user needs and requires lower costs for launch and facility management compared with the present H-IIA/H-IIB rocket. Prompt transition to private satellite launch services may enhance self-governing launching capability and improve international competitiveness. Even after the development is completed, JAXA will manage launch facilities and equipment properly to continue successful launch. In parallel with the development of H3 rocket, R&D will be conducted for the continuous improvement of space transportation technologies in Japan. This contributes to maintaining the independence of the space industry in Japan, strengthening international competitiveness and improving economics.

Continuous and consistent launch of Epsilon launch vehicle, a solid fuel rocket system critical as the strategic technology, is maintained by continuously improving reliability, maintaining basic technologies, and properly managing launch facilities and equipment. Launching costs will be reduced by improving synergy effects in development and flight demonstration, such as the use of common parts with H3 rocket. These efforts will strengthen international competitiveness and promote transition to private launch services allowing flexible and efficient response to diversified internal and external launch demands.

In parallel with these efforts, private business operators engaged in rocket development will be supported from the perspective of industrial promotion.

3.5. Space situational awareness

From the perspective of maintaining public lives and social and economic activities and assuring national security, the Basic Plan on Space Policy stipulates the implementation of a space situational awareness (SSA) operational system by around early 2020s based on the recognition of sustainable and stable use of space as a critical issue and increasing space debris. New topics such as SSA-based space traffic management (STM) have also arisen. Accordingly, R&D will be conducted for further enhancing SSA capability to support the construction of an inter-agency SSA

operational system by streamlining and operating existing SSA facilities, and promote sharing of JAXA's technologies and knowledge through cooperation with related agencies. This contributes to assuring national security through sustainable and stable use of space in the fields of security and private sectors.

3.6. Maritime Domain Awareness and early warning functions

A variety of man-caused and natural maritime threats and risks, such as illegal operation of foreign fish boats in the territorial sea and exclusive economic zones of Japan, worsening climatic hazards, sea area earthquakes and tsunamis, and marine pollution, have become obvious. Mitigating these threats and risks with the maritime domain awareness (MDA) is the pressing issue in the ocean policies and national security of Japan.

JAXA will make the following efforts to assure national security in collaboration with the Ministry of Defense, the Japan Coast Guard and other security related agencies:

Support will be provided for the government to investigate into the MDA in collaboration with security related agencies, and detailed ocean situations will be obtained by operating advanced earth observation satellites and automatic identification system (AIS) for obtaining information on vessels from satellites, R&D of related data processing and analysis technologies, and using satellite data.

In regard to the early warning capacity, support will be provided for the government to prove the effectiveness of element technologies in collaboration with security related agencies, and R&D of element technologies, required in the future, promoted based on the government investigation into future systems including the potential use of a wide range of technologies such as commercial technologies for assuring early warning capacity of Japan.

R&D to meet the space utilization needs in the future security will be promoted by deepening collaboration with security related agencies.

3.7. Enhancement of the overall mission assurance of space systems

While dependency on space systems is increasing in security, public lives and social and economic activities, threats and risks are also on the increase. Stable use of space is the pressing issue. To prevent negative effects of changes in space on national security, there is an increased need for improving the mission assurance in the whole space systems including satellites and ground facilities.

Accordingly, technical support, including the supply of knowledge of the

development and operation of space systems in terms of functional assurance, will be provided for the government investigation in collaboration with the Cabinet Office, Ministry of Defense and other security related agencies for enhancing the mission assurance in the whole space systems. Technical support will also be provided for the government investigation into the future form of launching sites and quick reaction type small satellites, which are closely related to mission assurance.

Based on the government investigation, vulnerability of space systems owned by JAXA, important for national security, public lives and social and economic activities, will be evaluated and required measures taken.

3.8. Space sciences and exploration

Research of space science and exploration will be promoted to create intellectual properties common to humankind, and the world's best outcomes will be produced and the international presence of Japan maintained and improved for exploiting new space development and utilization by obtaining innovative and exploratory technologies potentially expanding the activity range in space.

To achieve these objectives, the world's best scientific outcomes will be produced in collaboration with other agencies by using opportunities to participate in the "strategic medium missions," "open-type small missions" and "multiple small projects" stipulated in the Basic Plan on Space Policy to develop and operate small flying objects such as satellites, probes, observation rockets and large flying balloons.

