



Innovative Technology for Exploration of Deep Sea Resources

Challenge for exploration into the extreme world of deep sea ~Formulating a business model for deep sea resources~

There are a variety of marine resources under the deep seafloor surrounding the Japanese islands. As a result of recent studies, potential sites of rare-earth deposits which are one of the valuable marine resources and essential for the sustainable development of our society have been identified under the seafloor at the depth between 2,000m and 6,000m in the Japanese Exclusive Economic Zone (EEZ). In this research program jointly promoted by eight ministries and agencies, we aim to develop innovative technologies for exploration of deep sea resources. These technologies will be transferred to industry, with a view to formulating a business model toward the future.



Program Director

Shoichi Ishii

Advisor to Board of Directors,
Japan Petroleum Exploration Co., Ltd. (JAPEX)

Profile

Shoichi Ishii was appointed program director of Innovative Technology for Exploration of Deep Sea Resources, Cross-ministerial Strategic Innovation Promotion Program (SIP), Council for Science, Technology and Innovation (CSTI), Cabinet Office, Government of Japan, April 20, 2018. Prior to that, he served as acting program director of Next-Generation Technology for Ocean Resources Exploration "Zipangu-in-the-Ocean". Previously, he served as executive vice president of Japan Petroleum Exploration Co., Ltd. (JAPEX) since June 2014. Prior to that, he held various positions of responsibility in the business development since joining JAPEX in 1973. He received his bachelor's degree from Department of Economics, Faculty of Humanities, Niigata University. From June 2008 to present, he has served as president of Japan CCS Co., Ltd. From October 2014 to present, he has served as president of Japan Methane Hydrate Operating Co., Ltd. He served as a member of Committee on Oceanic Resources, Japan Business Federation for 9 years.

Research and Development Topics

1. Survey and analysis of marine mineral resources

It has been reported that huge deposits of rare-earth minerals having high concentration of Rare-Earth Elements (REEs) occur in the seafloor surrounding Minamitori-shima Island in the Japanese EEZ. We narrow down the potential sites of this resource, and make a rough estimate of the amount of the REEs.

2-1. Development of survey technologies

(Multiple operation of Autonomous Underwater Vehicles (AUVs) and terminal system with a battery charger in the deep sea)

It is important to identify the accurate potential of deep sea resources. Thus, we need to establish a technology to survey geographical features and seafloor structure efficiently at the depth between 2,000m and 6,000m in the deep sea. We must develop operation technology for multiple AUVs and the deep sea terminal system enabling an underwater cruise for a longer period through battery charging.

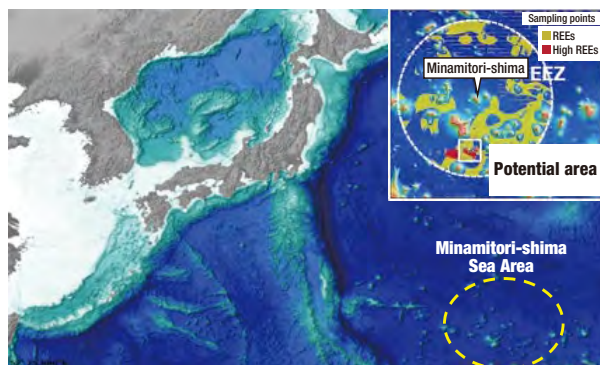
2-2. Development of production technologies

(Sampling and lifting technology of rare-earth deposits)

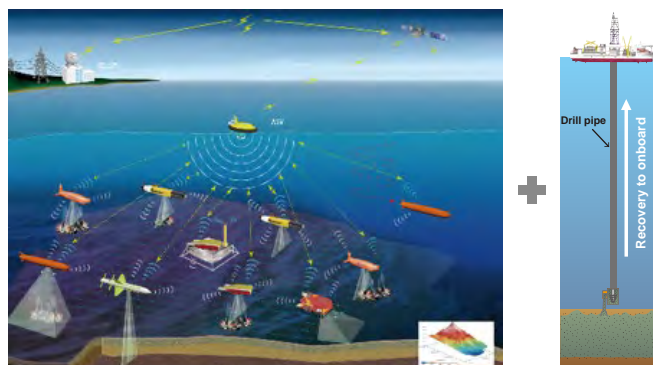
Nobody has established a continuous retrieval system of the rare-earth deposits from the bottom of deep sea. It is necessary to develop the technology for cracking to pump up the solidified rare-earth deposits, and sampling/lifting the cracked deposits by the fluid circulation through the drill pipes of the Deep Sea Drilling Vessel *Chikyu*. We verify such technologies through the field experiments to establish the engineering system as leading pioneer in the world.

3. Verification of survey and development system

Our goal is to pave the way toward the establishment of a business model to develop deep sea resources. We verify in a comprehensive way the engineering system developed through the research activities above. We take a step-by-step approach toward future industrialization for exploring deep sea resources, by gaining opportunities for the deep sea survey in response to various needs.



