

Participating Organizations

Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

National Institute of Advanced Industrial Science and Technology (AIST)

(National Research and Development Agency National Institute of Maritime, Port and Aviation Technology)
National Maritime Research Institute
Port and Airport Research Institute

National Institute of Information and Communication Technology (NICT)

National Institute for Environmental Studies (NIES)

Research and Development Partnership for Next Generation Technology of Marine Resources Survey

Japan Marine Surveys Association

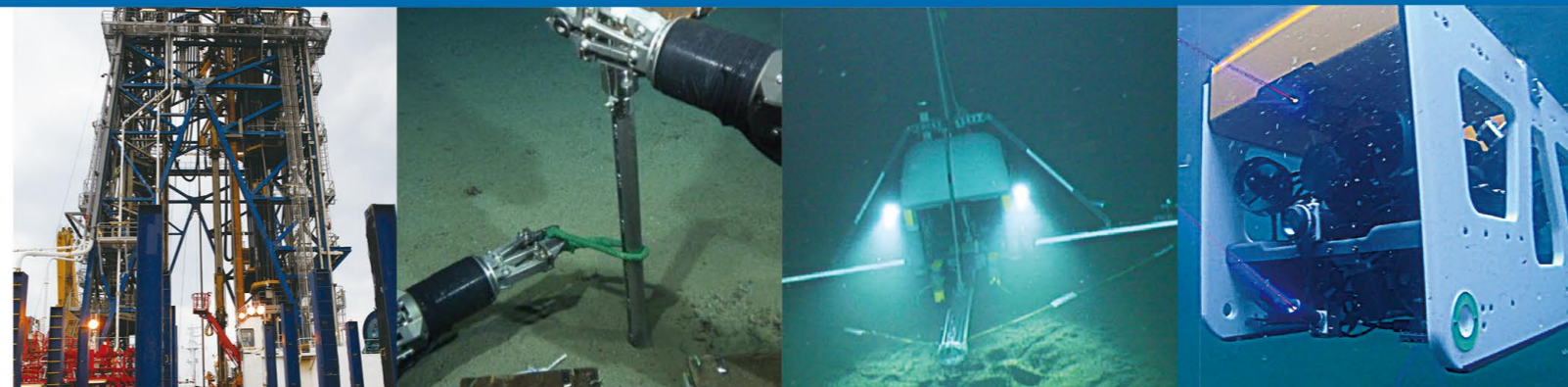
Kyushu University

Kochi University

The University of Tokyo

Tokyo University of Marine Science and Technology

Yokohama National University



Cross-ministerial
Strategic Innovation Promotion Program

Next-generation technology for ocean resources exploration (Zipangu in the Ocean program)



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Cross-ministerial Strategic Innovation Promotion Program

The Strategic Innovation Promotion Program (SIP) was launched by the Council for Science, Technology, and Innovation (CSTI), which oversees projects that target scientific and technological innovation in line with Japanese government directions as stated in the Comprehensive Strategy on Science Technology and Innovation and the Japan Revitalization Strategy. This interdisciplinary program among government agencies, academic institutes and private sectors addresses eleven issues. One of these issues is Next-Generation Technology for Ocean Resources Exploration.

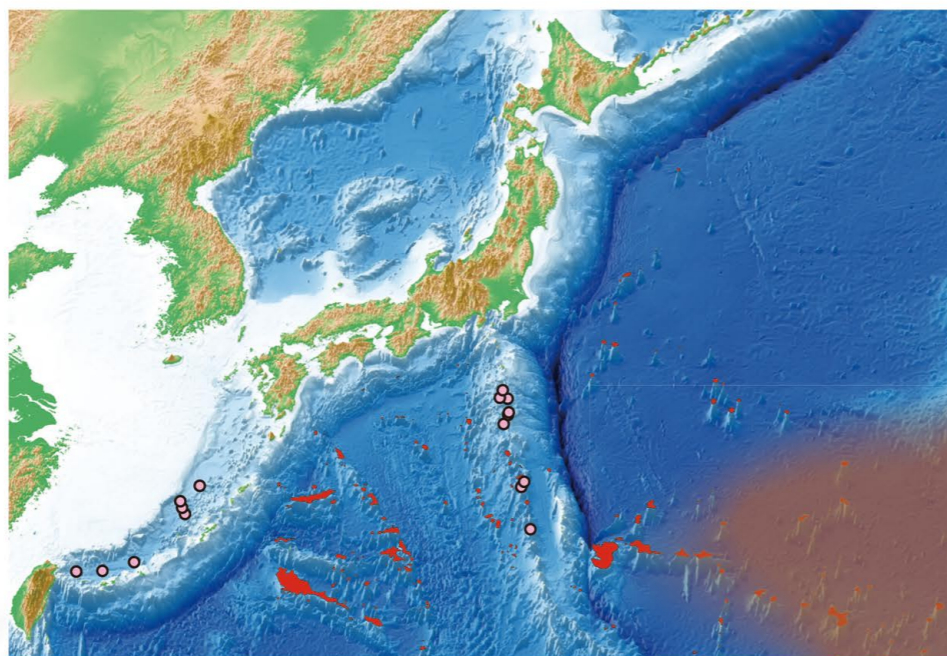
Next-generation technology for ocean resources plan (Zipangu in the Ocean program)