To accomplish and study space science and exploration missions, research may be programmed and promoted in such a way as to strategically obtain outcomes from a long-term standpoint based on a bottom-up approach via the joint usage system for universities, in consideration of contribution to international space exploration. Collaboration with external organizations including universities will be strengthened under the joint usage system to create and implement relevant projects.

An attempt will be made to return R&D outcomes obtained in the above projects to society such as industrial promotion in collaboration with private business operators.

A long-term standpoint is required for the research of space science, and necessary measures including human resource development will be taken for proactive and continuous acquisition of human resources responsible for R&D.

Cooperation for post-graduate education will contribute to fostering human resources in a wide range of fields including not only space aeronautics but also industries.

3.9. International Space Station

Japan has participated in the International Space Station (ISS) project as a symbol of

multilateral international cooperation including Japan-U.S. cooperation and played a core role with the aim of obtaining manned space residency technologies, creating innovation, promoting industry, providing scientific knowledge and improving the international presence of Japan. Considering the direction of expanding manned space activities by a variety of players including private business operators in the coming years, the focus will be placed on the maintenance and improvement of the international presence of Japan by creating innovation, promoting industry, and obtaining internationally competitive manned space technologies, and the following efforts will be made while cost-effectiveness is taken into account:

Maximize the outcomes of the ISS project based on the Japan-U.S. Open Platform Partnership Program (JP-US OP3) for strengthening the Japan-U.S. cooperation.

Strive to create scientific and academic outcomes using opportunities for experience in a microgravity environment of the Japanese Experiment Module (JEM) "KIBO," and make use and provide opportunities for space demonstration using outboard platforms, etc. to contribute to maintaining and improving the international presence of Japan, promoting industry, and improving public lives. Bring into reality of a picture of KIBO that would be widely used in the industry, academy and government as the R&D foundation supporting science, technology and innovation in stronger collaboration with universities and private sectors by 2020.

Through these efforts, be sure to make KIBO-based services independent as private businesses in light of expanding space utilization and industrial promotion. Furthermore, investigate the form and possibility of low-earth orbit manned space activities after 2025.

Upgrade H-II Transfer Vehicle (HTV) "KOUNOTORI" to improve the capability of transportation to the ISS and reduce operation costs by developing new spacecraft having a high spillover effect for the future, and provide opportunities for technical demonstration using opportunities to transport materials to the ISS for realizing efficient manned space activities and promoting the industry of Japan.

Continue to play the core role in the ISS project by operating "KIBO" and "KOUNOTORI" and keeping Japanese astronauts active, and expand opportunities of using the ISS from Japan to overseas. With this, Japan will be highly esteemed by not only nations participating in the ISS project but also Asian nations and United Nations, helping Japan maintain and improve its international presence.

Hold a leading position by demonstrating internationally competitive manned space residency and exploration technologies in the ISS and enabling Japan to participate in the future manned space activities based on international cooperation.

3.10. International human space exploration

The leading position and influence of Japan in deep space further than low-earth orbit will be strengthened and Japan will achieve its initiative in forming a new international cooperation system and rulemaking by participating in the “International Space Exploration (including unmanned exploration preceding to manned exploration)” for expanding the human activity area with a critical role based on the international cooperation including Japan-U.S. cooperation.

With an eye on the participation in the construction of a manned site near the moon, planned by the U.S., and moon landing and exploration through international cooperation, proactive plans of Japan, including technical aspects, will be investigated to put international programs into shape, and efforts made to demonstrate technologies potentially proving the superiority of Japan and having spillover effects (e.g. deep space replenishment technologies, manned space residency technologies, self-gravitational celestial body taking-off and landing technologies and self-gravitational celestial body surface exploration technologies) with a link to unmanned exploration in space science and exploration.

These activities will contribute to strengthening the relationship of Japan with ISS partners, maintaining and improving the international presence of Japan, and promoting the industry by disseminating the world’s best scientific outcomes and obtained technologies.

3.11. Platform technologies to support development and operation of systems including satellites (e.g. tracking and operationtechnology, environment testing technology)

Efforts will be made to establish the tracking and maneuvering techniques and environmental test techniques which are basic techniques required for stable operation and reliable development of satellites for contribution to achieving the objectives of space policies in Japan.

In regard to tracking and maneuvering techniques, mission accomplishment of satellites will be assured by maintaining and operating antennas and other facilities for controlling satellite tracking and data gathering. Higher efficiency of the tracking, controlling and data gathering systems will be achieved by R&D of tracking and maneuvering techniques, contributing to assuring national security and industrial promotion.

