part of the JST Strategic Basic Research Programs conducted by the Japan Science and Technology Agency.

MEXT promotes both theoretical and experimental study, as well as R&D including observations and analyses, in order to establish a platform for the development of a new frontier of intelligence, such as the comprehensive understanding and elucidation of oceans, earth and space.

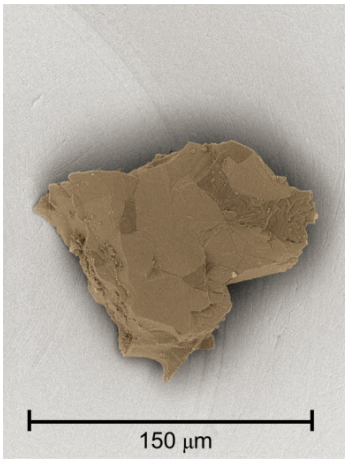
2) Promotion of R&D in the space field

Human beings' search for unknown frontiers is motivated by the intellectual activities that are needed to understand "the origin and ruling laws of space," and is the source of innovative and emerging technologies that can bring new opportunities in space development. Therefore, it is important for Japan to develop its space program in order to fully utilize the capabilities of space.

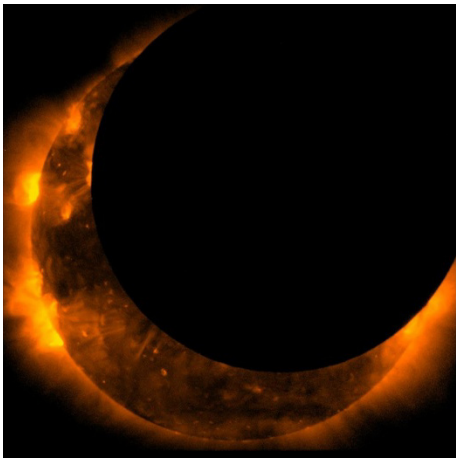
The following outcomes are also anticipated: the research results utilizing the special environments of space, the acquiring of new scientific knowledge, and the growth of new industry activities which utilizes the results of that research.

(i) Solar system exploration, space astronomy observation

In the space-science field, the Japan Aerospace Exploration Agency (JAXA) has led the launch of scientific satellites with the participation of researchers, such as those at universities nationwide, and its achievements have ranked "best-in-class" throughout the world. Japan promotes a scientific satellite plan as an important R&D subject. In order to maximize the scientific results of the asteroid explorer, "Hayabusa" which has returned to earth, the government has invited international applications for funding aimed at the research of tiny particles that "Hayabusa" brought from the asteroid "Itokawa." A superior research proposal was selected from among the proposals that were applied for from around the world in June, 2012, and the second international applications for funding were started in January 2013. An exhibition of the returned capsule was held across the nation and had over 890,000 visitors, making "Hayabusa" a social phenomenon. Its successor, "Hayabusa-2," is being developed for launch in FY 2014. Furthermore, the solar astronomical satellite, "Hinode," and the X-ray astronomy satellite, "Suzaku," which were developed through international cooperation, both continue their observation activities. The Venus Climate Orbiter, "AKATSUKI" is trying to achieve a circular orbit of Venus again. JAXA is also taking the lead and making progress on the development of the X-ray astronomy satellite, "ASTRO-H," which had the world's best performance, and the Mercury exploration project (Bepi Colombo) through international cooperation with European space organizations.



Tiny particles of asteroid "Itokawa"
Courtesy of JAXA



The X-ray image of the sun taken by the solar astronomical satellite "Hinode" while an annular eclipse was being observed on May 21, 2012. (Dark shadow is the moon)
Courtesy of JAXA/National Astronomical Observation of Japan

(ii) Acquisition of manned space technology with the International Space Station Program