Japan is a small country that depends almost entirely on imports for mineral resources. Historically, Japan has produced large amounts of precious metals, gold and silver. With a few exceptions metal producing mines are exhausted. Recently, however, new sources of mineral resources have been discovered on the seafloor surrounding the Japanese archipelago. Mineral resources now found on land in Japan originated on the sea floor before the archipelago's formation. Similar resources are still forming on the sea floor.

The exclusive economic zone (EEZ) surrounding Japan is twelve times larger than the area of Japan itself. Efficient exploration of the seas around Japan is, therefore, likely to discover new sources of valuable minerals.

For this purpose technology different from that used in oil and gas exploration is required. Because profitable production of mineral resources from the ocean floor is not possible with existing technology, nowhere in the world do we see full-scale development of maritime mineral resources. New technology must be developed to overcome this problem and allow the private sector to explore efficiently larger regions of the ocean floor.

Japan's government has taken the lead, starting with tie-ups between government agencies to pull together research organizations that will work together to develop the science and technology required to explore the seas around Japan. Program members are joining forces to develop theories of resource formation and construct a system for efficiently exploring selected parts of the ocean floor, based on scientific knowledge. They are also promoting development of technology to assess the environmental impact of resource exploration and extraction. Plans call for strengthening Japan's capabilities in ocean resource exploration by transferring the results of this effort to the private sector. The development of next-generation technology for ocean resources development, the Zipangu in the Ocean program is now underway.



○ Thermal activity ● Cobalt-rich crust*1 ● REY-rich mud ※1 based on Usui et.al(1994)

Strategical Goal

Next-generation technology for ocean resources exploration

1 Launch commercial-level exploration of ocean resources

Working closely with private companies in R&D process will speed identification of current needs and smooth transfer of technology developed by the program. Packaging the results will facilitate rapid response to market needs by establishing patent and creating intellectual property in technologies resulting from joint research and development.

- Speed development of competitive exploration technology: low cost, efficient, fast and reliable.
- Foster cooperation between government, the private sector, and the academia.
- Transfer of new exploration technologies to a broad range of private companies, thus promoting creation of an ocean resource exploration industry.

