



Japan Aerospace Exploration Agency
(JAXA)

Sustainability Report 2022



Introduction

JAXA's Sustainability Report describes not only our initiatives related to environmental load and social responsibility, but also our business activities in FY2021 in order to provide a better understanding of our overall business activities.

We hope that our readers will become interested in aerospace and the global environment and use it as a starting point for communication with us.

In order to realize our vision, plans, and projects, the following are JAXA's philosophy and management policies, as well as the code of conduct for JAXA employees.

Management Philosophy

To realize a safe and affluent society using space and the sky.
By utilizing leading technological developments, we will succeed and deliver our achievements along with broader wisdom to society.

 [Details](#)

Action Declaration

Jubilation for human society

We will provide enjoyment and surprise to people by evolving our lives.

Aspiration for creation

We will always aim for higher goals and continue to aspire to create by facing up to and overcoming any difficulties.

Responsibility and pride

We will faithfully act with responsibility and pride to confidently meet the expectations of society.

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Reaching Space Frontiers



Five Slogans to Keep Us Challenging

"Make the space and aeronautics field the ideal workplace"

As individuals and members of society, each of us aims for a workplace that is filled with greetings and consideration for others and contributes to mutual success by respecting each other's individuality and sharing the same feelings.

"Revitalize Japan through space and aeronautics"

By being conscious of the connection between work and society, we will foster the sense to contribute to our country and people as well as the international community through space and aeronautics.

"Improve our ability to execute in space and aeronautics"

As professionals in space and aeronautics, we will acquire the ability to create new ideas and strive to improve our planning ability, research and development ability, project execution ability, and organizational management ability to realize these ideas.

"Be proud of being involved in space and aeronautics"

We will take on challenges for space and aeronautics and act sincerely with responsibility and pride to contribute to society. Value small daily advances while maintaining a panoramic, long-term perspective.

"Increase the number of our companions in the space and aeronautic field"

We will spread the wisdom and results obtained through the activities of space and aeronautics throughout society and, in cooperation with other activities, contribute to the lives, economy, and safety of people, as well as to the resolution of international issues.

The Japan Aerospace Exploration Agency (JAXA) achieved a number of important missions while continuing to thoroughly implement infection control measures against COVID-19 under ongoing pandemic even in FY2021, the fourth year of the phase 4 medium/long-term goals.

In a low-Earth orbit, astronauts Noguchi and Hoshide completed a long-duration space mission in the International Space Station (ISS). In particular, Hoshide became the second Japanese boarding on the spaceship as an ISS commander. These achievements have further enhanced international confidence in Japan as an international partner in the ISS program, and are steadily being used to maintain and improve Japan's presence in the U.S.-led Artemis program and Lunar Orbital Platform "Gateway." In FY2021, we recruited Japanese astronauts for the first time in 13 years in anticipation of the expansion of Japanese astronauts' activities to the vicinity of the Moon and on the lunar surface, receiving the largest number of applicants to date. Looking into deep space, the initial analysis of samples (rocks and sand) from the asteroid Ryugu brought back by Hayabusa2, an asteroid sample-return mission, confirmed that Japan has acquired the world's first sample of a most primitive solar system material.

In the field of space transportation, which supports Japan's independent space activities, we successfully launched all of our current flagship rockets, the H-IIA and Epsilon, and contributed to the launches of government and commercial satellites, further enhancing our world-leading reliability. As for the development of the H3 Launch Vehicle, Japan's new flagship rocket, all parties concerned worked together to overcome technical problems with the first-stage engines.

At the same time, we are making steady efforts to improve the working environment, including energy conservation and other environmental considerations, and improving work-life balance. In addition, in order to further accelerate JAXA's efforts toward the SDGs and raise the awareness of our employees, we have newly formulated basic action policies on the SDGs.

Japan is one of the few countries in the world that can conduct autonomous and wide-ranging space activities. At JAXA, ongoing challenging projects are reaching their major climax. As a core implementing agency that supports Japan's aerospace development and utilization through technology, in FY2022 we will boldly take on any difficult challenges through concerted efforts by our directors and employees and strive to create achievements toward the completion of Phase 4, returning the fruits of our labor to society while giving due consideration to the environment.

September 2022

President

Details

We, JAXA, will reform the management system and change the mindset of executives and employees while emphasizing our public nature, transparency, and autonomy as a national research and development agency, with the aim of effective and efficient operations to maximize the fruits of R&D in Japan. Based on the Basic Plan for Space Policy, etc., the competent minister instructs JAXA on the Medium/Long-Term Goals for the next seven years, which specifies the goals for business operations and business efficiency improvement. We prepare a Medium/Long-Term Plan and an Annual Plan based on the Medium/Long-Term Goals to steadily proceed with operations and achieve goals.

We prepared a Medium/Long-Term Plan for the seven years from April 1, 2018, to March 31, 2025. Based on the Basic Plan for Space Policy and R&D Plan in the aeronautics field, we will reliably implement projects and promote fundamental R&D. In addition, we will strengthen cooperation with industry, academia, and government, keeping an eye on the accelerating progress of advanced technologies and will focus on giving back the achievements to the public. Thus, we aim to create outcomes in line with the following three action policies outlined in the Medium/Long-Term Goals.

Priorities for Phase 4 Medium/Long-Term Goals

1. Contribution to diverse national interests

(1) Ensuring space security

- ▶ Technical support for government studies on functional assurance of the entire space system in cooperation with security organizations
- ▶ R&D to meet the needs of space utilization in the security field, such as space debris
- ▶ Advanced R&D to improve technologies to support Japan's positioning system, and continuous R&D for optical satellite communication technologies, etc.
- ▶ Continuous operation of core launch vehicles and development of H3 and Epsilon S Launch Vehicles to secure and improve independent space transportation capabilities
- ▶ Demonstration of world-leading technologies to remove space debris at low cost in cooperation with private companies, and contribution to early establishment of international rules

(2) Contribution to disaster countermeasures, national resilience, and solutions for global issues

- ▶ R&D on improving the frequency, accuracy, and speed of satellite observation in cooperation with disaster prevention organizations, aiming at the widespread use of satellite data as decision-making information for disaster countermeasures
- ▶ Promoting utilization of satellite data for national land management and oceanographic observation, including application to maintenance and management of aging infrastructure
- ▶ Providing satellite data and promoting international cooperation to promote the use of satellite data as an indicator for decision-making and evaluation of actions on climate change
- ▶ Advanced R&D on earth observation satellites and upgrading of core technologies for satellites to provide satellite data continuously and stably and promote its utilization

(3) Creation of new wisdom through space science and exploration

- ▶ Strengthening partnerships with domestic and international research institutions. Formulating and implementing long-term, strategic scenarios with the aim of creating world-class research achievements. Promoting efficient and effective space exploration with programming.
- ▶ Strategic development of technologies that can contribute to Japan's superiority in international space exploration and/or that have a significant ripple effect on other fields.
- ▶ Promoting the creation of new wisdom and international contributions through the utilization of the space environment in low-Earth orbit activities including the International Space Station (ISS)
- ▶ Utilizing the ISS as a technical demonstration site for international space exploration and promoting open innovation and other systems for collaboration with private companies and universities, including those in non-aerospace industries.

(4) Realization of economic growth and innovation utilizing space

- ▶ Efficient processing of satellite data and creating new businesses through multidisciplinary utilization of satellite data in collaboration with private companies, which have strength in advanced technologies in different fields such as AI
- ▶ Realizing a wide range of utilization of the Japanese Experiment Module "Kibo," and launching self-sustaining businesses by private companies, etc. Promoting the participation of private companies in international space exploration
- ▶ Business planning and technology development/demonstration through partnerships with private companies to create businesses utilizing space with new ideas by the private sector. Strengthening the human resource base through personnel interchange with external parties.
- ▶ Developing the open innovation system to promote entry of different industries and venture businesses and to expand opportunities for R&D and demonstration of technologies useful for business. Promoting activities related to intellectual property.

2. Strengthening the overall infrastructure to support Japan's space activities, including industrial, scientific, and technological infrastructure

- ▶ R&D with private companies that commit to commercialization aiming to increase market share
- ▶ Innovative R&D for future business creation, such as flight demonstration using technologies for the reuse of space transportation systems
- ▶ R&D on advanced and innovative technologies related to future satellites, such as optical and digital technologies for low-cost, high-capacity, high-speed satellite communication networks, and high-precision large optical sensor technologies
- ▶ Personnel interchange with private companies to strengthen the human resources base of the aerospace industry, and incorporation of diverse human resources into the aerospace field to enhance the function of JAXA
- ▶ Support for government's investigations on the ISS as well as low-Earth orbit activities and manned space activities in international space exploration after the ISS project

3. Enhancing the aeronautics industry and strengthening its international competitiveness

- ▶ Putting priority on R&D to improve environmental compatibility, economic efficiency, and safety of aircraft in cooperation with the private sector, such as technology development for international joint development of next-generation engines
- ▶ Advanced R&D on noise reduction for supersonic aircraft to contribute to the improvement of international competitiveness of Japan's aeronautics technologies and establishment of international standards

01 > Ensuring space security

[Details](#)

The core launch vehicles launched in FY2021 were H-IIA No. 44 and No. 45, and Epsilon No. 5, all of which were successfully launched. The success rate of launches of H-IIA and H-IIB Launch Vehicles was 98.1% and the on-time rate was 85.7%, which shows that we have maintained world-leading technology.

For the H3 Launch Vehicle, which is a successor to those rockets, we initially aimed to launch Test Vehicle No. 1 in FY2021. However, we discovered new technical issues and decided to postpone the launch to determine the cause of this incident, formulate countermeasures, and take all possible measures. We take the change in the launch timing very seriously but consider it a necessary measure for a reliable launch. All of us will put in a concerted effort to proceed with the remaining development.



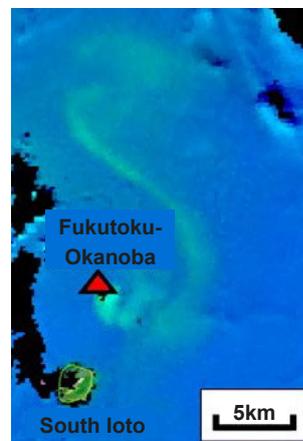
Epsilon Launch Vehicle

02 > Contribution to disaster countermeasures, national resilience, and solutions for global issues

[Details](#)

In FY2021, the Advanced Land Observing Satellite-2 "Daichi-2" (ALOS-2) completed its project. Throughout its seven years of operation since its launch in 2014, Daichi-2 has contributed to ensuring public safety, protecting and managing national land, and solving environmental issues within Japan and abroad. While continuing its operation, we are also looking ahead to the launch of the advanced radar satellite Daichi-4 (ALOS-4).

In addition, data on chlorophyll concentrations observed by the Global Change Observation Mission - Climate "SHIKISAI" (GCOM-C) was adopted by the site providing information about red tide damage in Hokkaido, creating new uses for satellite data. Furthermore, in response to the eruption of Fukutoku-Okanoba and its drifting pumice, we observed the data on discolored water obtained from SHIKISAI and on the formation and transition of a new island obtained from Daichi-2 and provided it to relevant organizations to demonstrate the effectiveness of satellite information in the event of a maritime disaster, thereby contributing to damage prevention and security in offshore and coastal areas in Japan. As countries all over the world are addressing the issue of global warming, the presence of JAXA's earth observation satellite data was widely shown internationally in the "Working Group I Report on the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) (AR6/WG1 Report)," which provides scientific grounds for international climate control.



Discolored water observed by the satellite SHIKISAI

03 > Enhancing the aeronautics industry and strengthening its international competitiveness

[Details](#)

In FY2021, in particular, we developed world-class technologies to reduce the friction resistance of aircraft, contributing to the realization of a sustainable society by reducing emissions and improving fuel efficiency. In our initiatives for aeronautical environment and safety technology, we have developed the world's only system for monitoring snow and ice on runways to prevent overrun accidents of aircraft, and have started airport demonstration experiments with Hokkaido Airports, which operates New Chitose Airport, etc. In addition, we improved the functions of the Integrated operation system for disaster relief and crisis management (D-NET) to cope with crisis management such as security and vigilance, and realized the central monitoring and flight plan coordination of more than 500 government and private aircraft, contributing to the safe and smooth operation of the Tokyo Olympics and Paralympics. In addition, we conducted research to reduce aviation noise, solved problems to realize an electric hybrid propulsion airframe, developed methods to analyze complex and large-scale aircraft flow and motion phenomena, reduced costly experiments, and built a digital development environment to prevent unforeseen problems during design.



Technology system for detecting snow and ice on the runway (image)

04 > Realization of economic growth and innovation utilizing space

[Details](#)

In FY2021, to expand the utilization of the Japanese Experiment Module "Kibo" of the ISS in synergy with private companies, we took on new challenges, such as the commercialization of a high-quality protein crystallization experiment service and the launch of extravehicular exposure chambers jointly developed by the private sector, thereby achieving a record number of on-orbit commercial utilization, a 50% increase over the previous year's.

In addition, as part of JAXA Space Innovation through Partnership and Co-creation (J-SPARC), a co-creation type research and development program that supports the creation of space ventures with new ideas by the private sector, Space Frontier Studio KIBO established by Bascule Inc. has taken root through the co-creation phase with JAXA as an interactive live distribution private business inside Kibo. Furthermore, a consortium led by J-SPARC has launched a 5-year research and development project for the Ministry of Agriculture, Forestry and Fisheries, conducting activities in which more than 200 companies participated in the lifestyle and healthcare sectors.



Main business themes of J-SPARC

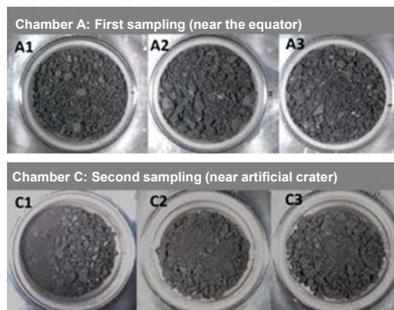
05 > Creation of new wisdom through

[Hayabusa2]

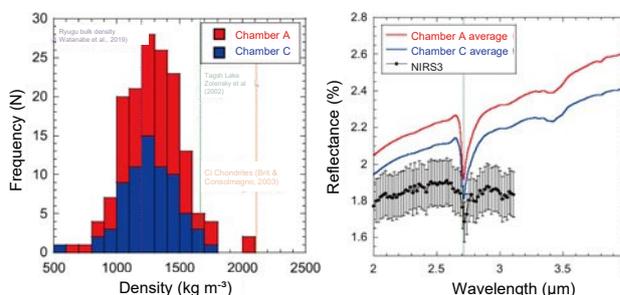
[Details](#)

In FY2021, Hayabusa2, an asteroid sample-return mission, collected samples (rocks and sand) from the asteroid Ryugu. Curation was conducted on these samples followed by the initial analysis.

Hayabusa2 collected about 5.4 g of samples, which is more than 50 times the amount originally expected. First, these samples underwent Phase-1 curation conducted by the Astromaterials Science Research Group and were initially described (including color, shape, size, mass, and spectroscopic data) and cataloged. Then, as part of Phase-2 curation, two groups, Okayama University and the Japan Agency for Marine-Earth Science and Technology, conducted more detailed studies of the samples. For the initial analysis of the samples, six teams (for chemical analysis, stone material analysis, sand material analysis, volatile component analysis, solid organic matter analysis, and soluble organic matter analysis) were organized, with approximately 300 researchers from 14 countries involved in the analysis. From May to June, samples were distributed to these initial analysis teams, and initial analysis began. In addition, 10% (about 0.5 g) of the Ryugu sample obtained was also provided to NASA in November under an agreement between JAXA and NASA. Using the sample, analysis is also underway at NASA. The results of these sample analyses are expected to provide valuable information in human history towards the elucidation of the evolution of the solar system. Other world-leading achievements that we attained in the field of space science include papers based on remote sensing observation data and papers on the curation of Ryugu samples that are published in internationally prestigious academic journals such as Nature Astronomy.



Microscopic image of the recovered sample. Container diameter: 21 mm (after removing large-sized samples)



(Left figure) Global density distribution of individual Ryugu particles. The average of the global density of Ryugu particles was smaller than that of any known meteorite. (Right figure) Comparison of infrared reflection spectrum between Ryugu sample and probe data. It was found that the returned sample is representative of the surface material of Ryugu, which is equivalent to the global value of Ryugu observed by NIRS3, a device on board the probe.

[Artemis program]

[Details](#)

As for the international space exploration (the Artemis program) led by the United States, we proceeded with the study and coordination of concrete proposals for Japan's contribution toward the realization of the first landing of a Japanese person on the moon. As part of this effort, for the crewed rover system, which will be a key element in future sustainable lunar exploration, JAXA has begun to explore the feasibility of the development of its major components that we provide and to study the positioning and communication systems necessary for its operability. We have also begun full-scale development of habitation modules for the Lunar Orbital Platform "Gateway" and the Lunar Polar Exploration mission (LUPLEX) to explore the possibility of the use of water resources in the polar regions of the Moon.