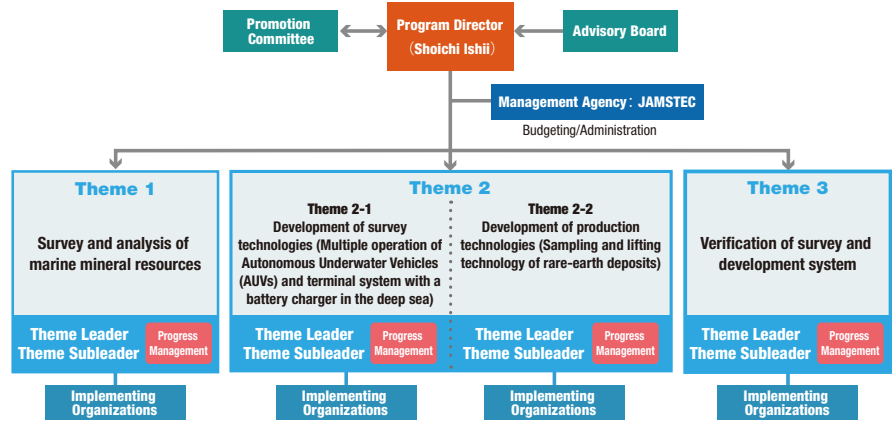
● Identification of potential sites of high concentration REEs by survey and analysis of rare-earth mineral deposits



● Development of survey technologies for the deep sea resources at the depth of more than 2,000m

Implementation Structure

Program Director (PD) is responsible for general planning and management. PD closely shares information and concept with Theme Leaders and Management Agency. Advisory Board gives advice to the PD in terms of technology and science. Promotion Committee, consisting of relevant ministries and agencies, facilitates coordination and collaboration among the government agencies. This structure will lead the program to establish the survey technologies of deep sea resources toward the future of Japan.



Leader: Cabinet Office (Council for Science, Technology and Innovation)

Subleader: National Ocean Policy Secretariat, Cabinet Office

Member: Office of National Space Policy, Cabinet Office, Ministry of Internal Affairs and Communications (MIC), Ministry of Economy, Trade and Industry (METI), Ministry of Education, Culture, Sports, Science and Technology (MEXT), Ministry of Agriculture, Forestry and Fisheries (MAFF), Ministry of Land, Infrastructure, Transport and Tourism (MLIT), Ministry of the Environment (MOE), Acquisition, Technology & Logistics Agency (ATLA)

Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Japan Oil, Gas and Metals National Corporation (JOGMEC), National Institute of Advanced Industrial Science and Technology (AIST), National Institute of Maritime, Port and Aviation Technology (MPAT)

Exit Strategies

Establish a business model for Deep Sea Resources Exploration

Survey and retrieval technologies developed through this program will be transferred to industry after verification of their practicality and effectiveness. Industrial companies, which undertake the technology implementation, win contracts for deep sea survey in response to various needs, activating next stage of marine survey. In the process of the technology transfer, we identify the challenges to overcome, examine methods to reduce the impact on the environment, and formulate a business model for the future toward the development of deep sea resources.

Progress in the next five years

Make a rough estimate of rare-earth elements (REEs) in the Minamitori-shima area

Evaluate the broad outline of the resources of the REEs in the sea area surrounding Minamitori-shima Island, where the potential for precious marine mineral resources has attracted a great deal of public attention.

Enhance the research capabilities of deep sea resources

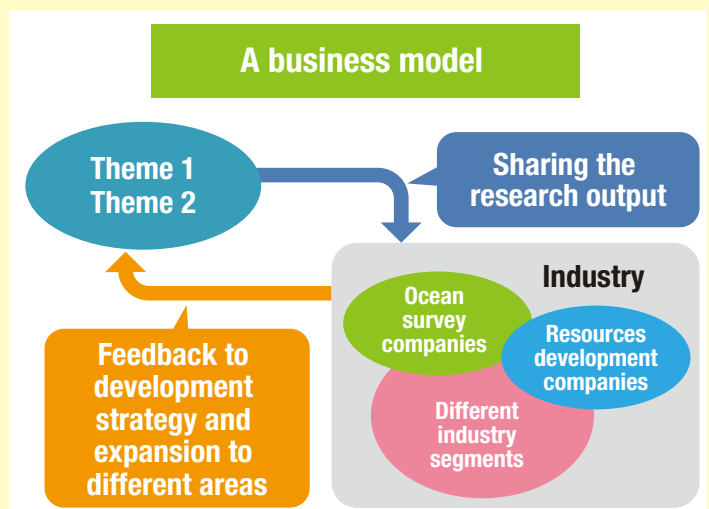
Significantly enhance the research capabilities for exploring deep sea resources, and develop the most advanced system for deep sea survey, which will enable exploration of the sea area at the depths ranging from 2,000m to 6,000m.

Realize the production technologies

Establish the sampling and recovery technology for harvesting deep sea resources, which is considered to be impossible with the existing technologies.

Transfer the technology to industry

Verify the survey and retrieval system, and transfer these research output to business companies. The role of those companies is to clarify the challenges to overcome toward industrialization and their solution.



● Conceptual diagram of business model for deep sea resources