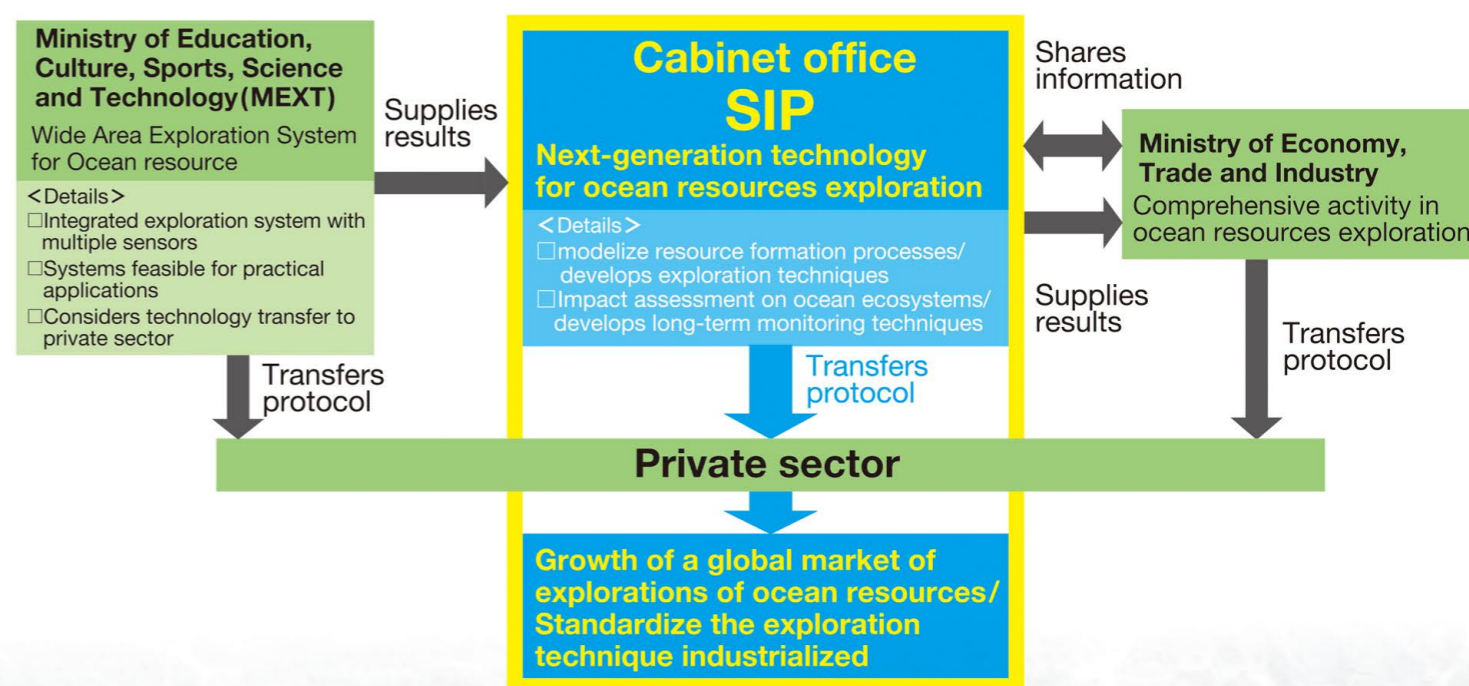
2 Establish a global standard

R&D results will be presented to international authorities as standard methods. Proactive collection of information and advertisement of the products of the project at international conference and academic meetings will foster acceptance as international standards.

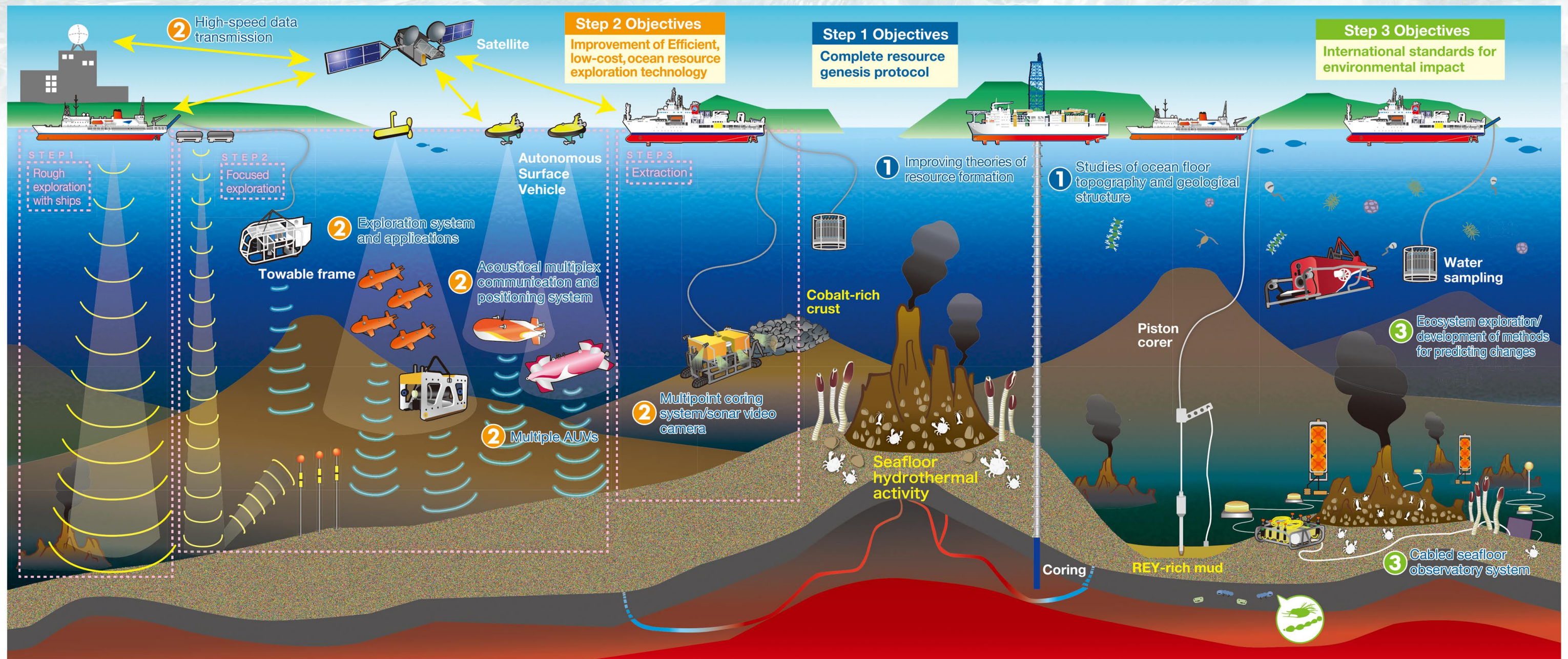
- Becoming global first-movers in developing exploration and environmental impact assessment technology will lead to establishment of global standards. Growth of a global market of explorations of ocean resources will provide opportunities to export the products in this project outside Japan, eventually.