Lunar Polar Exploration mission (image)

[ISS program]

[Details](#)

Regarding the ISS program, astronauts Noguchi and Hoshide stayed on the ISS for two consecutive terms of about one year in total. Astronaut Noguchi yielded scientific and technical results essential for the exploration and performed operations to upgrade the ISS as EVA activities, while astronaut Hoshide became the second Japanese astronaut to serve as a commander of the ISS and set a record for serving as a Japanese commander for the longest period of about five months, contributing to the stable operation of the ISS and sustainable development of low-Earth orbit activities.

Furthermore, for the recruitment of new Japanese astronauts for future space exploration, etc., we drastically revised the application requirements in order to secure more diverse human resources, and conducted active outreach activities. As a result, we received more than four times as many applicants* as in previous recruitment.

*By the deadline of April 2022, the number of applicants reached 4,127 (approximately 4.3 times as many applicants as in previous recruitment).



Astronauts Hoshide and Noguchi in the laboratory of the Japanese Experiment Module "Kibo" of the International Space Station
©JAXA/NASA



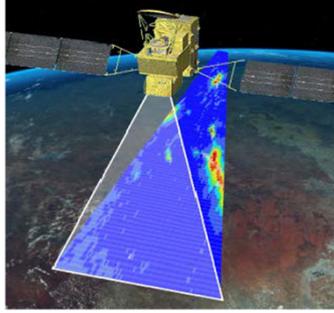
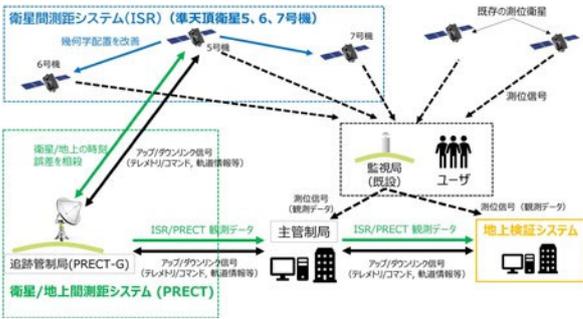
Advertisement for recruiting astronauts

As a core implementing agency that supports Japan's aerospace development and utilization through technology, JAXA is engaged in a variety of businesses to achieve the Phase 4 Medium/Long-Term Goals. This section introduces JAXA's ongoing development projects.

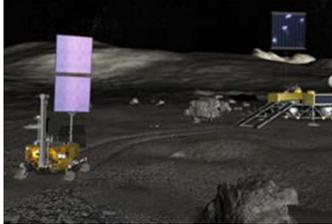
List of JAXA projects

Name	Scheduled launch year	Overview	Image
H3 Launch Vehicle Details	After 2022	The H3 Launch Vehicle is Japan's new flagship rocket. To realize a safe and prosperous society utilizing space, we will renovate the H-IIA Launch Vehicle currently in use to continually transport satellites and probes into outer space. Aiming at achieving high flexibility, high reliability, and high-cost performance from a thorough user perspective, we will develop an easy-to-use launch vehicle that can attract international attention, achieving a number of launches that have never been accomplished before.	
Epsilon S Launch Vehicle Details	2023	The Epsilon Launch Vehicle, which is a solid-fuel rocket, is one of Japan's core rockets. So far, all five Epsilon Launch Vehicles have been launched successfully in the first stage, achieving compact launch operations, a world-class satellite-borne environment, and high orbital insertion accuracy. In the next second stage, we will develop the Epsilon S Launch Vehicle, a successor to these launch vehicles, which is designed to achieve synergistic effects with the H3 Launch Vehicle, achieve launch cost reduction and high reliability at the same time, and improve satellite operability, thereby strengthening Epsilon's international competitiveness.	
Earth CARE (Earth Clouds, Aerosols and Radiation Explorer)/CPR Details	2023	EarthCARE is an earth observation satellite that Japan and Europe have been jointly developing. Using its global observation system, it monitors clouds and aerosols (small particles such as dust and dirt), contributing to improving the accuracy of climate change predictions. EarthCARE enables observation of the internal structure of entire clouds, which is expected to promote scientific elucidation and understanding of the impact of clouds and aerosols on climate change. The on-board Cloud-Profiling-Radar (CPR), which is designed and manufactured by Japan, is designed to examine the vertical structure of clouds and is capable of capturing the interior of thick clouds such as typhoons.	
Engineering Test Satellite-9 (ETS-9) Engineering Test Satellite-9 Details	2023	ETS-9 aims to demonstrate communications technology and satellite bus technology and to realize an internationally competitive satellite system that meets market needs. Satellite bus technology to be demonstrated by ETS-9 will increase power supply and reject a large amount of waste heat generated from onboard communication instruments. In addition, the use of an electric propulsion system utilizing all-electric satellite technology is expected to reduce the volume of propellant loaded and cut launch costs. Furthermore, autonomous orbital maneuvers using a geostationary GPS receiver will be implemented to reduce the overall satellite lifecycle costs from the launch until the end of its operation and to improve operational quality.	
Advanced optical satellite Daichi-3 (ALOS-3) Advanced Land Observing Satellite-3 Details	After 2022	Daichi-3 (ALOS-3), an earth observation satellite, is a successor of the optical mission of Advanced Land Observing Satellite (ALOS), also called Daichi. Equipped with an optical sensor of higher performance than that of Daichi, ALOS-3 achieves an improved ground resolution (0.8 m), achieving about a three-fold improvement in ground resolution while maintaining the wide swath (70 km at nadir). By continuously observing land areas on a global scale and constructing a system to quickly acquire, process, and distribute accumulated images both before and after the disaster, we aim to utilize ALOS-3 for disaster management and countermeasures of the central and local governments. The observed data from ALOS-3 is expected to lead to progress in a variety of fields including the development and updating of highly accurate geospatial information and research and application for monitoring of the coastal/vegetation environment.	<p>Achieving a three-fold improvement in ground resolution</p> <p>Daichi: Resolution 2.5 m Daichi-3: Resolution 0.8 m, simulation image</p>
Advanced radar satellite Daichi-4 (ALOS-4) Advanced Land Observing Satellite-4 Details	After 2022	Daichi-4 (ALOS-4) is a successor to Daichi-2 (ALOS-2). While maintaining the high spatial resolution (3 m) of Daichi-2, ALOS-4 is a radar satellite having an observation swath (200 km) four times wider than that of its predecessor, playing an important role not only in grasping the situation after a disaster, but also in promoting disaster mitigation including early detection of unusual volcanic activity, land subsidence, or landslides. We are also considering its application to forest management and other purposes. Compared to Daichi-2, ALOS-4 offers a five-fold improvement in resolution and higher-frequency observation, making it possible to detect smaller deforestation areas that cannot be monitored by DAICHI-2.	

List of JAXA projects

Name	Scheduled launch year	Overview	Image
<p>Global observing satellite for greenhouse gases and water cycle (GOSAT-GW)Global Observing SA Tellite for Green house gases and Water cycle</p> <p>Details</p>	2023	<p>GOSAT-GW is an earth observation satellite jointly developed by the Ministry of the Environment, National Institute for Environmental Studies, and JAXA for observing greenhouse gas and hydrological cycle fluctuation. GOSAT-GW is a satellite that expansively takes over the Global Change Observation Mission - Water "SHIZUKU" (GCOM-W) launched in 2012, and Greenhouse gases Observing SATellite "IBUKI" (GOSAT) launched in 2009 and "IBUKI-2" (GOSAT-2) launched in 2018. By using its two types of on-board sensors, GOSAT-GW will observe the physical quantity of water on the ground surface, on the sea surface, and in the clouds by penetrating the clouds as well, as snowfall and water vapor on land at any time of the day or night regardless of the weather. The satellite also contributes to improving the accuracy of greenhouse gas emission estimations by observing greenhouse gases on the globe over a wide range of areas with high accuracy.</p>	
<p>High-precision positioning system</p> <p>Details</p>	2023	<p>As a commissioned project related to the Quasi-Zenith Satellite System (QZSS) developed by the Japanese government, we will conduct a technical demonstration that contributes to improving user positioning accuracy by developing new functions toward the construction of a seven-satellite navigation system. Specifically, we will newly develop inter-satellite ranging and satellite-to-ground ranging functions and equip three additional satellites and ground systems with these functions. In addition to conventional signals, new signals will be used to estimate the position and time of positioning satellites in orbit with higher accuracy. This will allow us to perform a technical demonstration in which the accuracy of positioning signals (SIS-URE) delivered to users is greatly improved.</p>	
<p>New Space-Station Resupply Vehicle (HTV-X) Demonstrator (HTV: H-II Transfer Vehicle)</p> <p>Details</p>	2022	<p>HTV-X is an uncrewed spacecraft as a successor of H-II Transfer Vehicle "KOUNOTORI" (HTV). While maintaining the superiority of HTV, HTV-X is equipped with new technical demonstration platform capabilities to improve its transportation capacity and operability and to ensure feasibility and expansibility of future space technology and space systems. Taking advantage of the opportunity to furnish supplies to the ISS, which is its nominal mission, HTV-X will be used as a platform for in-orbit technical demonstration and experiments during the period from leaving the ISS to re-entry.</p>	
<p>Technical demonstration of automated docking</p> <p>Details</p>	2023	<p>For international space exploration missions such as resupply to Gateway and flexible space activities that are expected to be carried out in the future, automated docking technology that is different from the conventional capture-and-berthing technique is essential. To this end, we will conduct an in-orbit demonstration in the ISS utilizing the HTV-X technical demonstration platform to acquire automated docking technology that complies with the International Docking System Standard (IDSS) and contribute to future missions including international space exploration missions.</p>	
<p>Gateway's habitation module</p> <p>Details</p>	HALO2024 I-HAB2026	<p>An international working team consisting of ISS partners is conducting concept studies about the US-proposed Lunar Orbital Platform "Gateway" as a relay station for exploration missions to the Moon and Mars. Utilizing the technologies cultivated through the ISS program and H-II Transfer Vehicle "KOUNOTORI" (HTV) resupply transportation missions, we are presently exploring several potential plans for habitation functions and resupply missions for the Gateway. These include providing batteries for the Habitation and Logistics Outpost (HALO), and ECLSS (Environmental Control and Life Support) systems, refrigerant circulation pumps, batteries, video equipment, and other equipment for the International Habitation Module (I-HAB).</p>	
<p>Martian Moons eXploration (MMX)Martian Moonee X ploration</p> <p>Details</p>	2024	<p>MMX is the world's first Mars satellite sample-return mission. It plans to collect surface material from Mars' moon Phobos and return it to Earth. Through the analysis of collected samples, the mission will clarify the existence of water or organic matter, the origin of Martian moons, and the evolution process of the Martian Sphere, contributing to solving the mystery of planetary formation in the Solar System. We will also improve the technology required to make round-trips between the Earth and Martian sphere and enhance the advanced sampling techniques that will be employed on the Martian moon surface, thereby contributing to improving technology for future crewed exploration of planets and satellites.</p>	

List of JAXA projects

Name	Scheduled launch year	Overview	Image
Lunar Polar Exploration Mission (LUPEX) Lunar Polar Exploration project Details	2024	In order to determine the feasibility of utilizing lunar water resources for sustainable space exploration activities in the future, JAXA will conduct the Lunar Polar Exploration Mission in international collaboration with the Indian Space Research Organization (ISRO) and space agencies in the United States and Europe to obtain data on the quantity and forms of water present on the Moon. The acquired data will also contribute to the selection of the crewed landing point under the U.S.-led Artemis program.	
Smart Lander for Investigating Moon (SLIM) Details	2022	SLIM is planned to demonstrate the precision landing technology needed for future lunar and planetary exploration with a small probe. These innovations, if successful, will bring about a paradigm shift in our gravitational celestial exploration. The current approach searches for the site target optimized for landing. The techniques to be acquired will instead bring the spacecraft down to the desired point.	
X-Ray Imaging and Spectroscopy Mission (XRISM) Details	2022	XRISM is a new international X-ray observation project under development in collaboration with NASA, ESA, and other related organizations to open the frontiers of space science. Through X-ray precision spectroscopic imaging of "hot plasma," which is the wind blowing through the galaxies in the universe, we aim to investigate the flows of mass and energy, revealing the composition and evolution of celestial objects.	
Deep Space Exploration Technology Demonstrator (DESTINY+) Demonstration and Experiment of Space Technology for Interplanetary voYage with Phaethon fLyby and dUst Science Details	2024	DESTINY+ will explore the active asteroid Phaethon, the parent body of the Geminids meteor shower. The expedition is expected to uncover the mystery of the asteroid Phaethon and to dramatically increase the number of explorable objects by acquiring high-speed fly-by exploration technology.	
Technical demonstration of core engine (En-Core) Details	2023	En-Core represents an environmentally compatible core aeroengine. The world's major jet engine manufacturers dominate the production of core engines, especially high-temperature, high-pressure parts. Getting its share would be a leap for Japanese manufacturers, which already have a good share in low-temperature, low-pressure parts. JAXA is conducting research and development projects that aim to obtain competitive technologies to reduce NOx (nitrogen oxides) and CO ₂ (carbon dioxide).	
Flight experiment for reuse of the first stage (CALLISTO) Details	2024	CALLISTO is a flight experiment aimed at reusing the first stages of launch vehicles, which is one of the measures to effectively reduce transportation costs to space. As important technologies (key technologies) to allow a series of operations from launch to landing followed by reuse, this project aims to identify guidance and control technology, propellant management technology, and engine maintenance technology, and develop a small, reusable, experimental vehicle and conduct flight tests based on international cooperation with French and German space agencies.	

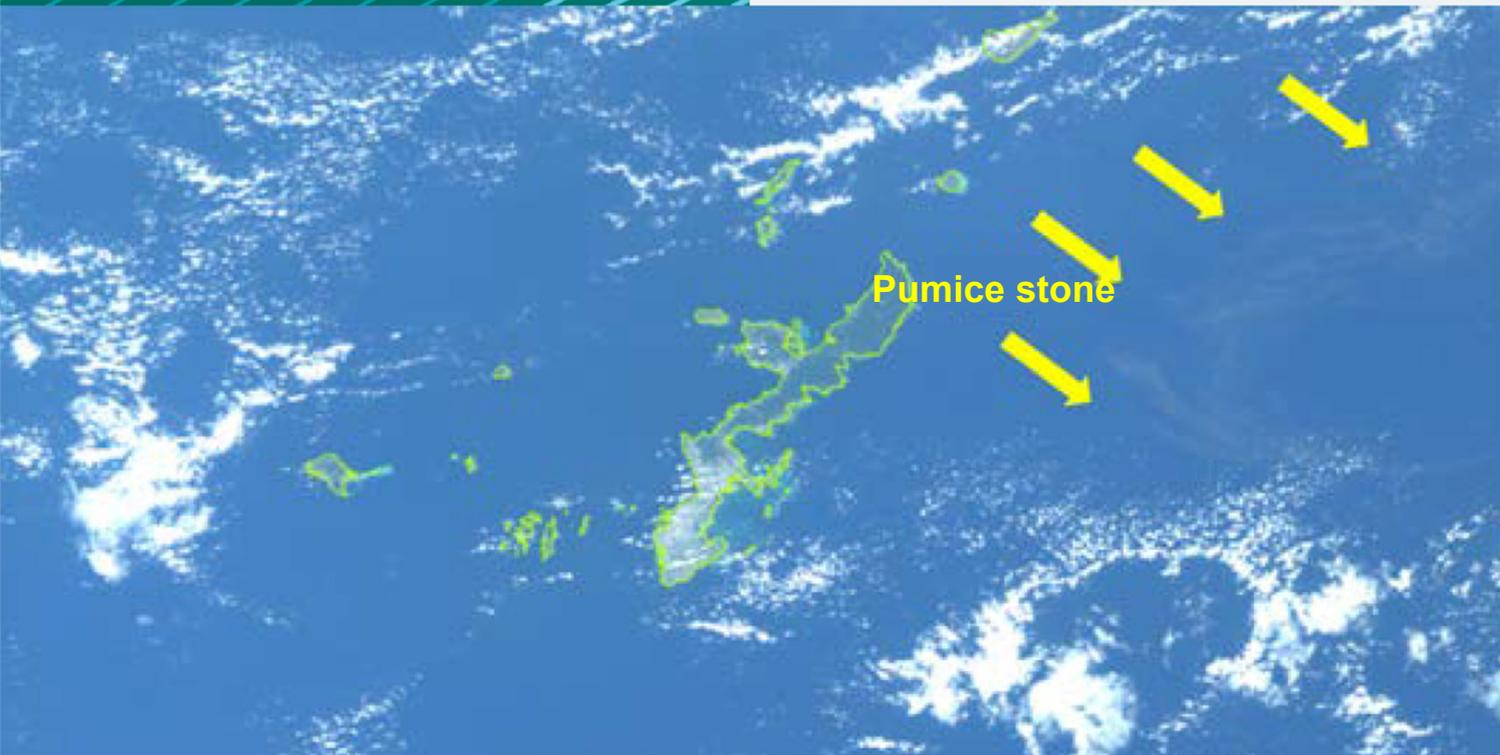


Photo: Drifting pumice caused by the eruption of Fukutoku-Okanoba captured by the Global Change Observation Mission - Climate "SHIKISAI" (GCOM-C)

Involvement in the Environment

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Global Environmental Preservation:

Environmental Monitoring on Land, Sea, and Air, and Contribution to Climate Change Measures

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Global forest distribution monitored by Daichi-2

[Details](#) [Details](#)

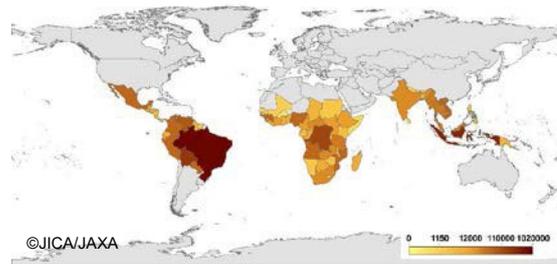
Contributing to assessing the achievement of the long-term goals of the Paris Agreement through satellite observations

In collaboration with the Japan International Cooperation Agency (JICA), JAXA has developed and operated the JICA-JAXA Forest Early Warning System (JJ-FAST), which uses observation data from Advanced Land Observing Satellite Daichi-2 (ALOS-2) and automatically detects and discloses changes in forests of 2 hectares or more in 78 countries around the world every 45 days. We are also working to capture information on global mangrove extent and changes based on the observation data from Daichi-2, etc.