The International Space Station (ISS) Program is an international project involving the cooperation of five regions: Japan, U.S. Europe, Canada and Russia. Japan's role in the project is to develop and operate the Japan Experiment Module, "KIBO," and the unmanned cargo-transfer spacecraft H-II Transfer Vehicle, "KOUNOTORI" (HTV). Japan's contributions include the following: 1) conducting "KIBO" construction, completed in July 2009, 2) sending Japanese astronauts for a long-term stay at the ISS, and 3) shipping supplies by using "KOUNOTORI." Following "KOUNOTORI 1" in September 2009 and "KOUNOTORI 2" in January 2011, "KOUNOTORI 3" succeeded in achieving a safe docking with the ISS. In addition, the Japanese astronaut Hoshide completed a long-term stay at the ISS, from July through November 2012. During this time, he performed extra-vehicular activities three times to replace components of the ISS. He also performed the world's first experiment to deploy small satellites using robotic arms and an experiment to observe the impact of zero gravity to life by using killifish on "KIBO." The duration of his extra-vehicular activity was the longest ever among Japanese astronauts.

Table 2-3-6/ Principle measures for conservation of basis of the nation's existence (FY 2012)

Ministries and agencies	Conducting organization	Measures
Cabinet Secretariat	Cabinet Research Office	Information-Gathering Satellites
MIC, Ministry of Internal Affairs and Communications	MIC	R&D of technology to predict and promptly respond against cyber attacks through international cooperation
		R&D of cloud-shifting promotion security technology prepared for disasters
	National Institute of Information and Communications Technology	R&D of network platform technology
MEXT	MEXT	Establishment of Innovative High-performance Computing Infrastructure (HPCI)
	Japan Aerospace Exploration Agency (JAXA)	Solid rocket
		Hayabusa-2
		The 26th Science-mission Satellite (ASTRO-H)
		International Space Station Program
		Upgrading platform rocket
		Mercury exploration project "Bepi Colombo"
		Small Science Satellite
	Japan Agency for Marine-Earth Science and Technology (JAMSTEC)	Deep-Earth Dynamic Research Program
		Extremobiosphere Research Program
		Basic marine technology
		Research and Development on the exploration and utilization technology for Marine Resources and Energies
		Oceanic-Earth Drilling Program
		Cooperation for Scientific Research
		Operation of the Oceangraphic Research Vessel
		Operation of the deep-sea research system and support ships
		Subsidies for building vessels
METI	METI	Establishment of a security verification site (cyber security test bed) for control systems
		Project to promote measures for information security
		R&D of an advanced space system with downsizing
		R&D of a transportable, integrated small-ground system
		R&D of oil resources via remote detection
		R&D of a hyper spectrum sensor
		R&D of a next-generation earth-observation satellite use platform
		Basic research on deep seafloor resources
		Basic research on the exploration technology of oil resources in l deep-water areas
		Entrustment expense fees for surveys on the standards for radioactive waste disposal
	Agency for Natural Resources and Energy	Entrustment expense fees for the establishment of technologies related to the measures against power reactor accidents
		Subsidies for the development of technologies related to the measures against power reactor accidents
		Entrustment expense fees for the establishment of technologies to improve safety measures against power reactors
		Subsidies for the development of technologies to improve safety measures against power reactors
		Entrustment expense fees for the development of technologies for new-type power reactors
		Subsidies for promoting coal-production technologies
		Project to promote the development of methane hydrate
		Project to develop mining technologies for hot water deposits in the seafloor
		Subsidies for advanced spent-fuel reprocessing project
	The National Institute of Advanced Industrial Science and Technology (AIST)	Consolidation of satellite image information and geological information, and the expansion of its use
		Geological survey of land and oceans, and improvements in the precision of earth-science basic charts

Ministry of Land, Infrastructure, Transport and Tourism (MLIT)	Japan Coast Guard (JCG) the Japan Coast Guard	Promotion of ocean surveys in the territorial waters and exclusive economic zone (EEZ) of Japan
	Geospatial Information Authority of Japan (GSI)	Expense for measuring electronic reference stations
Ministry of the Environment	Nuclear Regulation Authority	Entrustment expense fees for advanced safety measures for fuels
		Entrustment expense fees for surveys on technologies for safety measures against nuclear fuel cycle sites