Cooperation with Related Governmental Measures

This project is of course linked to other national projects to develop ocean resources. Participation in Promoting Committee, workshops and other meetings provide opportunities to share research results and develop steps for commercialization and practical applications in cooperation with counterparts pursuing similar projects at the Ministry of Economy, Trade and Industry (METI) / Japan Oil, Gas and Metals National Corporation (JOGMEC). In addition, another project, the "Wide Area Ocean Resources Exploration System," commissioned by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) is cooperated with this project.



Mineral resources development on Ocean floor



Step 1



Scientific research on formation processes of ocean resources

Understand the formation processes of ocean floor resources are formed, together with science-based methods for narrowing regions data to exploration.

Step 2 Technology development for ocean resources exploration



Exploration systems and protocols for Ocean resources



Technologies for operation multiple AUVs



Efficient subseafloor sampling system using ROVs



High-speed data transmission via satellite

The project mainly focus on industrialization of exploration of ocean floor resources through development of new technologies and utilization of conventional technologies.

Step 3 Ecological surveys and long-term monitoring



Methods developments for ecosystem change and forecasting



Cabled seafloor observatory system

Support private sector to apply the method, technique and protocols as international standards for exploration and ecological monitoring.

Goals of each step

Step 1

Identify regions where ocean resources are concentrated

Sharply reduce time required for exploration

Step 2

Improvement on efficiency of exploration systems

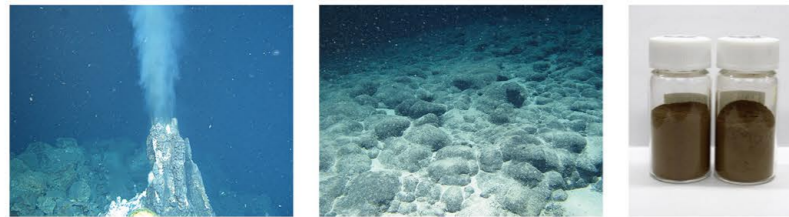
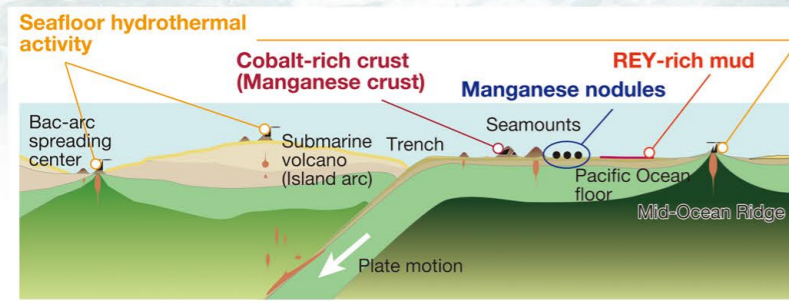
High cost performance system industrialized

Step 3

Develop and verify technologies for long-term monitoring of subfloor structure

Support private industry applications based on international standards for exploration and ecological monitoring

Step 1 Scientific Research on Formation Processes of Ocean Resources



In this step, seabed hydrothermal deposits, cobalt-rich crust, and REY-rich mud are focused. Exploration techniques and equipment will be developed through scientific investigations on resource formation processes and enrichment mechanisms for specific elements. The ultimate goal is to determine specifications for exploration equipment optimized to collect data based on scientific backgrounds.