JJ-FAST website automatically detects and discloses changes in forests of more than 2 hectares in 78 countries around the world every 45 days.

Because these initiatives are useful in assessing the achievement of the Paris Agreement's long-term goals (Global Stocktaking: GST), JAXA, in cooperation with relevant organizations, submitted a joint submission to the 1st GST (2021 – 2023). We will contribute to assessing the achievement of the long-term goals of the Paris Agreement through satellite observation.



Distribution of approximately 3 million deforestation events detected between 2016 and 2021 by country. Of these, more than 1/3 were detected in Brazil. The data is used to monitor illegal logging of rainforests.

Antarctic sea ice extent lowest ever recorded

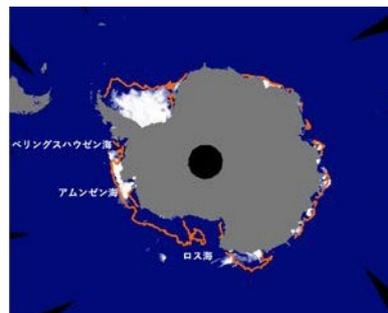
[Details](#)

Discovered the phenomenon based on the observation data from SHIZUKU in February 2022.

Observation data from Global Change Observation Mission – Water "Shizuku" (GCOM-W) revealed on February 20, 2022, that the Antarctic sea ice extent was the smallest since satellite observations began in 1978. The average minimum extent was 2,902,000 km² for each year from 2012 to 2021, but on February 20, 2022, the sea ice extent reached 2,128,000 km², which is 73% of the average minimum.

Participating in Arctic Challenge for Sustainability II (ArCSII) led by the National Institute of Polar Research, JAXA promotes collaboration between satellite data and polar research, aiming to contribute to the realization of a sustainable society through collaboration with different research fields and societies and international cooperation based on an accurate understanding of the current status and process of global warming and climate prediction.

The satellite GOSAT-GW, which is to be launched in FY2023, will be equipped with a successor to the observation equipment of SHIZUKU, which conducts these observations.



Antarctic sea ice concentration distribution on February 20, 2022, as captured by Global Change Observation Mission – Water "Shizuku" (white part)
(Prepared using the Arctic Data Archive System of the National Institute of Polar Research)
The orange lines show the average sea ice extent for the same period in the 2000s.

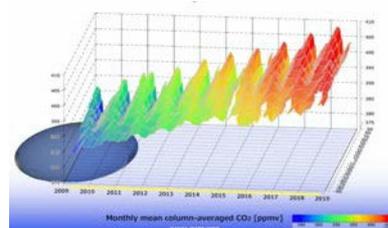
Monitoring the distribution of greenhouse gas concentrations

[Details](#)

Contributing to assessing the achievement of the long-term goals of the Paris Agreement through satellite observations

In collaboration with the National Institute for Environmental Studies and the Ministry of the Environment, JAXA operates the Greenhouse Gases Observing Satellite "IBUKI" (GOSAT) and the Greenhouse Gas Observing Satellite-2 "IBUKI-2" (GOSAT-2). Over the 13 years since the launch of IBUKI in 2009, we have observed the global distribution of greenhouse gas concentrations, and have identified the rising trend in the concentrations of carbon dioxide and methane. As mentioned above, we submitted a joint submission to the first GST to contribute to assessing the achievement of the long-term goals of the Paris Agreement. GOSAT-GW, which is to be launched in FY2023, will be equipped with a successor to the observation equipment for IBUKI-2.

Observing the land, sea, and air on a global scale, JAXA will monitor changes in the global environment over a long period from space.



Global latitudinal and monthly CO₂ concentrations observed by GOSAT. The data shows that from 2009, in which IBUKI started observation, to 2021, global carbon dioxide concentration increased by 29 ppm (parts per million). Similarly, methane concentration increased by 97 ppb (parts per billion).

Global Environmental Preservation: Social Implementation of Space Utilization and Disaster Prevention

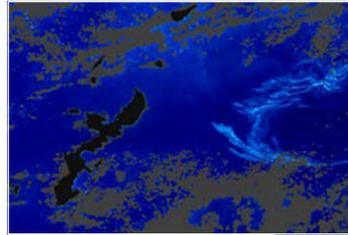
Satellite observation of pumice stones approaching and drifting to the Okinawa region

[Details](#)

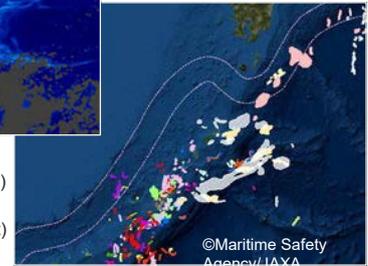
Released the data of drifting pumice stones produced by the eruption of Fukutoku-Okanoba

From the latter half of October to the end of the year 2021, a massive amount of pumice stones produced by the eruption of Fukutoku-Okanoba, a submarine volcano of the Ogasawara Islands, drifted ashore in the Okinawa region. We wish to extend our deepest sympathy to all those in the fishing and tourism industries who have suffered hardship from pumice. JAXA observed drifting pumice over a wide area using the Global Change Observation Mission - Climate "SHIKISAI" (GCOM-C) and other instruments. The location information of the pumice, which was read from satellite images, was provided to government agencies, fishery organizations, and other organizations to help ensure the safety of the sea.

Observation by earth observation satellites is essential when observing vast areas such as the ocean. JAXA will promote the necessary measures to monitor the marine environment and ensure marine safety.



Observation image captured by "SHIKISAI" at 10:34 (Japan time) on October 15, 2021. A massive amount of pumice (light blue part) drifting on the east side of the main island of Okinawa.



Distribution map of pumice deciphered from various satellite images by November 22, 2021

Observation of the eruption of Hunga-Tonga-Hunga-Ha'apai volcano

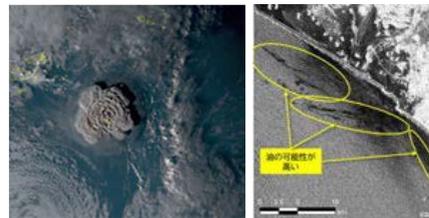
[Details](#) [Details](#)

Observations of aerosols from volcanic eruptions and oil spills caused by the tsunami

On January 15, 2022, a large-scale eruption occurred on a volcanic island in the South Pacific Kingdom of Tonga. JAXA conducted observations using the Advanced Land Observing Satellite-2 "Daichi-2" (ALOS-2), the Global Change Observation Mission - Climate "SHIKISAI" (GCOM-C), the Meteorological Satellite "Himawari" and provided data to relevant organizations.

The observation of "SHIKISAI" revealed that the aerosols that were rolled up by the eruption were distributed in the stratosphere at an altitude of about 28 km. In Peru, a massive amount of crude oil that was being unloaded from a tanker to an oil refinery spilled into the ocean due to high waves caused by a tsunami.

After the emergency observation using Daichi-2, JAXA provided the data on oil spills through the International Disaster Charter (an international collaboration composed of space agencies for disaster observation).



(Left) View of the eruption on a volcanic island in Tonga captured by Meteorological Satellite "Himawari"

(Right) Oil spill off Peru observed at 5:36 (Universal Time) on January 21, 2022

Major Awards for JAXA's Earth Observation Activities

Development of terrestrial water cycle simulation system integrating satellite data

[Details](#)

[Space Development and Utilization Award]

Under joint research with the University of Tokyo, JAXA is developing and operating a system (called Today's Earth) to estimate and predict physical quantities related to the water cycle on land in the world and Japan in real time. By integrating satellite observation and numerical simulation technologies, we aim to contribute to the mitigation of flood/inundation damage. As part of the "Development of terrestrial water cycle simulation system integrating satellite data 'Today's Earth,'" JAXA received the Minister of Education, Culture, Sports, Science, and Technology Award at the 5th Space Development Utilization Awards in recognition of its achievements in space development and utilization up to FY2021.



Members of the development team that received the Minister of Education, Culture, Sports, Science, and Technology Award at the 5th Space Development and Utilization Awards for the "Development of terrestrial water cycle simulation system integrating satellite data "Today's Earth."

Contribution of Daichi-2 to building national resilience

[Details](#)

< Minister of Education, Culture, Sports, Science, and Technology Award >

The Advanced Land Observing Satellite-2 "Daichi-2" (ALOS-2), which was launched in May 2014, has exceeded its target lifespan of 7 years and is now in its ninth year of operation. Precise observation data of land provided by ALOS-2 has been used to assess disaster status, conserve national land, and address global issues in Japan and overseas. In recognition of these achievements, we received the 2022 Minister of Education, Culture, Sports, Science, and Technology Award in the field of science and technology.

Contribution to agricultural weather watch and food security

[Details](#)

< Minister of Education, Culture, Sports, Science, and Technology Award >

JAXA is developing and operating a system for providing agricultural weather information using observation data from earth observation satellites. Agricultural weather information such as soil moisture, temperature, and precipitation is used by agricultural organizations in Japan and ASEAN countries to forecast harvest conditions. In recognition of its contribution to food security in Japan and ASEAN countries, we received the 2022 Minister of Education, Culture, Sports, Science and Technology Award in the field of science and technology.

Global Environmental Preservation: Research Contributing to the Realization of a Sustainable Society

Greenhouse Gas Observation from Passenger Aircraft

[Details](#)

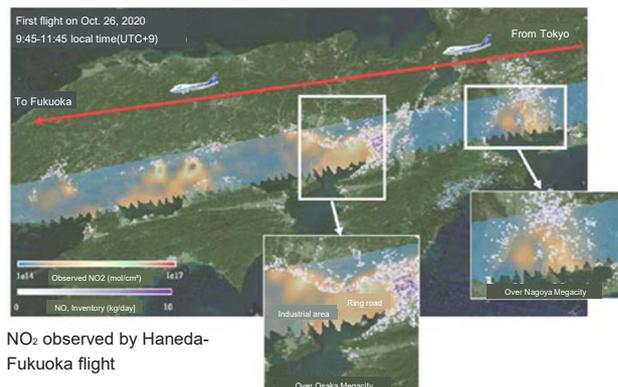
Providing New Means of Reducing Greenhouse Gases

Since the beginning of the 21 century, global warming caused by the increase in greenhouse gases has become increasingly recognized as a common issue for all humanity. As for these invisible greenhouse gases, JAXA is using the observation technology of GOSAT (IBUKI), which has been developed and is being operated by JAXA, to conduct observations from passenger aircraft over cities in cooperation with ANA Holdings as a new initiative.

In order to understand the effects of greenhouse gas reduction measures, it is important to assess emissions by source (transportation, manufacturing, power generation, etc.). This project aims to accurately estimate CO₂ emissions by simultaneously observing carbon dioxide (CO₂), which accumulates in the atmosphere over a long period of time, and nitrogen dioxide (NO₂), which is generated simultaneously during combustion and disappears in a chemical reaction.

As with IBUKI, we will also observe the light emitted by plants during photosynthesis, which is an indicator of greenhouse gas absorption.

In this project, it is possible to observe the skies over large cities with high spatial resolution and high frequency by observation from passenger aircrafts, and we will provide data contributing to effective emission reduction measures.



NO₂ observed by Haneda-Fukuoka flight

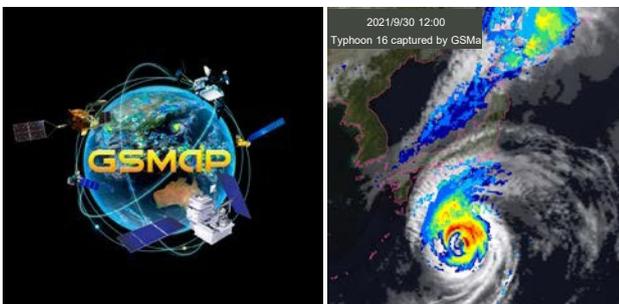
Solving social issues through satellite observation

[Details](#)

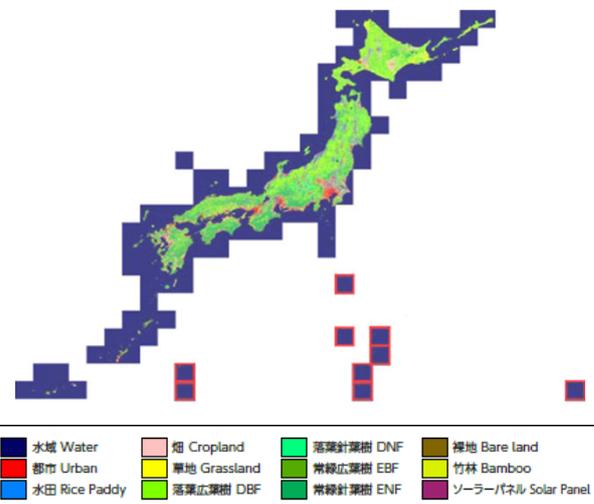
Contributed to more than 136 countries around the world

JAXA is working to solve social issues by utilizing data on precipitation, forests, and greenhouse gases obtained from satellite observations. For example, as an effort to reduce flood damage caused by heavy rain that has occurred frequently in recent years, we are working to build a flood forecast/warning system that integrates Global Satellite Mapping of Precipitation (GSMaP) data disclosed by JAXA with the ground data. GSMaP is a system that provides hourly global precipitation data from multiple satellite data. The system, which allows users to see easily where and how much rain is falling, is available free of charge on the Internet and is used by people in more than 136 countries including regions and countries where it is difficult to observe with ground-based rain gauges and weather radars.

Specifically, by calculating the ratio of vegetation (including forests, croplands, grasslands, and wetlands) to the area of mountainous land and quantifying it as the Mountain Green Cover Index, it is possible to understand the transition. The 2030 Agenda for Sustainable Development encourages UN member states to conduct a voluntary national review (VNR) of progress on the SDGs at national and regional levels regularly at the initiative of each country. In 2021, Japan submitted its second VNR for the first time in four years to the High Level Political Forum (HLPF) held by the UN Economic and Social Council. This VNR includes the changes in the Mountain Green Cover Index from 2010 to 2020 calculated by using JAXA's satellite data.



Satellite data is also used as an index to measure progress toward the SDGs. For example, the Advanced Land Observing Satellite-2 "Daichi-2" (ALOS-2) is acquiring data daily to help ensure the safety of people's lives and respond to global environmental issues. Using this observational data allows users to measure the progress toward attaining Goal 15: Preserving Land Affluence.



ALOS high-resolution land use land cover map across Japan (Ver 21.03, 2018 – 2020)

Promotion of Green Management

We contribute to global environmental issues and promote steady and daily environmentally friendly operations.

JAXA Basic Environmental Policy

JAXA will conduct activities to maintain the environment on Earth and in space to enable sustainable development of society.

To achieve this, we will:

- ▶ Work to solve global environmental issues and reduce environmental load through research, development, and utilization.
- ▶ Promote environmentally friendly operations and make continuous improvements.
- ▶ Disclose information on our efforts to solve environmental issues and value communication with all stakeholders.

Chairman of Green Management
Committee

(Senior vice president)

Kazuhiro Suzuki



We, JAXA, will contribute to the resolution of environmental issues by promoting R&D of technologies for monitoring global environment issues using satellites and environmentally friendly aircraft, and by introducing the results of such R&D into various activities in society.

In addition, in setting the Environmental Management Promotion Targets for FY2022, we will steadily promote energy conservation activities and reduction of environmental load while continuing to reduce environmental accidents to zero based on the basic action policies for SDGs newly established in FY2021.

Targets and Results for Promoting Green Management

Based on JAXA Basic Environmental Policy, we set targets for promoting green management in FY2021. The details of the targets and results are shown below.