5 Enhancement and Strengthening of the S&T Common Platform

In order to effectively and efficiently promote R&D that will respond to the various problems faced by Japan and the world, it is necessary to promote the R&D of S&T that is used across multiple areas. Furthermore, regarding the common and fundamental facilities and the equipment needed for a large variety and wide range of R&D, it is important to promote the connection of these facilities and equipment so as to create a mutual network that will further enhance and strengthen them. Therefore, in August 2012, MEXT supported investigations for concrete measures to strengthen platforms for research across the country at the committee of the Council for Science & Technology's (CST) advanced research base (Committee Chairman: Setsuo Arikawa, chancellor of Kyushu University, National University Corporation), and MEXT approved the report entitled "Strategies for a Research Base that enhances S&T Innovation – R&D capacity strengthening measures on the R&D platform." The government focuses on and promotes policies related to R&D for critical problems as follows:

(1) Strengthening of Cross-disciplinary S&T

The government promotes R&D on S&T that can be practically used across disciplines and in multiple fields, for example, the use of leading-edge measurement and analysis technology and nanotechnology, light/quantum science technology, information science and technology, and technology related to the mathematical sciences.

(Development of leading-edge measurement and analysis technology and equipment)

The leading-edge measurement and analysis technology and equipment are a common platform that supports the creation of unique, world-class, cutting-edge results in R&D—the type of results that can be awarded Nobel Prizes; therefore, key technologies are indispensable to progress in S&T.

Within MEXT, the Japan Science and Technology Agency conducts "Industry-Academia Collaborative R&D Programs (a leading-edge measurement and analysis technology and equipment development program)" and makes efforts on strengthening R&D platforms by promoting the development of one-and-only, leading-edge measurement and analysis technology and equipment that originate in Japan, and which can meet the needs of world-leading researchers and the demands of manufacturing sites in collaboration with industry, academia and government (Figure 2-3-7). There were as many as 28 commercialized prototypes as of the end of FY 2012. In FY 2012, MEXT strengthened target-oriented R&D, and promoted the development of measurement and analysis technology and equipment that will

be essential for results-based R&D aiming at a dramatic improvement in performance, and which will lower the costs of photovoltaic generation, fuel cells and storage batteries in order to contribute to green innovation. Furthermore, MEXT promoted the development of radiation measurement technology and equipment leveraged from the development on measurement analysis technology and equipment in order to support recovery from the Great East Japan Earthquake (refer to the Feature 1, Chapter 1).

Figure 2-3-7/ Examples of the development results of leading-edge measurement and analysis technology and their associated instruments

Left: Real-time stereo scanning electron microscope (This equipment enables the 3-dimentional observations with the naked eye in real-time. The product is expected to be applied to medical, biological and inorganic material areas.)
Right: Mass microscope (This equipment enables identifying molecules that exist at a specialized region through mass analysis, while observing other matters such as pathology segments. Contributed in discovery of pathological change in abdominal aneurysm)
Courtesy of Japan Science and Technology Agency

(R&D of nanotechnology)

The nanotechnology and materials field contributes to the progress of S&T and to solving problems in fields such as the life sciences, information and telecommunications, and the environmental sciences and also important technological keys for society to realize the growth of industry and to make people's lives more safe, secure, comfortable and convenient.

MEXT promotes fundamental R&D to realize breakthroughs in environmental technology by using a "Strategy for Rare Elements Project" to develop technology for the replacement or reduction of rare-elements such as rare earth and rare metals and a "Program for the Development of Environmental Technology Using Nanotechnology" (refer to 1-(1) and (3) in Part 2 Chapter 2 Section 2).

The National Institute for Materials Science (NIMS) develops advanced technologies that are commonly required including 1) world-class, leading-edge measurement technology for complete material measurement from the surface to the core, 2) simulation technology for high-precision analysis and evaluation of physical properties, and 3) the development of design methods and new manufacturing processes, in order to generate material from material elements (particles, organic molecules, etc.). NIMS also creates new substances and materials by taking advantage of physical properties that are unique to nano-sized substances—either organic or inorganic—by manipulating and controlling atoms and molecules on the nano-level (one billionth or 10^{-9} meter). In addition, NIMS promotes the R&D of materials that provide advancement, high-reliability and a high safety environment for energy-related