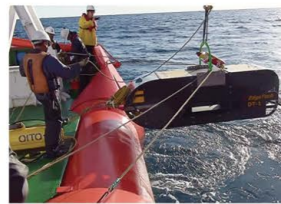
According to an accumulation of scientific knowledges, a region will be selected as the intensive research area by mid-2016 where a model of the genesis of ocean mineral resources will be proposed. Further sophistication and confirmation of the model will continue in surrounding areas through 2018.

This research will clarify the when, why, and where of such ocean mineral resources are formed, making it possible to use theories of resource genesis. To narrowing down areas with higher potentials by utilizing formation models, provides greater efficiency to ocean resources exploration.

Step 2 Technology development for ocean resources exploration

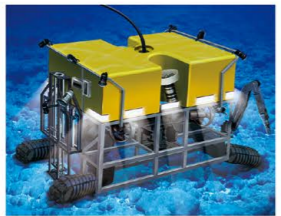
1 Exploration systems and protocols for Ocean resources

The goal is to develop systems and protocols for exploration of hydrothermal deposits, whose cost and efficiency are competitive even in international markets. These systems and protocols will employ a stepwise approach from larger to smaller regions to identify promising zones for intensive exploration. Ship borne systems will use acoustic and electromagnetic tools to narrow the targeted areas for more intensive study.



3 Efficient subseafloor sampling system using ROVs

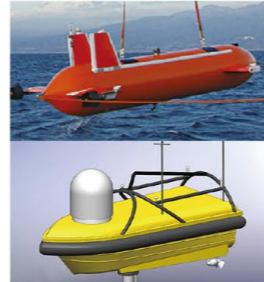
Existing ROVs with mountable modules will be used for efficient, low cost sampling. Module options include a multipoint coring system and highly cost-effective sonar imaging system.



2 Technologies for operation multiple AUVs

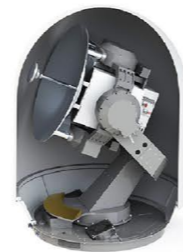
Two types of system are prepared for user requests:

- ① A suite of exploration platform consist of small AUVs and ASV.
- ② An ASV system which is a relay station equipped with communication system, enable users to utilize multifunction AUVs.



4 High-speed data transmission via satellite

Develop a high-speed data transmission network via satellites to link multiple unmanned platforms with survey ships, surface and submersible transponders, and research centers on land, which enables quick transmitting collected data and dramatic improvements in the size of survey area and of the speed of exploration.



Step 3 Ecological surveys and long-term monitoring

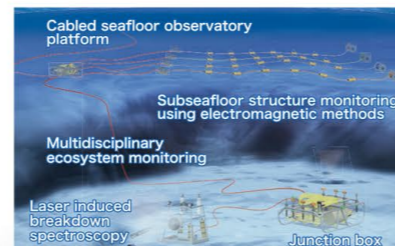
1 Methods developments for ecosystem change and forecasting

The assessment methods using data of biological and microbiological indicators, environmental conditions, and socio-economic factors developed in a close cooperation with institutes and private sectors. The practical protocols for environmental impact assessment (EIA) and environmental management plan (EMP) based on advanced technologies and intelligences will be established as a standard for sustainable use of ocean resources in commercial sector.



2 Cabled seafloor observatory system

Develop a cabled seafloor observatory platform to support experimental verification and evaluation of long-term monitoring methods for environmental impact assessment using the technologies for subseafloor structure monitoring, marine ecosystem, and in-situ chemical component analysis, etc.



Next-generation Technology for Ocean Resources Exploration Structure



Government Agency Tie-ups (Steps 1-3)

JAMSTEC is the management agency for all of the research in Steps 1-3. It coordinates and takes advantage of the special strengths of twelve research institutes, private corporations, and universities. Providing horizontal links that cut across boundaries between ministries, we bring all of those together in a unified public-private-academic partnership whose goal is to accelerate progress at every step from basic research to applied research and testing, including an exit strategy for rapid dissemination of R&D results. The Program Director is in charge of planning policy and promotion. As chair of the Promoting Committee he provides overall coordination. The Cabinet Office provides administrative support while the Promoting Committee brings together representatives of the various organizations involved. Working groups operating under the umbrella of the Promoting Committee handle details of considering and fine-tuning the activities that comprise each step. An Intellectual Property Committee has been set up to manage rights and permissions, together with other aspects of intellectual property management.