Item	Targets and KPI set in FY2021*1		Results in FY2021	Reference
Initiatives to Save Energy	Target specified in the Energy Conservation Act: Reduce the energy consumption intensity by 1% or more (annually) on average for five years.	KPI	Target specified in the Energy Conservation Act: Achieved a 4.2 percent reduction on average for five years.	P.15
	Reduce greenhouse gas emissions through compliance with the Energy Conservation Act.	KPI	Reduced by 2.6% compared to the previous fiscal year.	
	Compliance with the Tokyo Metropolitan Ordinance on Environmental Preservation Reduce CO ₂ emissions at Chofu Aerospace Center (headquarters) by 25% compared to base emissions.	KPI	Reduced by 33.8% compared to the base emissions. (Preliminary figure before notification to the Tokyo Metropolitan Government*2)	P.16
Initiatives to Create a Recycling-Oriented Society	Continue to have zero violations of laws and regulations regarding waste disposal.	KPI	There were no violations of laws and regulations.	P.18
	Give consideration to the reduction of environmental load in goods procurement.		In accordance with the JAXA Green Procurement Policy and Green Contract Policy 2021, we conducted procurement with consideration to the reduction of environmental load.	P.19
Actions for environmental risks	Continue to have zero environmental incidents.	KPI	There were no environmental incidents.	P.14
Creation of new value: Contributing to solution of social issues through business	Research, development, and utilization contributing to solution of global environmental issues.		To solve global environmental issues, in collaboration with other organizations, we developed and utilized satellites and other instruments that contribute to the elucidation of climate change and monitoring of disasters and conducted R&D in the aeronautic field that contributes to aircraft noise reduction and environmental compatibility.	P.10-12
Communication with society	Communication with stakeholders on environmental issues. (Public relations and collection of opinions)		We actively disseminated information on our efforts to solve global environmental issues through lectures, symposiums, and booths at various events.	P.33

*1 KP (1 Key Performance Indicators): Indicators that can be used to evaluate actions and achievements for targets.

*2 The figure (33.8%) will be confirmed after verification by a registered organization under the Tokyo Metropolitan Ordinance on Environmental Preservation.

Report on Environmentally Friendly Operation

Environmentally Friendly Operation

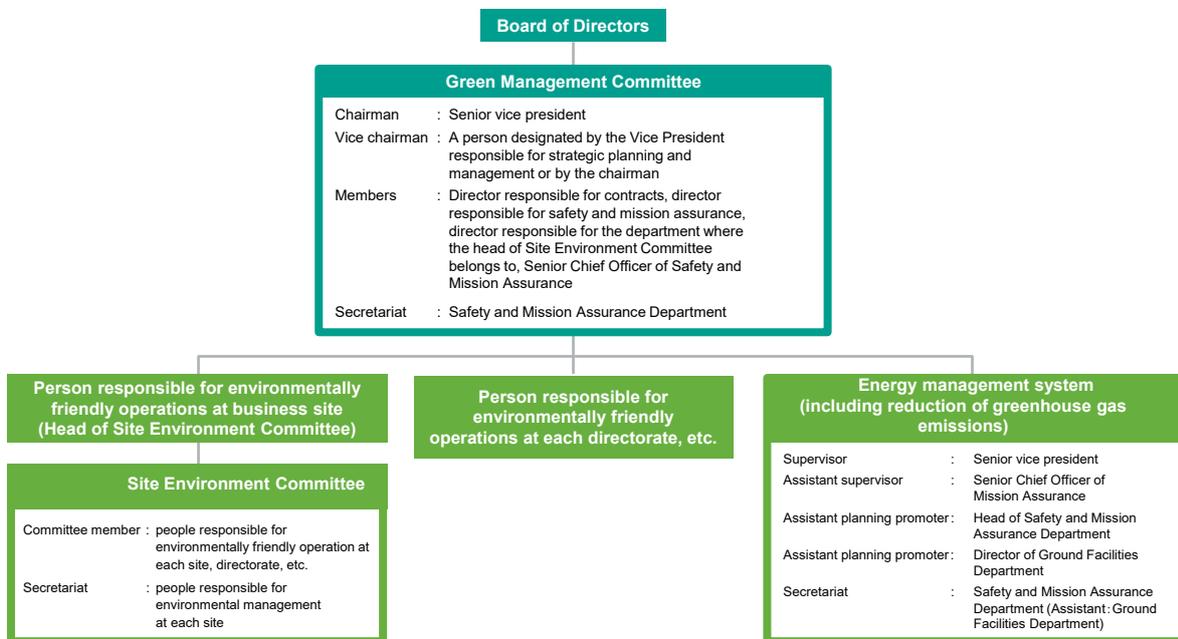
Environmental Policy at Each Site

We implement environmentally friendly operations to contribute to global environment preservation and sustainable development. We established the Green Management Committee chaired by the Senior Vice President to set our goals and implementation plans for the environment such as rationalization of energy use and proper waste disposal. Based on them, plans for each site are prepared and implemented.

The results of activities are properly evaluated and reflected in the next year's plan.

We appoint a responsible person at each site and organization and clarify the roles and responsibilities to implement environmentally friendly operations.

Green Management System



Construction of JAXA Integrated EMS

In order to ensure consistency in the operation of EMS (Environmental Management System), JAXA has standardized its knowhow on tackling environmental management issues by integrating the systems that had been operated on a site-to-site basis.

As a result, we will share the knowhow among business sites, improving JAXA's overall EMS performance with synergistic effects.

Prevention of Environmental Incidents and Legal Violations

In order to prevent environmental pollution, we ascertain the risks that may lead to environmental accidents in advance, prepare a visualized environmental risk map and a list of measures against environmental accidents, and post them in each building on business sites for ready reference. We utilize them to set evacuation routes in disaster drills and to check actions in case of incidents and update them if revised.

As a result of these efforts, no environmental incidents occurred in FY2021.

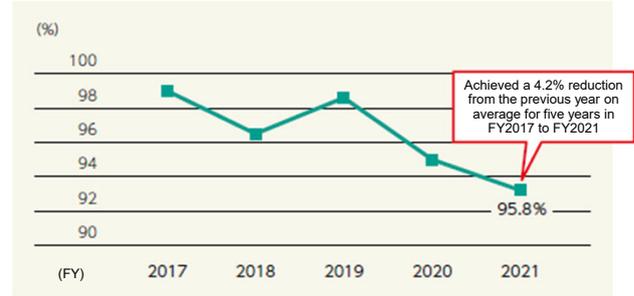
Report on Environmentally Friendly Operation [Initiatives to save energy]

Actions for the Act on the Rational Use of Energy (Energy Conservation Act)

Since being designated as a specified business operator* on October 1, 2010, we have made efforts to reduce the energy intensity by at least 1% on average for five years in accordance with the Energy Conservation Act. In FY2021, the five-year average of energy intensity was reduced by 4.2%, achieving the goal specified in the Energy Conservation Act.

At the Chofu Aerospace Center, where a significant reduction was achieved, the impact of the new model was significant in terms of the increase in the number of nodes (components of the supercomputer) and the improvement in the job filling rate (CPU usage ratio) compared to the first unit (JSS), which is the standard for supercomputers.

Change from the previous year in energy consumption intensity*2



*1 Businesses with annual energy consumption of 1,500 kL or more in crude oil equivalent.

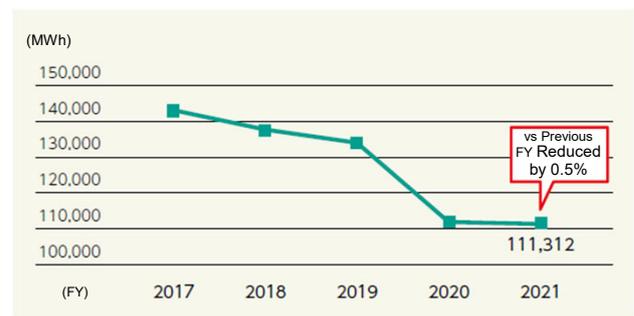
*2 Energy consumption intensity is an index for reducing the amount of energy used in business activities. Our energy intensity is adjusted to offset the increase/decrease in energy consumption due to the number of launches and operation status of test facilities.

Trends in Electricity Consumption

JAXA uses electric power as a basic power source for aerospace R&D and the operation of a wide variety of related facilities.

In FY2021, our total electricity consumption leveled off at 111,312 MWh, which was a reduction of 0.5% compared to the previous fiscal year.

Electricity Consumption



Trends in City Gas Consumption

We use city gas mainly as fuel for power generators and air conditioners. In FY2021, our total city gas consumption was 604K m³, which was reduced by 30.6% compared to the previous fiscal year. The reasons for the decrease in city gas consumption are as follows.

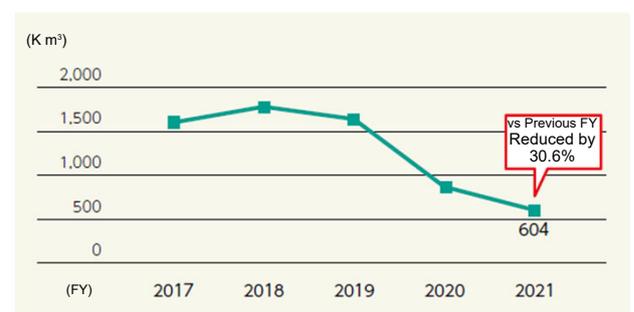
○ Tsukuba Space Center (TKSC)

In FY2021, no city-gas refrigerators were operated due to problems with electric refrigerators that occurred in FY2020, and no city-gas power generation was performed due to tight electricity demand.

○ Chofu Aerospace Center

Power of air conditioners for supercomputers and hypersonic wind tunnel facilities was changed from city gas to electricity in FY2021.

City Gas Consumption



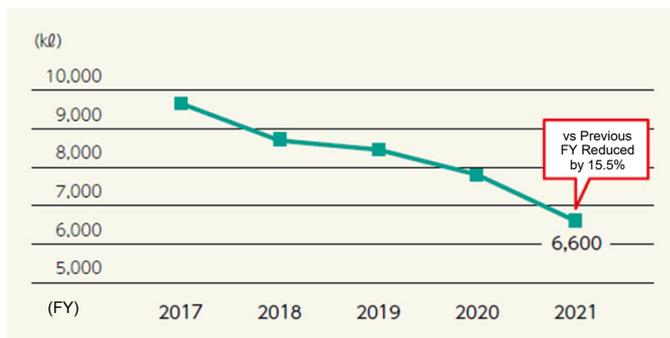
Report on Environmentally Friendly Operation [Initiatives to save energy]

Trends in Heavy Oil (JIS Grade A) Consumption

We use heavy oil (JIS grade A) mainly as fuel for generators at the Tanegashima Space Center and boilers in the combustion test facility at the Kakuda Space Center.

In FY2021, JAXA's total heavy oil (JIS Grade A) consumption was 6,600 kl, which was a reduction of 15.5% from the previous year. This was mainly due to a significant decrease of 14.93% over FY2020 as a result of improvements in power generation efficiency at the Tanegashima Space Center (See page 17 for details of initiatives).

Heavy Oil (JIS Grade A) Consumption

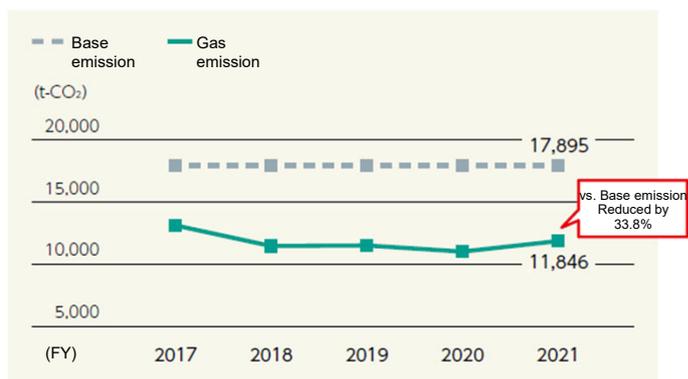


Compliance with the Tokyo Metropolitan Ordinance on Environmental Preservation (Initiatives to Reduce CO₂)

The Chofu Aerospace Center is an important base for the promotion of aeronautical technology research and is equipped with one of the largest facilities in Japan, including wind tunnel test facilities, aero-engine test facilities, and supercomputers. Since these facilities consume a lot of energy (electricity, etc.) for operation, the Tokyo Metropolitan Ordinance on Environmental Preservation is applied and requires reducing CO₂ emissions compared to the baseline level.

CO₂ emissions in FY2021 were 11,846t-CO₂, which was reduced by 33.8% (target: 25%). This is mainly due to the fact that the adjustment related to the power consumption of each unit is carried out as planned.

CO₂ emissions at Chofu Aerospace Center



Optimal tuning for SDGs! Optimization of large NAS battery control at Tanegashima Space Center

In response to the government's policy of realizing a decarbonized society by 2050, JAXA has been conducting ESCO projects at the Tsukuba Space Center and Sagami-hara Campus.

In this article, we introduce our efforts to reduce heavy oil (JIS grade A) used at the Tanegashima Space Center, which is the main cause of CO₂ emissions (the maximum amount of CO₂ generated inside JAXA).

In upgrading the aging power generation system at the Tanegashima Space Center, we conducted an overall review from the viewpoints of reliability, maintainability, economic efficiency, and environmental friendliness, and introduced the NAS battery, a high-power, large-capacity storage system. The installation was completed in May 2021, and fine-tuning was carried out while implementing test operations for one year thereafter to optimize the control of the existing generators and NAS batteries. The main effects are as follows:

- The operating efficiency of the existing generators was drastically improved (30 to 35% before the NAS battery introduction, 55 to 60% after the NAS battery introduction) by effectively utilizing the backup function of the NAS battery. We expect that this allows us to operate the existing generators under high load operation, resulting in a significant reduction in annual fuel consumption. (Figure 1)
- Since rechargeable batteries can cope with sudden power fluctuations, we succeeded in suppressing output fluctuations in the operating load of the existing generators and confirmed the stable operation of the generators. (Figure 2)
- Full-scale operation is expected to reduce annual CO₂ emissions by about 10%.
- These batteries can also be used in the future in combination with renewable energy sources such as solar and wind power.
- In view of the future energy supply situation, JAXA believes that it is essential to convert the existing power generation systems into new systems capable of flexibly supporting increasingly diversified energy services with an eye on energy demand in the next 30 years toward the realization of the Sustainable Development Goals (SDGs) in society (Fig. 3).

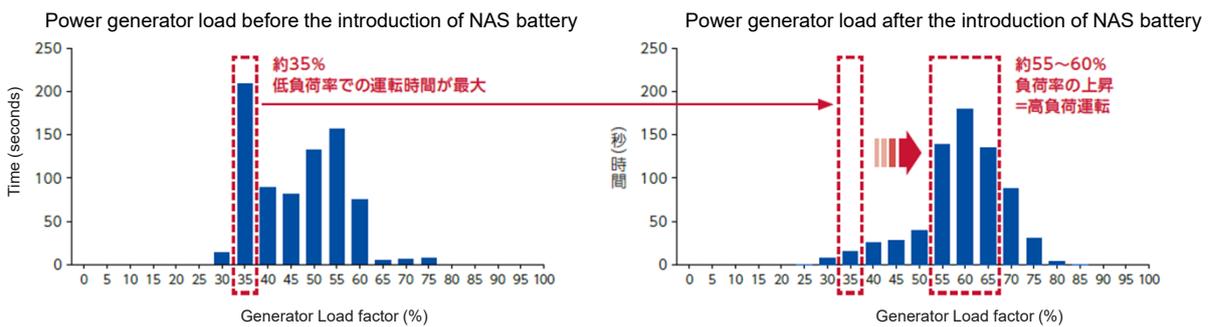
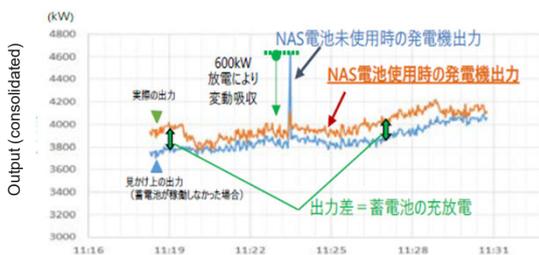


Figure 1. Improvement of generator load factor by introducing NAS battery

Fine tuning of NAS battery system

The system mitigates output fluctuation of a generator by performing power discharge by NAS rechargeable batteries in case of sudden power fluctuation.



Generator output with or without rechargeable batteries

Figure 2. Improvement in output fluctuation of generators by introducing NAS batteries

With the participation in projects from business units such as energy services utilizing the power of the private sector and in cooperation with external research institutes, we will accelerate the introduction of these technologies by conducting various feasibility studies toward the realization of future energy plans for rocket ranges.