Approvals and licenses of wireless stations required for JAXA-owned satellites,

rockets and aircraft, etc. will be obtained according to international and domestic frequency usage rules, contributing to mission accomplishment.

JAXA-owned environmental test equipment will guarantee the mission accomplishment by properly maintaining and operating the equipment for stable operation and reliable development of satellites and by conducting proper environmental tests. R&D of environmental test techniques will raise the efficiency of the tests and improve the efficiency in the development of satellites, contributing to assuring national security and industrial promotion. Extensive use and social return of technologies and equipment will be achieved by expanding acquired environmental test techniques to other industries and promoting sharing in industrial sectors.

4. Works in cross-disciplinary research and development

4.1. Works to promote the industry and grow space utilization through Public-Private Partnership and the like

Endless technological innovation will be accomplished in the field of space by establishing partnerships with private sectors based on a proper role allotment to promote collaborative R&D, promoting open innovation in which technologies in different fields are integrated according to industrial trends, and creating new space related businesses mainly by private business operators while use of private funds is accelerated from the perspective of extensive use of space and industrial promotion.

Proactive promotion of returning JAXA's R&D outcomes to society in collaboration with private sectors will create new businesses including venture businesses and foster human resources who would work for the space industry.

Considering the contribution to these efforts, a strategic intellectual property system will be improved flexibly and continuously for more efficient use of intellectual properties of JAXA.

Providing opportunities for space demonstration in collaboration with financial institutions or by sharing rockets, taking measures to improve accessibility to satellite data, and offering various supports for creating space businesses and adding high values will extensively contribute to industrial promotion. The opportunities for space demonstration will be provided, aiming for self-governing commercial businesses.

4.2. Maintaining and enhancing space industry platforms and scientific technology platforms for creating new value (including platforms to counter space debris and space solar energy generation)

Challenging R&D to guide society, such as technologies for space debris measures and reusable space transportation system (low costs and highly frequent space transportation) will be implemented to develop new business arena and achieve continuous technological innovation in consideration of assuring national security, realizing a safe and secure society, accelerating space utilization and industrial promotion, creating the world's best scientific outcomes and maintaining and improving the Japan's international presence. In collaboration with the government, related agencies and private sectors, R&D of element technology, sensors, parts and components, and system development methodology will be conducted to assure independency of system containing satellites, maintain and improve international competitiveness, ensure mission accomplishment, and ultimately maintain and develop the space industry infrastructure in Japan. In cooperation with manned space technology and space science research, R&D of space exploration will also be promoted using technologies in various fields for the development of international space exploration and industry.

R&D will be conducted for energy transmission and reception technologies used for space solar power generation systems, which potentially provide solutions for global issues facing humans such as energy, climate change and environment. R&D of liquid natural gas (LPG) propulsion technologies is also conducted for strengthening the international competitiveness of Japan from a long-term view.

Extensive use of advanced technologies and commercial products in space systems will be addressed by providing opportunities for space demonstration to maintain and develop science and technology infrastructure and promote the space industry.

More sophisticated solutions will be provided for developing new space utilization by investigating, planning new satellite systems and promoting initial R&D and demonstration, in collaboration with public offices and private users of satellites according to changes of situation surrounding JAXA and need for solving societal issues with transfer of R&D outcomes to relevant users in mind.

5. Aeronautical science and technology

Based on the R&D Plan for aviation science technologies, R&D to meet social needs, R&D of advanced technology linking to next generation, and R&D of basic aviation technologies required for sustainable development of the aviation industry will be promoted for the development of aviation industry and improvement of international competitiveness. Using a system for promoting open innovation, collaboration with domestic and overseas related agencies, transfer of technologies to private sectors and

dissemination of outcomes will be done, and proactive support will be provided for supporting the standardization of aviation technologies and enhancing the standards for the development and promotion of aviation industry.

(1) Research and development that responds to the needs of society

R&D of next-generation engine technologies, noise reduction fuselage technologies, and technologies for expanding aircraft utilization will be conducted in collaboration with private sectors to demonstrate internationally competitive technologies and transfer these technologies to private sectors for assuring environmental adaptability, economics and safety of aircraft. This will ultimately contribute to increasing the share of private business operators in international joint development projects, and developing completed aircraft and appliances businesses in Japan.