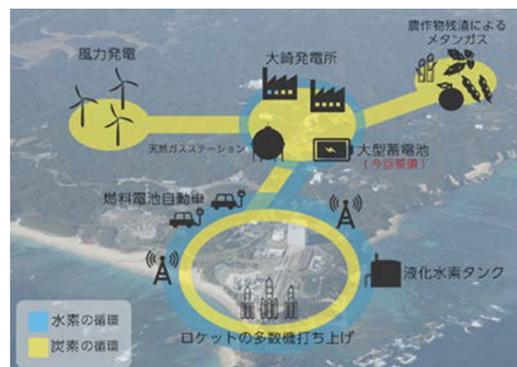


Figure 3. Image of energy self-sufficiency in the future (JAXA HP)

[Details](#)

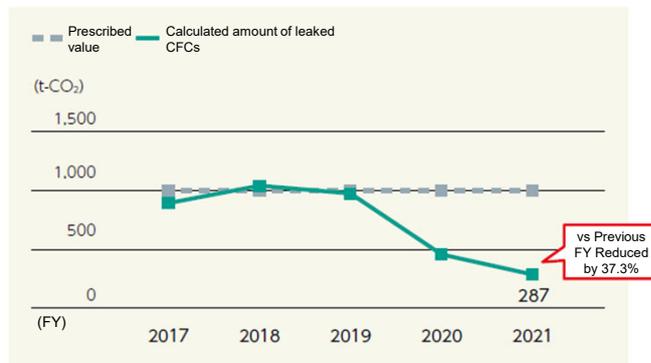
Report on Environmentally Friendly Operation (Initiatives to Create a Recycling-Oriented Society)

Measures to Prevent CFC Leakage

Since we use CFCs as refrigerants in air conditioners, freezers, and refrigerators, we try to reduce the leakage of CFCs to prevent ozone depletion and global warming. In FY2021, the calculated amount of leaked CFCs was 287 t-CO₂, a 37.3% decrease from the previous year.

This is mainly due to measures such as reviewing the frequency of inspections of air conditioners and replacing aging pipes early.

Calculated amount of leaked CFCs



Appropriate Management of Chemical Substances

We promote the appropriate management of chemical substances by establishing management procedures for chemical substances and periodically checking compliance. The table on the right shows the amount of chemical substances released and transferred in FY2021 as notified under the Act on Confirmation, etc. of Release Amounts of Specific Chemical Substances in the Environment and Promotion of Improvements to the Management Thereof (PRTR Law), indicating that chemical substances are appropriately managed.

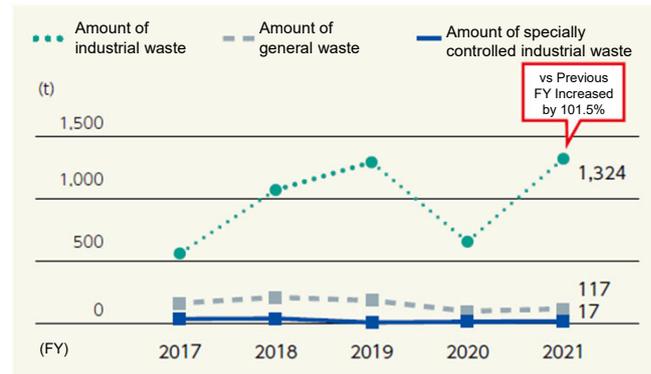
Substance name	Amount released (kg)		Amount transferred (kg)	
	Released to atmosphere	Discharged into public water and soil/disposed of by landfill	Transferred to sewage system	Transferred to external areas
Methylnaphthalene	355	0	0	20
Tetrachloroethylene	139	0	0	1,960
Dichloropentaful Orop propane (HCFC225cb)	564	0	0	4,710
Xylene	8	0	0	15
1-2-4 -Trimethylbenzene	10	0	0	18

Appropriate Management of Industrial Waste

We try to reduce the amount of waste by exploring the opportunities for reuse inside and outside of JAXA when various equipment is no longer needed due to completion of projects. In FY2021, the amounts of general waste and industrial waste were 117 t and 1,324 t, which increased by 20.6% and

101.5% compared to the previous fiscal year, respectively. The amount of specially controlled industrial waste was 17 t, which was a 30.8% increase compared with the previous fiscal year. The main reason for the significant increase in industrial waste was the generation of about 580 tons of waste concrete due to the renovation of the annular combustor test facility and the dismantling of air storage units at the Chofu Aerospace Center.

Amount of waste



Appropriate Disposal of PCB

Since the PCB disposal deadline is set by the Act on Special Measures concerning Promotion of Proper Treatment of PCB Wastes, we need to find all equipment that contains PCBs. In some cases, the letters on the nameplates of old equipment are so faint that it is difficult to read them, or the equipment is manufactured overseas, making it difficult to investigate whether it contains PCBs. For this reason, we have been investigating facilities containing PCBs while introducing professional knowhow from outside companies. In FY2021, we disposed of no apparatuses containing high-concentration PCBs and 581 apparatuses containing low-concentration PCBs. The number of apparatuses containing high and low-concentration PCBs held at the end of the fiscal year was 207 and 1,071, respectively.

The disposal deadlines of apparatuses containing high-concentration and low-concentration PCBs are set for March 31, 2023, and March 31, 2027, respectively. Therefore, we are proceeding with the planned disposal of PCBs to complete the disposal within the deadlines.

Disposal of apparatuses containing PCBs

	Number at the start of FY	Number newly found	Number of disposals	Expected number at the end of FY
High-concentration PCBs	207	0	0	207
Low-concentration PCBs	458	1,194	581	1,071

Initiatives to Create a Recycling-Oriented Society



Promotion of Green Procurement and Green Contracts

We procured only designated procured goods for 133 of the 145 items procured in accordance with the JAXA Green Procurement Policy 2021. For the remaining 12 items, supervisors checked that no alternatives are available, and we made efforts to procure environmentally friendly goods as much as possible. In addition to these items, seven items classified as public works were procured.

Contracts that fall under the six contract types covered by the Green Contract Law were 17 contracts for supply of electricity (contract amount: 96,099 MWh), two contracts for purchase and lease of automobiles, and seven contracts for disposal of industrial waste.

[JAXA Green Procurement Policy \(Promotion of Procurement of Eco-Friendly Goods\)](#)

[Results of Procurement of Goods and Green Contracts](#)

Results of procurement of goods that do not meet the criteria

(items)

	FY2019	FY2020	FY2021
Procurement of goods that do not meet the criteria	18	16	12

Results of green contract

(cases)

	FY2019	FY2020	FY2021
Contracts for supply of electricity	7	9	17
Contracts for purchase and lease of automobiles	2	2	2
Contracts for energy-saving renovation projects	1	0	0
Contracts for disposal of industrial waste	2	7	7

Actions in the Value Chain

[Details](#)

For goods other than those specified in the JAXA Green Procurement Policy, we select goods that have the least environmental load possible while ensuring appropriate price, function, and quality. In addition, we encourage contractors (including subcontractors) for delivery of goods, provision of services, and construction to promote green procurement as much as possible.

If multiple bidders quote the same price when selecting a contractor, we give priority to the bidder with the best commitment to environmental activities by evaluating the issuance of environmental reports including ISO 14001 reports, acquisition of ISO 14001 certification, or implementation of equivalent environmental activity evaluation programs.

Promotion of Paperless Office / Abolition of Seal Usage

The number of pages printed in FY2021 decreased by approximately 71% compared to 4 years ago due to a sudden change in working styles as a result of the establishment of paperless offices and measures against COVID-19. Based on the results of a survey on actual usage at each site (users, locations, utilization rates, etc.), we reduced the number of output devices from approximately 450 to approximately 200.

Amount of copy paper used

(Unit: K)

FY2017	FY2018	FY2019	FY2020	FY2021
19,294	15,815	12,859	7,092	5,677

vs FY2017
-71%

Enhancement of environmental education



Enhancement of environmental education



We provide environmental education not only to our employees but also to people belonging to other companies who work within JAXA to educate them on the importance of environmentally friendly operations.

■ **Awareness education**

We educate our employees, etc., to be aware of the importance of our environmentally friendly operation and the impact of their work on the environment.

■ **Procedure education**

We provide practical training for green procurement and waste disposal.

Especially for waste disposal, which may lead to legal violations and environmental accidents, reliable practices are required. Therefore, the acquisition of a certain level of knowledge through training is recommended to conduct waste disposal.

■ **Internal auditor training**

In FY2021, we changed the conventional training program provided by an external educational institution to an internal training program conducted by the Safety and Mission Assurance Department.

In the internal training, we explained JAXA's integrated EMS and internal audit system and provided specific information on audit standards and audit points.

Overview of environmental education and number of participants

Name of training	Target and method Number of participants in parentheses	Description
Awareness education	e-learning for all employees who work at our sites (397)	Introduction of the necessity of environmental consideration, requirements of laws and regulations to be complied with, and measures for rationalization of energy use.
Education on green procurement procedures	e-learning for those involved in the procurement of goods, etc. (831)	Basic procedures for green procurement and points to judge compliance with the criteria
Education on waste disposal procedures	e-learning for those involved in waste disposal Training related to responsible offices (218); Training related to contracts (147)	<ul style="list-style-type: none"> Information on revisions to laws and regulations and review of procedures, etc. A series of procedures from waste generation to waste disposal Points to note when preparing contracts and manifests
Training for internal auditors	Face-to-face training for participants in FY2021 internal audits (3)	Auditing techniques, etc., to determine the effectiveness of processes and link them to improvement plans

Coexistence with Local Nature

Participation in Community Cleanup Activities

At the Kakuda Space Center, we pick up trash around the site twice a year in cooperation with partner companies working within the site.

In FY2021, we collected a total of 46.1 kg (43.9 kg in FY2020) of waste such as bottles, cans, and PET bottles.

We will continue this activity in cooperation with our partner companies.

On June 19, the Minamitane Branch of Taneyaku Corporation Association and the NPO Spaceship Tanegashima organized an annual cleanup of tourist spots. Employees of Tanegashima Space Center and related companies also participated in the cleanup of Takesaki Beach in order to preserve the natural environment of Tanegashima Island.





Material Balance

We determine the environmental load generated by our business activities and practice business activities that contribute to the creation of a recycling-oriented society.

INPUT

Resources and energy	Unit	FY2020	FY2021	
Electricity purchased	MWh	111,877	111,312	
Water resources	K m ³	403	384	
(details)	Water supply	K m ³	155	153
	Groundwater	K m ³	12	25
	Rainwater	K m ³	2	2
	Other*	K m ³	234	204
Gasoline (including for vehicles)	kℓ	20	22	
Kerosene	kℓ	38	27	
Light oil (including for vehicles)	kℓ	43	39	
Heavy oil (JIS grade A)	kℓ	7,807	6,600	
City gas	K m ³	870	604	
Propane gas	t	22	8	
Petroleum hydrocarbons	K m ³	0	0	
Liquefied natural gas	t	15	5	
Other combustible natural gases	K m ³	0	0	
Jet fuel (including fuel for flight)	kℓ	173	214	
Aviation gasoline	kℓ	0	0	
Liquid nitrogen	t	2,791	2,046	
Paper	t	39	23	

- The data on substances covered by the PRTR Law is shown on page 18.
 - The data is based on resources and energy purchased by JAXA. The data does not include fuel and other resources purchased by service providers due to the transfer of launch services to the private sector.
- *Intake weirs and rivers

OUTPUT

Environmental loads	Unit	FY2020	FY2021	
CO2 emissions	Energy related	t-CO2	62,134	60,500
	Non-energy related *1	t-CO2	504	220
Calculated amount of leaked CFCs	t-CO2	458	287	
NOx emissions *2	t	273	174	
SOx emissions *2	t	57	40	
Soot emissions *2	t	0	0	
Wastewater *3	K m ³	403	361	
Biochemical oxygen demand (BOD) ⁴	mg/ℓ	20	20	
Chemical oxygen demand (COD) ⁴	mg/ℓ	3	3	
General waste	t	97	117	
Industrial waste	t	657	1,324	
Specially-controlled industrial waste	t	13	17	
Class I designated chemical substances	t	3	8	

- *1. Non-energy related CO₂ emissions include emissions of CH₄, N₂O, and SF₆.
- *2. NOx, SOx, and soot emissions are measured from units generating soot or smoke regulated by the Air Pollution Control Act.
- *3. In cases where the amount of wastewater is not measured, it is calculated based on the assumption that the amount of used water is the amount of wastewater.
- *4. BOD and COD are calculated based on the measured values at sites with specified facilities under the Water Pollution Prevention Act and the total amount of wastewater discharged at the sites (per year).

Energy required for JAXA's business activities and the resulting environmental impact

Rocket launches and satellite tests	Other tests	Power building management	Construction	Airplane test flights
<ul style="list-style-type: none"> ● Use of fuel ● Use of liquid nitrogen, etc. ● Use of chemicals ● Generation of treated wastewater ● Noise and vibration ● Use of electricity 	<ul style="list-style-type: none"> ● Use of electricity ● Use of liquid nitrogen, etc. ● Use of chemicals 	<ul style="list-style-type: none"> ● Use of fuel for power generation (heavy oil, etc.) ● Use of boiler fuel ● Control of air pollutants (NOx, etc.) ● Use of chemicals ● Noise and vibration 	<ul style="list-style-type: none"> ● Use of water resources ● Use of energy ● Generation of industrial waste ● Noise and vibration 	<ul style="list-style-type: none"> ● Use of fuel ● Use of chemicals ● Use of electricity ● Noise and vibration



Photo: Exhibition of returned "Hayabusa2" capsule at the Fukuoka City Science Museum (Photo offered by Fukuoka City Science Museum)

Social Involvement

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Basic Action Policies on the Sustainable Development Goals (SDGs) Details

With the revision of the Basic Plan for Space Policy in June 2020 clarifying the contribution to SDGs as one of the space policy goals, the environment surrounding SDGs and the aerospace sector has changed significantly. In light of these environmental changes, JAXA formulated basic policies on SDGs in March 2022 and appointed a new director responsible for SDGs promotion in April to further accelerate efforts toward SDGs and raise employee awareness.

JAXA's SDGs Mission Statement

(Corporate philosophies and social missions related to SDGs concretized into action guidelines)

Utilizing the SDGs as a global common language for solving social issues and as an opportunity for innovation, JAXA will work with various partners to realize a sustainable, safe, and prosperous society by conducting pioneering R&D and developing findings.

Action Guidelines

(The above statement is presented from three perspectives of business, individual, and outside the organization so that it can be more easily understood and lead to action and initiatives.)

Leading R&D

Solving earth-space issues by conducting pioneering R&D and developing findings

Bringing out the creativity of each individual

Leveraging JAXA's organization, capabilities, and assets, every one of us will demonstrate creativity, empathize with the SDGs, and take action to realize them.

Working with partners around the world

By collaborating with diverse stakeholders around the world, we will create synergies in our projects and maximize the return of results to society.

High-priority fields for JAXA

Efforts for **Space**

Expanding areas of human activities sustainably

[Priority fields]

- Taking on challenges in the space frontier and returning findings to the earth
- Construction of space infrastructure/institutions and rules for sustainable space activities

Efforts for **Society**

Supporting a sustainable and safe society

[Priority fields]

- Implementing management and strengthening of national land and infrastructure, and building an infrastructure supporting Disaster Prevention Society 5.0
- Solving global issues, and achieving economic growth and innovation

Efforts for **Global environment**

Protecting the rich and beautiful global environment

[Priority fields]

- Contributing to a decarbonized and recycling-oriented society
- Engaging in research and development of green space aviation systems
- Providing the scientific evidence for promoting climate change measures, global environmental preservation, SDGs, and ESG

Efforts for **Governance**

Organizations that contribute to society on a sustainable basis

[Priority fields]

- Promoting fair and responsible organizational management and diverse partnerships
- Creating joy and wonder and developing human resources

As a core implementing agency that supports aerospace development and utilization through technology, JAXA, in cooperation with various partners, is promoting various initiatives that contribute to the achievement of SDGs toward the realization of a sustainable, safe, and prosperous society by conducting pioneering R&D and developing findings. Some of these initiatives are as follows:

Promoting “Sentinel Asia” to Contribute to Disaster Reduction in the Asia-Pacific Region

(Space Technology Directorate I)

Through “Sentinel Asia,” an international cooperative project that aims to contribute to disaster monitoring in the Asia-Pacific region by utilizing earth observation satellites, we are working to reduce the damage caused by natural disasters in the Asia-Pacific region by sharing disaster-related information from the images captured by the earth observation satellites and other sources with disaster management organizations in disaster-affected countries via the Internet. In 2021, a total of 27 emergency observations were made by utilizing the Advanced Land Observing Satellite-2 “Daichi-2” (ALOS-2).



[Details](#)



Toward a Space Free from Collisions between Satellites and Space Debris

(Space Tracking and Communications Center)

With our techniques and long experience learning about space debris avoidance by satellites, we have built a system as a tool to implement space debris avoidance. We decided to provide the system to satellite operation agencies (including public agencies, corporations, and universities in Japan and overseas) free of charge. This system is called RABBIT (Risk Avoidance assist tool based on debris collision proBaBiliTY). By preventing debris generated by in-orbit collisions and enabling the safe operation of satellites, we will contribute to the realization of a sustainable society that benefits from space development.



[Details](#)



Contributing to Founding Research Using Microgravity Environment

(Human Spaceflight Technology Directorate)

By performing protein crystallization under microgravity in the Japanese Experiment Module “Kibo” of the International Space Station, there is a greater chance of obtaining high-quality crystals than on the earth. For more than 10 years, JAXA has been promoting high-quality protein crystal growth experiments in “Kibo” to develop and provide Japan’s unique crystallization technology, achieving various results that lead to the design of new drugs.



[Details](#)



From the director responsible for promoting SDGs



Director responsible for SDGs Promotion
Yasuo Ishii

As a core implementing agency that supports the government’s overall aerospace development and utilization through technology, we aim to strengthen our efforts toward the SDGs by taking advantage of our organization’s strength and business from basic research to development and use. By showing this attitude to you, we aim to realize the major reforms needed by 2030 with the power of space aeronautics.

In particular, we believe that sustainable activities in space while protecting the environment are essential for the future of humankind and the sustainability of society on Earth.

We believe that JAXA will be able to create new value for a sustainable society that goes beyond the SDGs by promoting SDGs in space including the sky as a high-priority field and collaborating with various partners in industry, government, and academia.

[Details](#)

JAXA's Roles and Responsibilities for Diversifying Stakeholders

As specified in our management philosophy, we believe that our mission is to pursue the enormous potential of space and aviation to contribute to solving global environmental problems.

To fulfill our mission, it is important to interact with all stakeholders. JAXA's roles are changing and expanding amid the rapid changes in the environment surrounding Japan and overseas, expanding stakeholders, and working styles. We will flexibly play our new roles and take on challenges while steadily responding to the responsibilities that change and expand with those roles.

JAXA's social responsibility to stakeholders

JAXA's communication channels to stakeholders (main)



- People of Japan**
 - Providing factual and accurate information (improve the transparency of business)
 - Providing timely and easy-to-understand information (to earn confidence in JAXA)
 - Promoting aerospace R&D through various projects
 - Ensuring two-way communication opportunities
- Administrative agencies**
 - Formulating business plans based on goals specified in the national policy
 - Promoting projects autonomously in accordance with the JAXA Law.
 - Proper execution of the budget
- R&D institutions**
 - Developing and improving the level of academic research in the aerospace field
 - Building mutual and cooperative relationships through international cooperation
 - Giving benefits from aerospace technology back to society
 - Proper management of intellectual property
 - Proper management of confidential information
 - Export Control
- Companies**
 - Conducting highly transparent and fair transactions
 - Preventing bid-rigging
 - Proper management of confidential information
 - Giving benefits from aerospace technology back to society
 - Creating new space-related businesses including venture support
- Employees and their families**
 - Ensuring appropriate working conditions and work environment
 - Physical and mental health management for employees
 - Capacity building for employees
- Educational institutions**
 - Expanding the base of human resources in the aerospace field
 - Providing research and education opportunities for researchers and graduate students
 - Providing support for educational programs and educational opportunities for elementary, junior high, and high schools
- Environment**
 - Promoting business with consideration for reduction of environmental load
 - Providing data and technologies to solve global environmental issues (data from earth observation satellites, etc.)
 - Promoting green contracts and green procurement

Organizational Governance



Internal Control

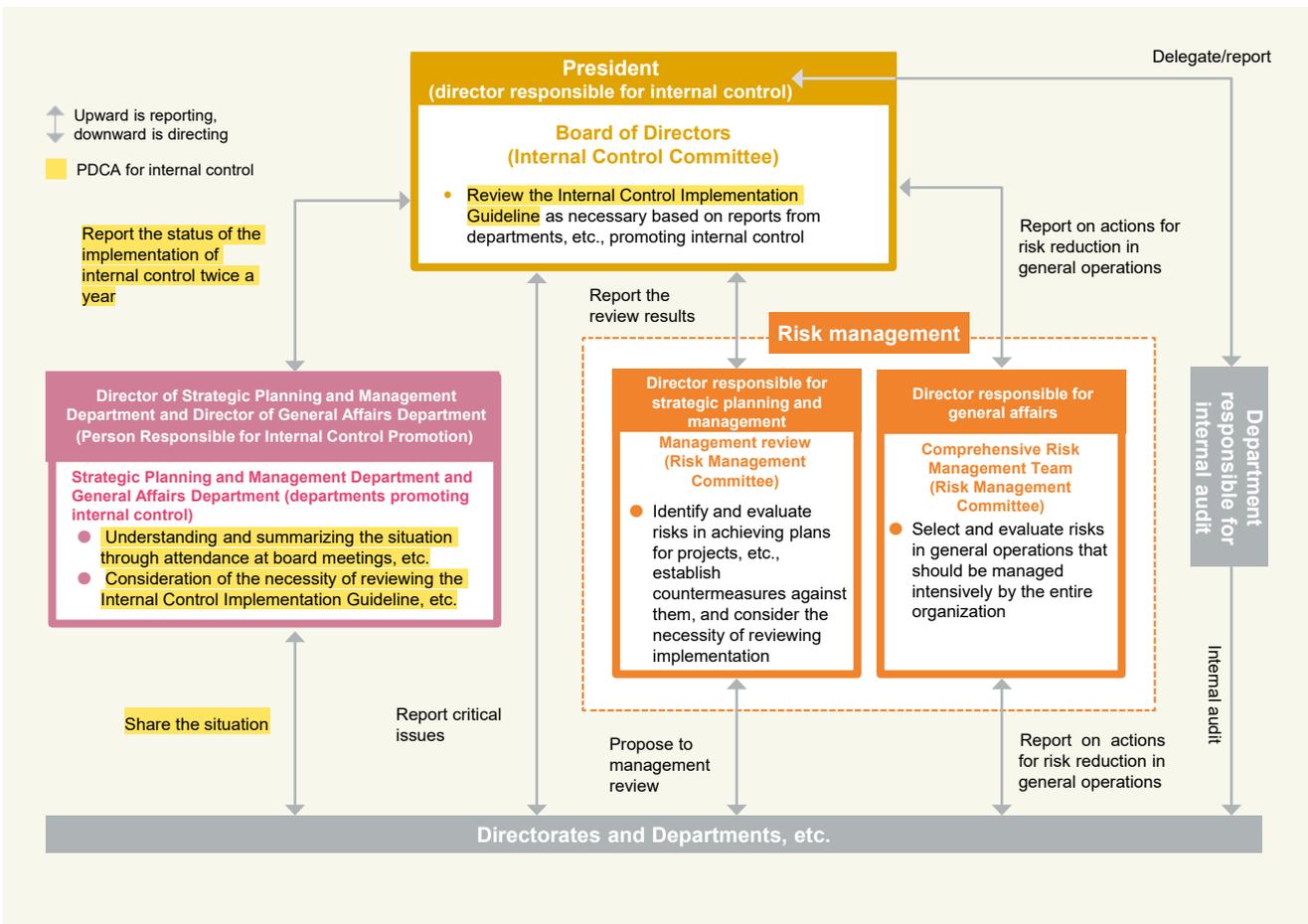
Since becoming a national research and development agency in April 2015, we have been working to strengthen internal control. Specifically, in response to the revised Act on General Rules for Incorporated Administrative Agencies, we specified the internal control system in our business procedures and established the “Internal Control Implementation Guideline” to strengthen internal governance. We will continue to fulfill our missions as a national research and development agency in an effective and efficient manner while complying with laws and regulations and implementing internal control.

Main items included in the Internal Control Implementation Guideline

- | | |
|--------------------------------|----------------------------------|
| 1. Control environment | 4. Information and communication |
| 2. Risk assessment and actions | 5. Monitoring |
| 3. Control activities | 6. ICT introduction |

[JAXA Internal Control Implementation Guideline](#)

Overview of internal control system



Audit System

We established a system to check that internal control is functioning well by combining the audits conducted by the auditors and accounting auditors based on the Act on General Rules for Incorporated Administrative Agencies and the internal audits conducted by the Evaluation and Audit Department independent of the business execution departments. Audits are conducted for the purpose of ensuring appropriate and efficient business execution and contributing to the improvement of business operations, and audit results are reported to the President as needed and shared at board meetings, etc.

In addition, information regarding the audits is published on our website in accordance with Article 22 of the Act on Access to Information Held by Incorporated Administrative Agencies, etc.

[Audits in JAXA](#)

Organizational Governance



Top Management Commitment

Overview of Phase 4 Medium/Long-Term Plan Based on Medium/Long-Term Goals

Highlights of 2021

Introduction of JAXA's Projects

Involvement in the Environment

Social Involvement

Third-Party Opinions/ Review Results

Data Sheets

Promotion of Risk Management

In our projects, we identify risks in each project and implement risk-reduction activities.

We have also established a Comprehensive Risk Response Team to promote comprehensive risk management for risks in general operations other than projects and other businesses. Specifically, we select risks that should be intensively managed, such as ICT and security risks related to information systems and risks related to disasters and external threats. Directorates and departments set targets to reduce these priority risks in their respective business plans for reducing risks as part of their daily operations.

Preparing for Large-Scale Disasters, etc.

We established the Business Continuity Plan at each site to prepare for disasters. The Business Continuity Plan defines the operations that we should prioritize to ensure the safety of executives and our employees as well as the continuation and prompt recovery of operations, daily preparation for disasters, and initial response in the event of a disaster.

Based on the plan, we are striving to improve our business continuity capability by establishing communication systems including a safety confirmation system, stockpiling spare equipment and supplies necessary for initial response, maintenance, and recovery, and conducting large-scale earthquake drills.

Ensuring information security



In light of recent social circumstances such as sophisticated cyber-attacks, we are taking information security measures such as strengthening information security management systems, enhancing visualization, protective measures, and monitoring of information systems including telework environments, and improving employee training. We also contribute to nationwide initiatives to reduce security incidents that go beyond the activities of a single organization, such as developing industry-specific security guidelines with related organizations, discussing and sharing overseas initiatives, and sharing threats that we identify with security specialized companies and relevant organizations.

Consumer Issues

Disclosure and Provision of Information

JAXA is obliged to disclose corporate documents in accordance with the Act on Access to Information Held by Incorporated Administrative Agencies, etc. We follow the procedures for information disclosure in response to requests for disclosure in accordance with this law.



Protection of Personal Information

To protect the rights and interests of individuals while ensuring the appropriate and smooth operation of our business, we specified matters concerning the protection of personal information in our Personal Information Protection Regulations to protect personal information.



Safety, Reliability, and Quality Assurance



We promote various activities to ensure safety, reliability, and quality so that we can safely launch rockets and conduct astronaut activities, and reliably conduct observation by satellites, various experiments, and R&D of aeronautical technologies to obtain results that contribute to society.

In FY2021, in addition to our efforts to ensure the safety, reliability, and quality assurance initiatives for various spacecraft projects including the H3 Launch Vehicle currently under development, we committed ourselves to our actions to develop human resources and improve capabilities such as providing training on safety, quality, and reliability and conducting “failure cram school” activities continually to pass down the failure experiences of JAXA staff members to young people in their own words so that young people can efficiently absorb knowledge through simulated factor analysis and countermeasure planning. In recent years, an increasing number of new companies are entering the space business, and we have strengthened our support activities to improve safety, reliability, and quality by taking advantage of our experience and knowledge. We also developed new technologies related to safety, reliability, and quality using digital technology (DX) such as the trial and promotion of the use of additive manufacturing technology (3D printer). In response to a rapidly increasing number of space debris and satellites due to intensified space activities, we promoted our efforts to reduce debris and prevent collisions to ensure the sustainable use of orbit.

Fair Operating Practices



Promotion of Compliance



To ensure the proper execution of our business in accordance with laws and regulations, we established a whistleblowing hotline to receive reports of violations of laws and regulations.

In addition, we established a compliance hotline for the cases that do not fall under the above-mentioned whistleblowing to provide a wide range of consultations on JAXA's compliance from inside and outside of JAXA. Furthermore, we educate and train our directors and employees on a regular basis to raise awareness.

System to Manage Conflict of Interest

We have introduced a system to manage conflict of interest to promote collaborative activities with universities and industries. We require self-assessment of our directors and employees and established a Conflict-of-Interest Management Committee and a Conflict-of-Interest Management Advisor (external lawyer) to provide advice and check to ensure that our directors and employees appropriately conduct industrial collaboration activities.

Q Actions for Compliance & Conflict of Interest

Export Control



In response to the global consensus on preventing the proliferation of weapons of mass destruction, Japan established laws and regulations such as the Foreign Exchange Act and Export Trade Control Order that specify regulated export items and export license systems.

We established internal regulations based on these laws and regulations and are working to ensure the implementation of export control by examining export cargo, educating staff, and conducting audits.

In accordance with the revision to the statutes pertaining to the Foreign Exchange Law that came into effect in May 2022, we are also reviewing the operation for "deemed exports" and taking appropriate measures such as checking whether they fall under a specific category.

Fair Execution of Research and Appropriate Use of Research Funds



To ensure thorough implementation of the rules and raise staff awareness, we set the "Code of Conduct for Researchers" (for fair execution of research) to establish the Research Ethics Committee and the "Basic Policy and Code of Conduct" (for appropriate use of research funds) to establish the Office for Prevention of Misconduct in Competitive Research Funds, thereby preventing misconduct and ensuring proper operation and management.

Q Prevention of Misconduct in Research and Appropriate Management of Research Funds

Appropriate Contracts



We, as an organization that uses the national budget, strive to fairly conduct projects by emphasizing the transparency and fairness in contracts. As an example, discretionary contracts that exceed the criteria for the small-amount discretionary contract are reviewed by the Contract Review Committee to check that competition is promoted and that the contract processes are in accordance with the regulations. The concluded contracts are announced on our website.

In recent years, the scope of procurement management has been expanded to include project operations, and the Procurement Department has been involved from the stage of selecting companies in charge of development to promote dialogue with the companies. Thus, we promote actions to ensure fairness and rational procurement.

Q JAXA Procurement Policy

Management of Intellectual Property

Based on the intellectual property policy, we will identify and protect our own technological achievements as intellectual property and appropriately transfer them to Japanese industry, contributing to the creation of businesses that utilize the results of R&D and the promotion of efforts to stimulate open innovation.

Q Intellectual Property Policy

Labour Practices

Efforts to Utilize Human Resources

We are working to develop human resources throughout the organization by establishing the Phase 4 Human Resources Development Policy as the priority in medium to long-term human resources development, aiming to both realize the career design of each employee and maximize the results of the organization.

JAXA's vision of human resources

Human resources who have the motivation and ability to propose and create new value to society through aerospace based on their specialized skills and continue to take on challenges

Phase 4 Human Resources Development Policy

Actions	Results of actions related to human resources in FY2021
Strengthen the human resource base in the aerospace field by enhancing the mobility of human resources	To obtain human resources with diverse backgrounds and experience who can be immediately effective, we started to hire employees throughout the year and introduced web-based interviews to increase the number of experienced personnel hired and achieved a significant increase from 14, the number of new experienced personnel hired in FY2018. (36 in FY2019, 34 in FY2020, and 36 in FY2021)
	In response to the recent rapid changes in social conditions and technological trends, and diversification of needs, we relaxed the requirements for side jobs and accepted and managed applications from employees for side jobs to provide them with a variety of experiences and opportunities to strengthen their technical and proposal skills.
Exchange of human resources with the private sector and promotion of new aerospace business	Under the cross-appointment system, one staff member was newly seconded to external organizations. We strengthened the human resource base through human resource exchanges with external organizations, such as promoting space utilization/development with JAXA's knowledge and expertise. In FY2021, including the cases that continued since the previous fiscal year, a total of 27 people were accepted from external organizations and 4 people were seconded by JAXA.
Operation of work systems that enable diverse and flexible working styles	Based on the operational status of the flexible working system featuring the relaxation of conditions for flexible working and teleworking, which were implemented in response to the COVID-19 pandemic, and the results of a staff questionnaire, we have introduced a "new working style" with the aim of ensuring the business continuity of the organization and the work-life balance of our staff. (In addition, from April 2022, actual costs for telework allowance and commuting allowance will be introduced.)
	As one of the options for working styles to realize diverse lifestyles, we relaxed the transfer obligation stipulated in the working regulations and other rules and established a new system to allow employees who wish to engage in work under certain conditions to limit their place of work, thereby expanding the range of their working styles.
Healthy management that enables employees to work healthfully both in body and mind	As initiatives related to employee health, we established the "Health Management Policy" featuring health promotion activities as the management foundation and raised the awareness of each employee of health management with organizational cooperation, thereby leading to the revitalization of the workplace.

Retention Rate of New Staff



The retention rate after three years of employment is 100%. For 36 new graduates hired in 2019, we provide extensive support, such as guidance through practical work in the assigned department (OJT system) in the first year and follow-up training and career counseling in the second year.

Number of new employees by gender in FY2021

	New graduates hired	Experienced employees hired
Male	17	32
Female	19	4

Reemployment after Retirement

In accordance with the revised Act on Stabilization of Employment of Elderly Persons, we established a system to rehire those who wish to work after retirement until the end of the fiscal year when they reach 65 years of age. Currently, about 100 rehired employees are working in various workplaces, making use of their rich experience and specialized skills.

Health Promotion

We have established a health management policy based on health promotion activities as management foundation to respect the health of every employee and to maintain a vibrant organization.

Based on our health management policy, we launched the fit motto project. The fit motto project aims to create a comfortable workplace where employees can work more actively and healthfully. (Fit motto is a coined term from "fit" and the Japanese word "motto (more).") Individuals, workplaces, and the Human Resources Department worked together to improve the workplace environment throughout the company by utilizing organizational analysis of stress checks.