(2) Research and development in advanced technology for the next generation

Aiming at future development of the aviation industry, propulsion airframe integration design technologies for silent supersonic aircraft which are based on low-sonic boom design technologies will be obtained to improve the international superiority of Japan in aviation science, and actively contribute to establishing international standards. Also addressed is the acquisition of technologies such as more advanced electric aircraft to drastically reduce CO_2 emissions caused by aircraft for the innovation of aviation technologies to change society.

(3) Research and development of platform technologies for continued developments in the aviation industry

The world's best numerical simulation technologies, such as computational fluid dynamics (CFD), of which Japan has the advantage, will be further sophisticated, and basic technologies for test, measuring and material evaluation will be maintained and strengthened. These efforts aiming at establishing aircraft design technologies for more prompt and efficient development of aircraft will contribute to continuous development of aviation industry in Japan.

IV. Important matters to support the achievement of goals in the Basic Plan on Aerospace Policy

This section sets forth the "Other Important Matters Concerning the Running of the Operations" in Article 35-4-2 of the Act.

1. Cross-sectoral matters

1.1. Promotion of international cooperation and development overseas and research and analysis

(1) Promotion of international cooperation and development overseas

High level reciprocal relationships will be established and maintained with major space agencies overseas to promote efficient and effective business operations while diplomatic values like the assurance of national security are taken into account.

Space related technologies in Japan and advantages of space utilization will be spread to the world through proactive cooperation with space agencies and space utilization agencies in various nations and international organizations to contribute to expanding space utilization and space markets in ASEAN and other nations. These efforts may be accomplished by fostering human resources in charge of establishing and maintaining mutually beneficial relationships with these nations. Accordingly, expansion of space utilization according to needs of various nations and establishment of space infrastructure as social foundation in these nations will be promoted to maintain and strengthen the industrial infrastructure in Japan and industrial promotion by supporting the government for public-private collaboration to deploy space infrastructure overseas.

In addition, proactive support will be provided for the government to form legal infrastructure required for promoting international investigation into the legal issues of continuous and peaceful use of space, and implementing advanced space activities including space resource exploration and on-orbit services in Japan and overseas to contribute to assuring national security and industrial promotion.

(2) Research and analysis

As international situations in space and aviation have drastically changed due to the increasing importance of space security in and out of Japan, changes of situation in space businesses with the entry of new private players, increasingly sever international competition among industrialized nations and rise of developing nations, understanding and analyzing internal and external trends are more urgent needs than ever before. Accordingly, domestic and international trend survey and analysis will be reinforced and attained results will be used for determining JAXA’s strategy. JAXA will also proactively supply survey and analysis information as well as making proposals to the government for its strategic and effective policy and business planning.

1.2. Fostering of understanding by our citizens and contributions to train human resource who will carry the next generation

(1) Fostering understanding by our citizens

Public awareness is essential to promote aerospace R&D projects as citizens are users and sponsors.

The obligation of JAXA to deliver timely, appropriate and detail information on the significance of promoting aerospace businesses, outcomes so far and the value and importance of future outcomes will be fulfilled in collaboration with the government and private sectors as required to increase public awareness of JAXA as the core agency for achieving the objectives of national aerospace policies and the national R&D agency to promote aerospace operations businesses.

(2) Contributions to training of personnel who will carry the next generation

Multiple ways of thinking and self-governing, independent, and continuous learning habit are important with globalization, informatization and technological innovation as the background. Accordingly, efforts in this issue include proactive provision of opportunities for a wide range of learners and supporters to study aerospace fields, and recommendations of using educational materials based on outcomes and knowledge obtained from relevant R&D to help foster human resources shaping the future society.

1.3. Project management and ensuring safety and reliability

Reliability of projects will be assured and the whole management capability of JAXA improved by completely observing project management rules across JAXA and continuously improving related fields of research and study with an eye on their trends, and at the same time, risks throughout the project will be reduced by sparing sufficient time for initial investigations and trial R&D at the project planning stage for contributing to more effective business creation and mission accomplishment.

In the event of a large change or suspension of a project or loss of the mission, recurrence of similar incident will be prevented by means of exhaustive investigation into the cause and sincere efforts to keep public reliability, with the prevention of demotivation for new challenges in mind.

Efforts of maintaining and improving safety and reliability will contribute to smooth implementation of JAXA projects, maximized outcomes and improved international competitiveness.

Exchange of information and knowledge with outside institutions on project management and assurance of safety and reliability will also be promoted.

1.4. Utilization of information systems and ensuring information security

(1) Utilization of information systems

Efficiency of clerical work and appropriate working environment will be maintained and improved by installing a common information system within JAXA and proactively improving the system.