Safety Management



In FY2021, we continued to foster safety awareness through e-learning on safety that reflects past accidents and other incidents, identified dangerous areas and implemented countermeasures through safety patrols, conducted near-miss reporting, and sharing information that contributes to preventive safety. In addition, we continue to achieve "zero" accidents involving students, which is a target of our accident prevention efforts within JAXA sites. Based on the results of analysis of past accidents, we will continue to conduct safety management tailored to the circumstances at each site, and implement measures to achieve "zero" work-related accidents resulting in injury leave.

Labor-Management Relations

In accordance with the Labor Standards Act, we respect labor-management autonomy and make decisions on matters related to working conditions (wages, working hours, benefits, etc.) through consultations with the labor union.

With the aim of improving the best condition of each one of our employees and revitalizing the workplace, we are implementing a health promotion program named "JAXARUKU fit motto" (including walking, health action, and workplace exercise), ensuring the physical and mental health of individuals and the organization.

Labour Practices



Actions for a Better Work-Life Balance

Action Plans for the Act on Advancement of Measures to Support Raising Next-Generation Children and the Act on the Promotion of Female Participation and Career Advancement in the Workplace

(May 1, 2019 - March 31, 2023)*1



Target 1	Promote the use of at least 60% of the total number of days of annual paid leave and WLB*2 leave given in the fiscal year.	Action 1
Target 2	Encourage male employees to take 5 or more days of childcare leave (with a target of 10%), and 3 or more days of special leave for childbirth (total of maternity leave for men and childcare leave) (with a target of 80%)	Action 2 Action 3
Target 3	Increase the percentage of female managers to at least 15%.	Action 4 Action 5 Action 6
Target 4	Increase the number of and expand the base of women researchers in the field of space science to increase the percentage of women in educational positions.	Action 6
Target 5	Reduce the average monthly overtime hours to 20 hours or less.	Action 4 Action 5 Action 7

Descriptions		Results in FY2021
Action 1	Encourage employees to take their annual paid leave for long vacations by notifying the recommended days for taking leave on the intranet.	We encouraged employees to take vacations by notifying the recommended days for taking leave and the status of used annual paid leave by department on the intranet. The use rate of annual paid leave and WLB leave in FY2021 was 62%.
Action 2	Improve the system to promote the use of childcare leave and other special leave related to childcare, including a review of the operation for the leaves.	In addition to childcare leave and special leave related to childcare, we are promoting the use of a variety of leave systems, including WLB leave, which can be used throughout the year and can be taken on an hourly basis.
Action 3	Raise awareness among employees and managers through activities to promote the use of childcare support systems.	We are reforming staff consciousness by holding lunch networking events for childcare information exchange and posting interviews with male employees who have taken childcare leave on our website. We are also encouraging male employees whose spouses have given birth to take more than five days of childcare leave.
Action 4	Enhance the work system and workplace environment to reduce the burden of commuting and accommodate diverse work styles, such as the enhancement of the telework system.	To cope with the COVID-19 pandemic, we encouraged telework throughout the organization.
Action 5	Promote work-life balance for employees before and after childbirth, during childcare or nursing care by streamlining, consolidating, and increasing the efficiency of operations.	Using IT, we promoted a variety of work styles that are not restricted by time or place. The average monthly overtime hours was 19.6 hours per month for permanent employees, excluding those in the discretionary labor system, fixed-term system, or management positions.
Action 6	Hold collaborative lectures on JAXA's missions at women's colleges and universities with a relatively high percentage of female students to promote the appeal of space science and space development.	On special open days of our sites online, we shared a video from female technical staff introducing the satisfaction of work and how to balance work and life to promote understanding of space development work. In FY2021, the percentage of female managers was 10.9%.
Action 7	Further improve work-life balance by raising awareness on work-life balance.	We held nursing care seminars on different themes to raise awareness of how to balance work and life.

*1) The initial plan was to complete it by March 31, 2022, but we are currently in a transitional period to promote internal system reform and further new ways of working. In order to formulate a new action plan based on these trends, we extended the planned period by one year until March 31, 2023.

*2) Work-Life Balance

[Details](#)

In April 2022, we added the following measures in order to identify trends and take more active measures necessary for the formulation of new action plans.

Since April 2022, the following measures have been newly added:

- Implementing measures to facilitate employees to take a vacations, such as observance of the rule to withhold from setting of regular meetings on recommended days for taking leave
- Considering the relaxation of conditions for WLB leave
- Conducting a questionnaire survey for system design aimed at balancing work and childcare
- Implementing measures to eliminate vague anxieties and assumptions about becoming a manager through the career mentor system and to eliminate misconceptions through the unconscious bias training.
- Providing information on the use of various systems for "Ensuring work-life balance through flexible working hours utilizing flexible work and telework"
- Incorporating the results of research and analysis focusing on the development of a pipeline for women's participation in management into the personnel system to enhance the percentage of women in management positions

Labour Practices



Systems that support a better work-life balance

	Actions	Description
Career Advice	Career advice for next generation	Providing information at online events
	Mentoring program	Support for staff development
Support for Childcare and Nursing Care	JAXA Hoshinoko Nursery School / JAXA Soranoko Nursery School	Tsukuba Space Center / Chofu Aerospace Center
	Subsidized childcare (babysitter) programs for sick and post-sick children	
	Work system supporting childcare and nursing care	Maternity leave for men, shorter working hours for childcare, shorter working hours for nursing care, etc.
	Lunch networking event for childcare	A place to exchange information
	Nursing care seminar	Provision of information
Work Style Reform	Review of flextime/intermission system, etc.	Flexible working system, reduction of overtime, and management of working hours according to working conditions
	Teleworking	Promoting new ways of working by easing conditions
	Use of IT tools	Utilizing information systems and web conferences
	Measures against harassment	Establishing the Harassment Committee and upgrading the Counselor System in order to create a harassment-free work environment in which each employee can work comfortably
	Paperless	Streamlining meetings, etc., and abolishing the use of signatures and seals
	Consciousness raising	Conducting unconsciousness bias training

Career Advice

● Career advice for next generation

With the introduction of special open days of our sites online due to COVID-19, we introduced the career path formed and the content of research and development conducted by female employees, and experiences of male employees on balancing work and childcare as role models for career development through video distribution.

● Mentoring program

This is a system in which experienced mentors (senior workers), separate from the direct supervisors in the workplace, interact with the mentees (junior workers) to help them solve their problems in career development and resolve their concerns, and support their personal growth. To make mentoring more effective, we are working on a fundamental review of the mentoring system.

In addition, we actively studied the construction of a pipeline to promote women's participation in the workplace (consistent development of female managers) and conducted unconsciousness-bias training for all employees as an effort to reform their awareness.

Support for Childcare and Nursing Care

● Various leave systems

We have seven leave systems: annual paid leave, special leave, sick/injured childcare leave, nursing care leave, childcare leave, and leave for spouse overseas transfers. Special leave includes leave given for volunteer work and for donating bone marrow for bone marrow transplantation.

● Establishment of Hotlines

We established the "Voice Your Concern Hotline" available for anyone who works at JAXA. We provide consultation on balancing work and family life such as marriage, childbirth, childcare, and family care, as well as on the workplace environment, with the aim of creating a comfortable work environment.

● On-site nurseries

We operate on-site nurseries at two sites, the Tsukuba Space Center and Chofu Aerospace Center, to provide a comfortable working environment where employees can balance work and childcare.

● Work system supporting childcare and nursing care

We allow employees to limit overtime and late-night work and to work shorter hours for childcare until their children reach the third grade. In addition, subsidized childcare (babysitter) programs for sick and post-sick children are available until their children reach the sixth grade. In September 2019, we were certified by the Minister of Health, Labor and Welfare as a "childcare supporting company" (Kurumin certification) based on the Act on Advancement of Measures to Support Raising Next-Generation Children.

For nursing care, in addition to leave and vacation, employees can limit overtime and late-night work and work shorter hours while caring for a family member in need of constant nursing care.

In addition, we hold nursing care seminars & briefing sessions describing our support systems to provide information to our staff.

● Lunch networking event for childcare

Our offices in Chofu, Tokyo, Tsukuba, and Sagami-hara hold monthly lunch networking events for childcare during lunch breaks. In this event, anyone, regardless of gender, can participate in exchanging information, including employees who are raising children, who have subordinates raising children, and who want to gather information for their future child-rearing.



Labour Practices

Work Style Reform

● New way of working

At JAXA, we have been promoting diverse and highly productive work styles for each and every employee by creating a healthy and lively work environment with the aim of transforming working life. In response to the COVID-19 outbreak, we are actively working to expand our telework system, establish a new flextime work system without restrictions on core time and other factors, review our intermission system such as the abolition of simultaneous daytime intermission, introduce a work suspension system that allows employees to divide their daily work time into multiple parts, and utilize online meetings.

In addition to observance of the rule to withhold from setting of regular meetings on recommended days for taking leave, we have also tried to establish a long vacation recommended period to facilitate employees taking a long vacation, which is considered to have a high refreshing effect in order to establish working environment to make it easier for employees to take leave. In addition, since FY2022, we have established a telework allowance as an allowance for employees engaging in teleworking, and will continue to promote new ways of working unconstrained by time or place, for example, by providing information on flexible working styles that utilize flextime work and telework to achieve work-life balance.

● Use of IT tools

We have introduced secure IT tools to support various ways of working. Since employees are lent lightweight laptops equipped with webcams as standard equipment, they can participate in online meetings, which is highly effective in telework under the COVID-19 pandemic. In addition to the introduction of tools, we are also working to improve the literacy of our employees to use them. Furthermore, we reviewed and abolished the use of seals and signatures in line with the government's Regulatory Reform Implementation Plan.

Human Rights



Efforts to Prevent Harassment



● Establishment of Training and Hotlines for harassment prevention

Comprehensive compliance training, code of ethics training, and harassment prevention training are provided to raise awareness and prevent harassment. To ensure that employees do not take on their concerns about harassment and the work environment, we established a hotline to improve and solve their problems.

- Hotline for various harassment such as sexual harassment, power harassment, and academic harassment (external consultation service)
- Harassment hotline
- Compliance hotline

● Establishment of the Harassment Committee

In October 2021, we established the Harassment Committee, chaired by the director responsible for personnel affairs, based on the results of a study by the Harassment Countermeasures Study Team (composed of labor and management), which was established to study new measures against harassment based on "the Act on Comprehensive Promotion of Labor Policies, Stability of Employment of Workers and Enhancement of Occupational Life" (Act No.132 of 1966) and other related laws and regulations. The Harassment Committee, which is composed of not only members from JAXA such as the Human Resources Department but also representatives of workers and external lawyers, will properly perform harassment recognition for individual consultations and promote measures based on the analysis of JAXA's current situation to realize a harassment-free workplace.

Elimination of Discrimination against the Disabled



In response to the enactment of the Act for Eliminating Discrimination against Persons with Disabilities on April 1, 2016, we established internal regulations on how directors and employees should respond to the Act and provide training to deepen knowledge and understanding within the company. In addition, the Compliance Hotline provides consultation on discrimination against persons with disabilities as a part of its wide range of services.

Top Management Commitment

Overview of Phase 4 Medium/Long-Term Plan Based on Medium/Long-Term Goals

Highlights of 2021

Introduction of JAXA's Projects

Involvement in the Environment

Social Involvement

Third-Party Opinions/Review Results

Data Sheets

Community Involvement and Development

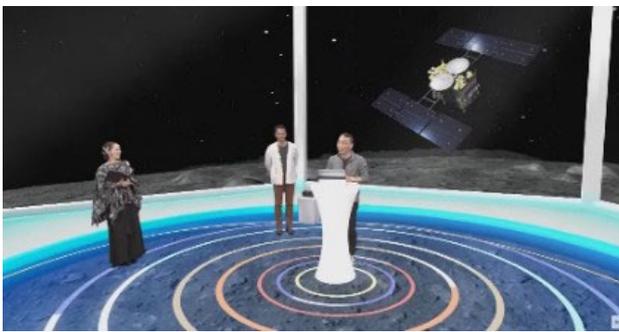
Public Relations and Events

In FY2021, under the COVID-19 Pandemic continuing from the previous year, the government declared a state of emergency and issued semi-emergency coronavirus measures. Accordingly, we were significantly constrained in our conventional public relations activities, which were designed to gather people together. For this reason, we conducted public relations activities after thoroughly implementing measures to prevent the spread of infections, mainly through remote response. On the other hand, public relations activities using online services or websites alone would not give the public opportunities to have “real experiences.” In response, we provided them with opportunities to see on-site exhibits and contact with JAXA staff after thoroughly implementing measures to prevent the spread of infections.

Results in FY2021

	FY2020	FY2021
Number of visitors to the exhibition hall	103K*	156K*
Press release	171 times	171 times
Press conferences and briefings	60 times	41 times
Number of staff dispatched for lectures / Number of audiences	207 / 68,378	355 / 146,553

* To prevent the spread of COVID-19, it was closed based on the government's declaration of a state of emergency and the actions of local governments. Even after it is reopened, the number of visitors was limited by appointment to prevent the spread of infections.



JAXA Symposium 2021 (virtual event)

Exhibition facilities and open day to the public

We operate 14 exhibition facilities throughout Japan and attract a large number of visitors every year. In FY2021, the facilities were closed to prevent the spread of COVID-19 in light of the government's declaration of a state of emergency and the movements of local governments. Even after the reopening, these facilities were operated by advance reservation only to limit the number of visitors for preventing the spread of infections. Kakuda, Chofu, and Sagami-hara opened their facilities to the public online, and three communication centers in Katsuura, Masuda, and Okinawa opened their facilities to the public through special onsite-online hybrid exhibition.



Space Dome in Tsukuba Space Center



Space Science and Technology Museum in Tanegashima Space Center

[Facility Tour](#)

Web site, SNS, live streaming



We actively provide highly transparent information through JAXA's official website, concierge and community site “Fan! Fun! JAXA,” SNS, and YouTube.

In 2021, on JAXA's YouTube channel, 161 new videos (178 videos in the previous year) were released. “TRAIL”, a film created by JAXA, won us an award from the Minister of Education, Culture, Sports, Science and Technology at the 63rd Science and Technology Film/Video Festival. The film was produced based on the testimonies of the developers and materials of the time to introduce the main events of Japan's 65 years of space development. The event livestreaming subchannel was also used for real-time distribution of the launches of the Crew Dragon Spacecraft (Crew-2) with astronaut Hoshide aboard, and the Innovative Satellite technical demonstration No. 2 by Epsilon Launch Vehicle No. 5 as well as symposiums and events.

The JAXA Digital Archives, which provides materials for JAXA's images and videos, has been renewed to improve its convenience.



Bulletin JAXA's

It is available in two media: an easy-to-read tabloid (paper) version and a web version. The tabloid version has QR codes embedded throughout for easy access to more detailed information. The web version includes all the contents that were not included in the tabloid version due to limited space. We have invited people from different fields to appear in the paper as a part of our efforts to spread our message to various fields beyond the aerospace field.

[About "JAXA's"](#)

Press conferences and press releases

To provide information on the significance and achievements of JAXA projects in a timely manner, we provide a wide range of opportunities for thorough explanation and dialogue to the press and media, such as press releases, press conferences and press briefings.

In FY2021, from the perspective of preventing the spread of infections, we held online press conferences and briefings in principle as we did the previous year. We provided information in as timely a manner as normal times.

Community Involvement and Development



Support to Space Education for the Next Generation

Using space as material, we will raise children with curiosity, sprits of adventure, and craftsmanship, based on the preciousness of life.

In 2005, under the philosophy of “Space ignites sprit within children,” the Space Education Center started with the aim of “fostering young people with fertile minds and broad insights” making use of knowledge and technologies gained through space exploration and development. In collaboration with educators who are directly responsible for the development of children, we have been developed projects that utilize our various achievements in the aerospace field. We will continue to contribute to the development of human resources who will pave the way for the future.

Activities by Space Education Center - Program Map

Support for school education	Teacher training	Class collaboration	SEEC dispatch program	Educational information magazine “Sora no Tobira” (Portal to Space)	
Support for social education	Cosmic College	Space School®	Space Education Leaders Seminar		Space Education Symposium Regional Forum on Space Education
Provision of experience-based learning opportunities	Aerospace School	The space mission you create (Kimission)	APRSAF Water rocket competition		
	One-Day Space Reporter	ISEB Student Dispatch Program	APRSAF Poster contest		

[Details](#)

Major Space Educational Support Activities in FY2021

In this fiscal year, despite the significant impact of the COVID-19 pandemic, we actively took measures against the lingering effects of the pandemic such as the promotion of online activities, the active implementation of ICT-based training and seminars, and the production of digital educational materials, and promoted the development of an environment where space education can be practiced anytime, anywhere, providing learning opportunities continually and expansively.

Development and disclosure of “Lesson Packages in Space”

Aiming for voluntary and independent implementation of space education in school settings, we have developed “Space Lesson Package,” a new digital educational tool including class materials, videos, and teaching plans, and made it available on our website.