Collaboration with other research institutes and private sectors will be promoted more effective and efficiently by installing and improving a fundamental information system for sharing JAXA owned data with outsiders, and promoting its utilization.

(2) Ensuring information security

Information security measures will be taken based on information security policies stipulated in the “Common Standards of Information Security Measures for Government Agencies” and according to the advices from audits conducted by the Cybersecurity Strategic Headquarters, and stable operation of JAXA and national security will be ensured by appropriately protecting technological information, and improving security measures for information systems, essential for preventing serious information security incident and operating spacecraft.

1.5. Matters concerning sites and facilities

Facilities and equipment shared within JAXA will be maintained according to medium to long-term plans for upgrading, development, maintenance and operation, including anti-aging and risk mitigation measures for smooth and effective promotion of JAXA projects.

2. Contracting intelligence-gathering satellite work from government

A necessary system will be established for steadily implementing an information gathering satellite project commissioned by the government.

3. Common to agencies

3.1. Internal governance

An internal control system that takes JAXA specific operations into account will be built and steadily operated based on the business and service documents under the

president's leadership according to the related laws and regulations, by circulating the PDCA cycle for planning, execution and evaluation of operational activities in an efficient manner, to contribute to achieving the objectives of aerospace policies.

Especially, approaches effective for preventing research misconduct, including misconduct in research and illegal use of research funds, will be promoted according to the government guidelines.

The objectives of the project management that constitutes a part of the internal control system will be covered in IV.1.3.

3.2. Matters concerning human resource

Adequate staffing including mutual personnel exchange with private sectors, and personnel management within JAXA leading to the future with the role of JAXA taken into account will be strategically promoted for steady project implementation and development of leaders who take the lead in new R&D, and at the same time, personnel infrastructure will be formed to create new value by leading society with science and technology. Working environment will be maintained and improved by constantly improving the ways of working, which will, in turn, contribute to promoting activities of a variety of human resources including productivity improvement and female workers.

V. Matters concerning improvement and raising efficiency in our business operations

Administration of operations will be improved and streamlined to conduct the business operations covered in Chapter III, achieve the objectives of aerospace policies and maximize R&D outcomes. Full attention will be given to business operations so as not to damage R&D capability to achieve the objectives of aerospace policies.

(1) Preparing an organizational structure for leading our society in science and technology and for creating new value

A flexible and effective organization will be established for achieving the objectives of aerospace policies of Japan with changes in social conditions in mind by reforming the present organization so as to positively make new proposals to society, lead society with science and technology, and create new value by improving the comprehensive strength of JAXA.

(2) Promotion of effective and agreeable operations management

New businesses that meet the needs of policy and society will be created and outcomes returned to society in an effective and rational way by pursuing efficient operations through the investigation into a new organizational model and administrative processes, and streamlining operations and expenses. The efforts for keeping personnel expenses appropriate will be covered in the subsequent paragraph (*description of setting numerical objectives for streamlining the administration is under adjustment*).

Procurement will be streamlines while fairness and transparency are ensured according to the "Policy for Streamlining Procurement by Incorporated Administrative Agencies" (decision of the Minister of Internal Affairs and Communications on May 25, 2015). Effective procurement will be achieved for strengthening international competitiveness according to various aspects of procurement systems in Japan and abroad while consistency with the accounting system is ensured.

(3) Appropriateness of personnel expenses

Following the government policies on the pay standard, the allowance of appropriate standard for executives and regular employees will be verified and maintained with the special characteristics of operation taken into account, and verification processes and results will be made public. Allowance will be set as required in a flexible manner for acquiring appropriate human resources, and detailed explanation will be given to obtain understanding of the public.

VI. Matters concerning the improvement of the financial conditions

(1) Improvement to our financials

Steady operation of JAXA will be guaranteed by taking outstanding obligation of operating expenses grant, etc. into account, implementing budgets in an efficient way, and suitably attaining the composition of finances and publication of financial information according to the "accounting standards of independent administrative agencies" and other standards. The assets recognized as unnecessary will be disposed in a proper way, and critical properties transferred systematically.

(2) Promoting growth in our revenues

In addition to making efforts for implementing policies and meeting social needs using operating expenses grants, increases in self-generated income will be encouraged to create new businesses and return outcomes to society in an efficient way by proactively acquiring external funds in reinforced collaboration with private

and public sectors in Japan and abroad for acquiring competitive research funds or offering knowledge of various aerospace technologies owned by JAXA.