Implementation of GIGA School special seminars

As part of the “GIGA School Concept” project promoted by the Ministry of Education, Culture, Sports, Science and Technology, we cooperated with the promotion of the concept by holding a special lecture in real time for children nationwide by Astronaut Hoshide, who is currently on board the ISS.



Holding seminars on guidance on knowhow for community organizers of Cosmic College

In addition to providing educational materials, we also held seminars for community organizers of Cosmic College to provide them with practical knowhow for promoting online programs.





Masaru Mizoguchi

Masaru Mizoguchi

[Short Biography]

Doctor of agriculture, Professor, Department of Global Agricultural Sciences, Graduate School of Agricultural and Life Sciences, The University of Tokyo. Graduated from the Department of Agricultural Engineering at the University of Tokyo, which was founded by Hachiko's owner. Specialized in soil physics, agricultural engineering, and international agro informatics. Conducting research on decontamination of agricultural land and revitalization of agriculture in Iitate Village, Fukushima Prefecture since the Great East Japan Earthquake.

Partly because of change in the editorial structure, this year's report has a different and more interesting flavor compared to that of previous year. Particularly, the "List of JAXA projects" on pages 6 to 8 drew my attention. The outline of 18 projects is briefly summarized with beautiful photos, giving a complete picture of JAXA's business.

In the "Top Management Commitment," President Yamakawa gave a summary of a long-duration space mission of Japanese astronauts aboard the International Space Station, the recruitment of the first Japanese astronaut in 13 years, the initial analysis of samples from the asteroid Ryugu, and the development of the new Launch Vehicle H3 (p.2). On the next page, the report summarizes the priority initiatives for Phase 4 and clarifies the goals the organization should aim for in the "Overview of Phase 4 Medium/Long-Term Plan Based on Medium/Long-Term Goals."

In the "Highlights of 2021," a brief review of five items is provided. Among them, the results of the initial analysis of samples recovered from Ryugu in [Hayabusa2] of "05 > Creation of New Knowledge through Space Science and Exploration" and the report in [ISS Project] that JAXA received more than four times as many applications for the Japanese astronaut positions as in the previous recruitment are noteworthy in that JAXA gave the Japanese people a bright hope in the last fiscal year despite a lot of gloomy news such as the COVID-19 pandemic. The "List of JAXA projects," which I mentioned at the outset, effectively conveys the reality of space development.

In the section "Involvement in the Environment," it is refreshing to summarize the achievements of the contribution to climate change measures in terms of environmental monitoring of land, sea, and air as part of "Initiatives to Preserve the Global Environment." These include the monitoring of the global distribution of forests with the Advanced Land Observing Satellite "Daichi-2," observation of the Antarctic sea ice extent with the Global Change Observation Mission – Water "Shizuku," and monitoring of the distribution of greenhouse gas concentrations with the Greenhouse Gases Observing Satellite "IBUKI." In addition, as part of its disaster prevention efforts, JAXA's rapid response has greatly contributed to society such as the observation of pumice stones that drifted ashore on Okinawa after the eruption of a submarine volcano in the Ogasawara Islands last year using the Global Change Observation Mission - Climate "SHIKISAI," which presumably led to many awards from the Minister of Education, Culture, Sports, Science and Technology (p. 11). The section "Initiatives to Reduce Environmental Load" describes systematic measures such as environmental management. Of these efforts, I found "enhancement of environmental education" and "coexistence with local nature" interesting.

For "social involvement," I highly praise the active development of public relations activities and events through websites, SNS, and live streaming for "community involvement and development" of many "commitments to social responsibility." In particular, I greatly appreciate that JAXA work to develop human resources that will support the future of the Agency such as the development and release of the Lesson Packages in Space as a space education support activity for the next generation and the implementation of special lectures at GIGA schools (p. 34). I hope that such activities will continue in the next year and beyond.



Kimiharu Saita

Kimiharu Saita

[Short Biography]

He majored in marine meteorology at Hokkaido University and became a certified weather forecaster while he was a student there. After working as a journalist, he became a weather broadcaster for NHK in 2006. Currently appears on "Newswatch 9." As the representative director of Himmel Consulting Co., Ltd., space weather project manager of ABLab General Incorporated Association, and chairman of the Outreach Subcommittee of the Space Weather Users Council, he is promoting efforts in preparing for new disasters.

In 2021, full-fledged space tourism services by private companies were launched, and for the first time, the number of civilians who went into space exceeded the number of astronauts from public institutions. On the other hand, JAXA recruited Japanese astronauts for the first time in 13 years, receiving a record 4,127 applications (approximately 4.3 times as many applicants as in previous recruitment). How is JAXA's role changing as more companies in Japan enter the space business? I looked over the report looking for the answer.

In "Initiatives to Preserve the Global Environment," the report states that JAXA is contributing to assessing the achievement of the long-term goals of the Paris Agreement by monitoring the global forest distribution with Daichi-2 and the concentration distribution of greenhouse gases with IBUKI-2. Climate change is a global challenge and links to related Web pages can help more people to become aware of the details. When the Hunga-Tonga-Hunga-Ha'apai volcano erupted, JAXA made emergency observations with Daichi-2. Also, JAXA has established a system using the Global Satellite Mapping of Precipitation (GSMaP), which is released by JAXA, and the system is currently used by people in more than 136 countries including areas and countries where ground-based observation is difficult. This gives us an idea of JAXA's commitment and contribution to disaster management.

In the section "Initiatives to Reduce Environmental Load," the graph shows the changes in consumption of energy such as electricity and city gas over the past five years. We see that the energy consumption is showing a decrease. The shift to paperless operation is also remarkable, and the number of sheets printed has decreased by about 71% compared with five years ago. This may be partly due to changes in the way people work as a result of COVID-19 countermeasures, but it is likely that the in-house environmental education using e-learning has been effective.

As "Efforts to achieve SDGs," RABBIT, a tool based on techniques and long experience learning about space debris avoidance, will be provided free of charge to public agencies, companies and universities in Japan and overseas to prevent collisions with space debris. This technology is indispensable for realizing a sustainable society that enjoys the benefits of space development, and is expected to make further contributions in the future.

In the section "Commitment to Social Responsibility," what caught my attention was the description of JAXA's ideal candidate as "Human resources who have the motivation and ability to propose and create new value to society through aerospace based on their specialized skills and continue to take on challenges." Efforts have been made to secure human resources from various backgrounds in order to respond to diversifying needs. In FY2021, there were 36 experienced hires, but only 4 of them were women, which shows that there is room for improvement.

I think many of the public are aware of the success of Hayabusa2 and the goal of the first landing of a Japanese person on the moon, but there were also many international contributions in the report that I had never heard of before. JAXA's social networking sites have garnered many fans including 416,000 followers on Twitter and 199,000 on Instagram. I hope that further promotion of the usefulness of space utilization in our daily lives and society will contribute to the development of the space industry as a whole.

To Enhance the Reliability of This Report

To enhance the reliability of Sustainability Report 2022 (hereinafter this report), we used a checklist and an internal audit system to evaluate the activity reports from all divisions in accordance with Environmental Reporting Guidelines issued by the Ministry of the Environment.

Using the Self-assessment Guide for Enhancing the Credibility of Environmental Reports as a reference, we used a checklist to check that the information (numerical data, etc.) and descriptions about environmental load contained in this report comply with the Environmental Reporting Guidelines.

September 2022
Head of Safety and Mission Assurance Department

李野正明

To ensure the reliability of the information (numerical data, excluding those on papers) about environmental load contained in this report, we selected the following sites from all of our sites, conducted audits in July 2022 to verify the consistency of the source documents and forms with the numerical data in this report, and checked that there were no problems.

- Chofu Aerospace Center
- Tanegashima Space Center
- Masuda Tracking and Communications Station

September 2022
Head of Evaluation and Audit Department

佐藤雅彦

[Details: Self-assessment Checklist](#)

[Editor's Note]

Thank you for reading JAXA's Sustainability Report 2022. In this cover painting, a thread of cloud representing a contrail (aviation) or rocket cloud (space) is depicted harmoniously in people's lives with JAXA's intention of "contributing to society through the space aviation field." This report describes how JAXA's aerospace business contributes to various environmental and social issues. For details, please refer to the JAXA official website. We would also like to use this report as a tool to communicate with you, and would appreciate your cooperation in the questionnaire.

[Scope of the Report, etc.]

Scope.....All business sites except overseas
 Period.....April 1, 2021 to March 31, 2022 (including some data after this period)
 Guidelines for reference....."Environmental Reporting Guidelines 2018" issued by the Ministry of the Environment, "ISO 26000: 2010 Guide to Social Responsibility" (Japan Standards Association)
 Improving Reliability.....Conducting an Internal Assessment to Improve the Reliability of this Report
 Rounding of numbers.....Rounding to the nearest whole number

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[Publication]

September 2022 (Vol. 17)
 Editor in chief.....Masaaki Mokuno, Director, Safety and Mission Assurance Department
 Issue of the next report.....September 2023

[Contact]

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Environmental INPUT Data (Resources and Energy)

Resources and energy		Unit	FY2017	FY2018	FY2019	FY2020	FY2021
Electricity purchased		MWh	143,162	137,728	134,036	111,877	111,312
Water resources		K m ³	453	440	412	403	384
(details)	Water supply	K m ³	182	184	152	155	153
	Groundwater	K m ³	42	33	31	12	25
	Rainwater	K m ³	2	2	3	3	2
	Other*	K m ³	228	221	226	234	204
Gasoline (including for vehicles)		kℓ	32	28	25	20	22
Kerosene		kℓ	57	45	49	38	27
Light oil (including for vehicles)		kℓ	47	49	44	43	39
Heavy oil (JIS grade A)		kℓ	9,661	8,694	8,456	7,807	6,600
City gas		K m ³	1,601	1,780	1,639	870	604
Propane gas		t	36	18	28	22	8
Petroleum hydrocarbons		K m ³	0	0	0	0	0
Liquefied natural gas		t	0	0	0	15	5
Other combustible natural gases		K m ³	1	1	1	0	0
Jet fuel (including fuel for flight)		kℓ	186	180	215	178	214
Aviation gasoline		kℓ	0	0	0	0	0
Liquid nitrogen		t	3,547	3,016	2,695	2,645	2,046
Paper		t	77	63	51	39	23

* The data is based on resources and energy purchased by JAXA. The data does not include fuel and other resources purchased by service providers due to the transfer of launch services to the private sector.

* Intake weirs and rivers

Environmental OUTPUT Data (Environmental load substances)

Environmental loads		Unit	FY2017	FY2018	FY2019	FY2020	FY2021
CO ₂ emissions	Energy related	t-CO ₂	84,9542	81,809	77,955	62,134	60,500
	Non-energy related *1	t-CO ₂	278	314	645	502	220
Calculated amount of leaked CFCs		t-CO ₂	892	1,040	974	458	287
NOx emissions *2		t	309	306	307	273	174
SOx emissions *2		t	107	95	59	57	40
Soot emissions *2		t	0	0	0	0	0
Wastewater *3		K m ³	453	440	412	403	361
Biochemical Oxygen Demand (BOD) *4		mg/t	32	41	26	20	20
Chemical Oxygen Demand (COD)*4		mg/t	8	6	3	3	3
General waste		t	162	209	184	97	117
Industrial waste		t	562	1,073	1,297	657	1,324
Specially-controlled industrial waste		t	35	39	7	13	17
Class I designated chemical substances		t	7	5	4	3	8

*1 Non-energy related CO₂ emissions include emissions of CH₄, N₂O, and SF₆.

*2 NOx, SOx, and soot emissions are measured from units generating soot or smoke regulated by the Air Pollution Control Act.

*3 In cases where the amount of wastewater is not measured, it is calculated based on the assumption that the amount of used water is the amount of wastewater.

*4 BOD and COD are calculated based on the measured values at sites with specified facilities under the Water Pollution Prevention Act and the total amount of wastewater discharged at the sites (per year).

Personnel-related data

		Unit	FY2017	FY2018	FY2019	FY2020	FY2021
Number of employees		people	1,512	1,517	1,554	1,652	1,589
Average number of days of paid leave taken		days	11.8	12.7	13.5	11.13	11.9
Number of employees taking childcare leave		people	31	48	56	59	53
Number of employees taking sick/injured childcare leave		people	162	168	190	135	167
Percentage of female managers		%	9.0	10.4	10.2	10.5	10.9
Percentage of disabled employees		%	2.42	2.49	2.65	2.66	2.52
Number of compliance hotline calls		cases	42	54	45	25	32
Use of the whistleblowing system		cases	0	0	1	0	0
Work-related accidents*	Accidents during work	cases	11	14	12	7	13
	Accidents during commuting	cases	10	8	2	3	1

* The number of work-related accidents occurred to employees of subcontractors is also included.

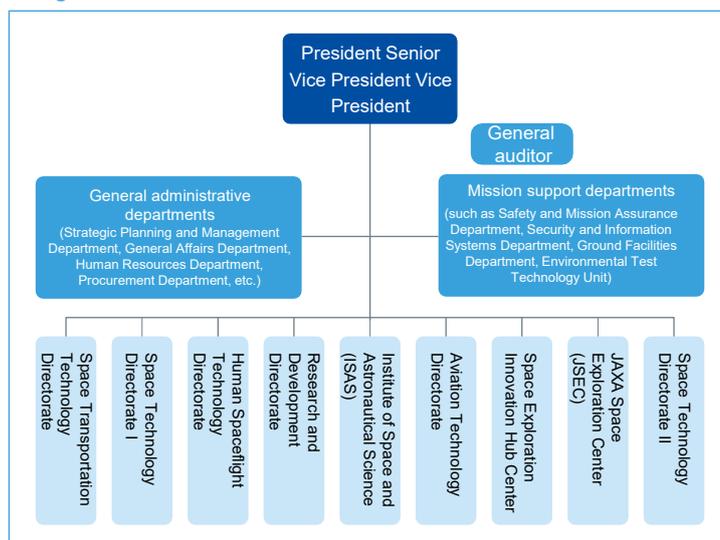
About JAXA

Japan Aerospace Exploration Agency (JAXA), a national research and development agency
Japan Aerospace Exploration Agency

- **Headquarters** 7-44-1 Jindaiji-Higashimachi, Chofu City, Tokyo
TEL:0422-40-3000 FAX:0422-40-3281
- **Establishment (History)** An Incorporated Administrative Agency, the Japan Aerospace Exploration Agency (JAXA) was established in October 2003 in accordance with the Act on the Japan Aerospace Exploration Agency, Incorporated Administrative Agency (Act No.161 of December 13, 2002), merging three aerospace organizations, the MEXT Institute of Space and Astronautical Science (ISAS), the National Aerospace Laboratory (NAL), and the National Space Development Agency of Japan (NASDA). It became a National Research and Development Agency in April 2015.
- **President** YAMAKAWA, Hiroshi
- **Number of directors** one senior vice president, seven vice presidents, two general auditors
- **Number of employees** 1,589 (As of March 31, 2022)
(Number of permanent employees)

● Organization Chart

As of March 31, 2022



Details

Summary of Balance Sheet

(Unit: million yen)

Assets	
I. Current assets	384,291
II Fixed assets	
1. Property, plant and equipment	369,327
2. Intangible assets	6,182
3. Investments and other assets	24,460
Total fixed assets	399,970
Sum of liabilities and net assets	784,260

Liabilities	
I. Current liabilities	299,210
II. Fixed liabilities	330,273
Total liabilities	629,483
Net assets	
I. Capital	544,250
II Capital surplus	(423,658)
III. Retained earnings	34,185
(including total loss in this year, 15,228)	
Total net assets	154,778
Total liabilities and net assets	784,260

Summary of Profit and Loss Statement

(Unit: million yen)

Classification of profit and loss	
Ordinary expense	230,855
Ordinary income	215,651
Extraordinary loss	35
Extraordinary profit	37
EBIT	15,203
Corporate income tax, corporate residents' tax and enterprise tax	25
Net loss	15,228
Total loss	15,228

FY2021 (Budget and Results) and FY2022 (Budget)

(Unit: million yen)

Classification	FY2021		FY2022
	Plan	Actual	Plan
Income			
Subsidy for operation	157,220	157,220	123,759
Subsidy for facility improvement	13,054	9,584	2,781
Subsidy for the ISS development	42,867	36,922	18,630
Subsidy for R&D on earth observation systems	5,566	5,609	5,995
Subsidy for promotion of advanced core rocket technology	7,029	5,020	3,993
Commission income	28,807	61,954	27,388
Other income	1,040	1,138	1,090
Total	255,584	277,447	183,636

Classification	FY2021		FY2022
	Plan	Actual	Plan
Expenses			
General and administrative expenses	4,985	4,946	6,076
Business expenses	153,275	139,014	118,773
Expended subsidy for facility improvement	13,054	9,419	2,781
Expended subsidy for the ISS development	42,867	36,878	18,630
Expended subsidy for R&D on earth observation systems	5,566	5,416	5,995
Expended subsidy for promotion of advanced core rocket technology	7,029	5,010	3,993
Commission expenses	28,807	62,001	27,388
Total	255,584	262,684	183,636

Financial Statements, etc.

Sustainability Report 2022

Japan Aerospace Exploration Agency