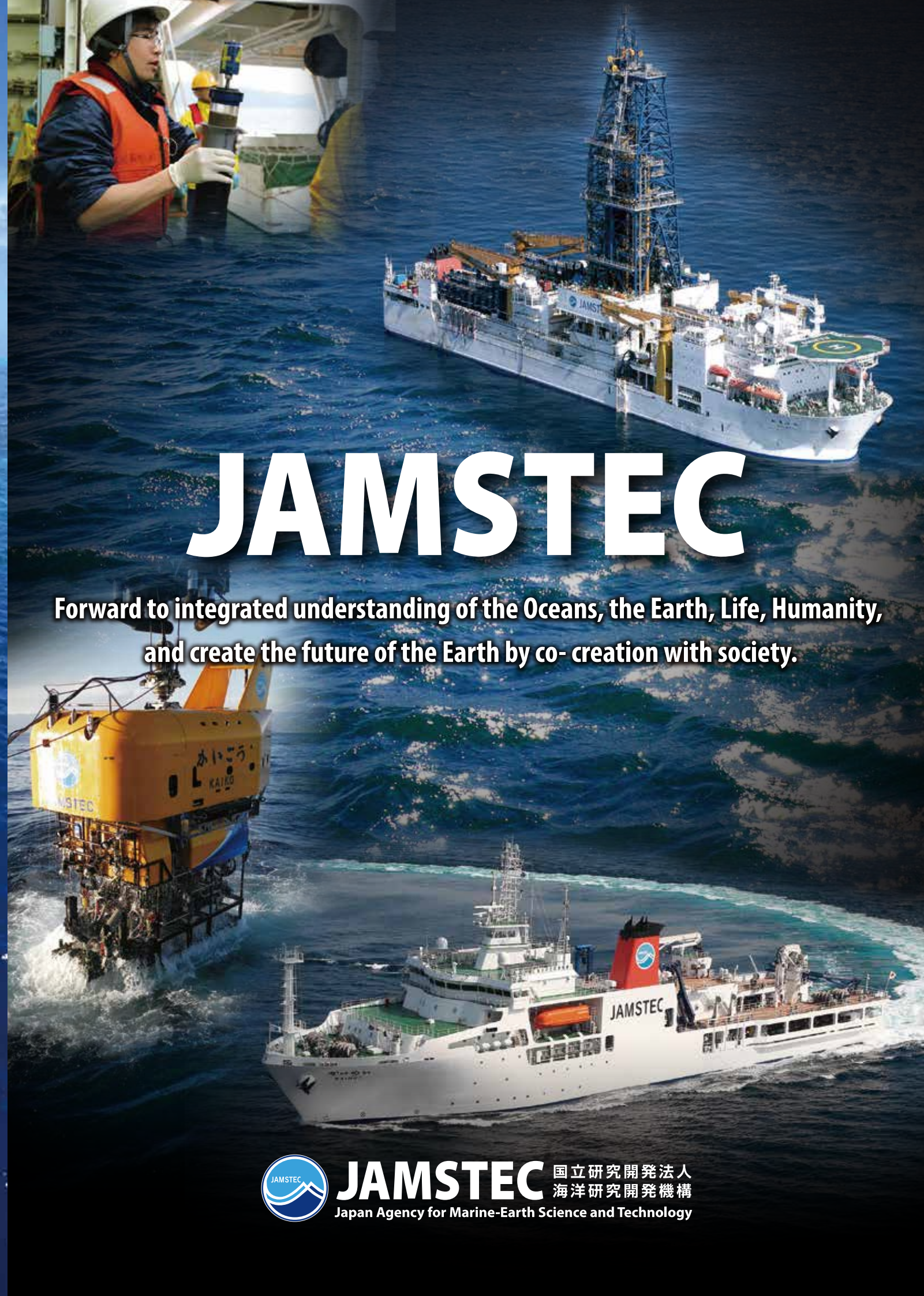




JAMSTEC  
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2019.8.27作成



# JAMSTEC

Forward to integrated understanding of the Oceans, the Earth, Life, Humanity,  
and create the future of the Earth by co-creation with society.



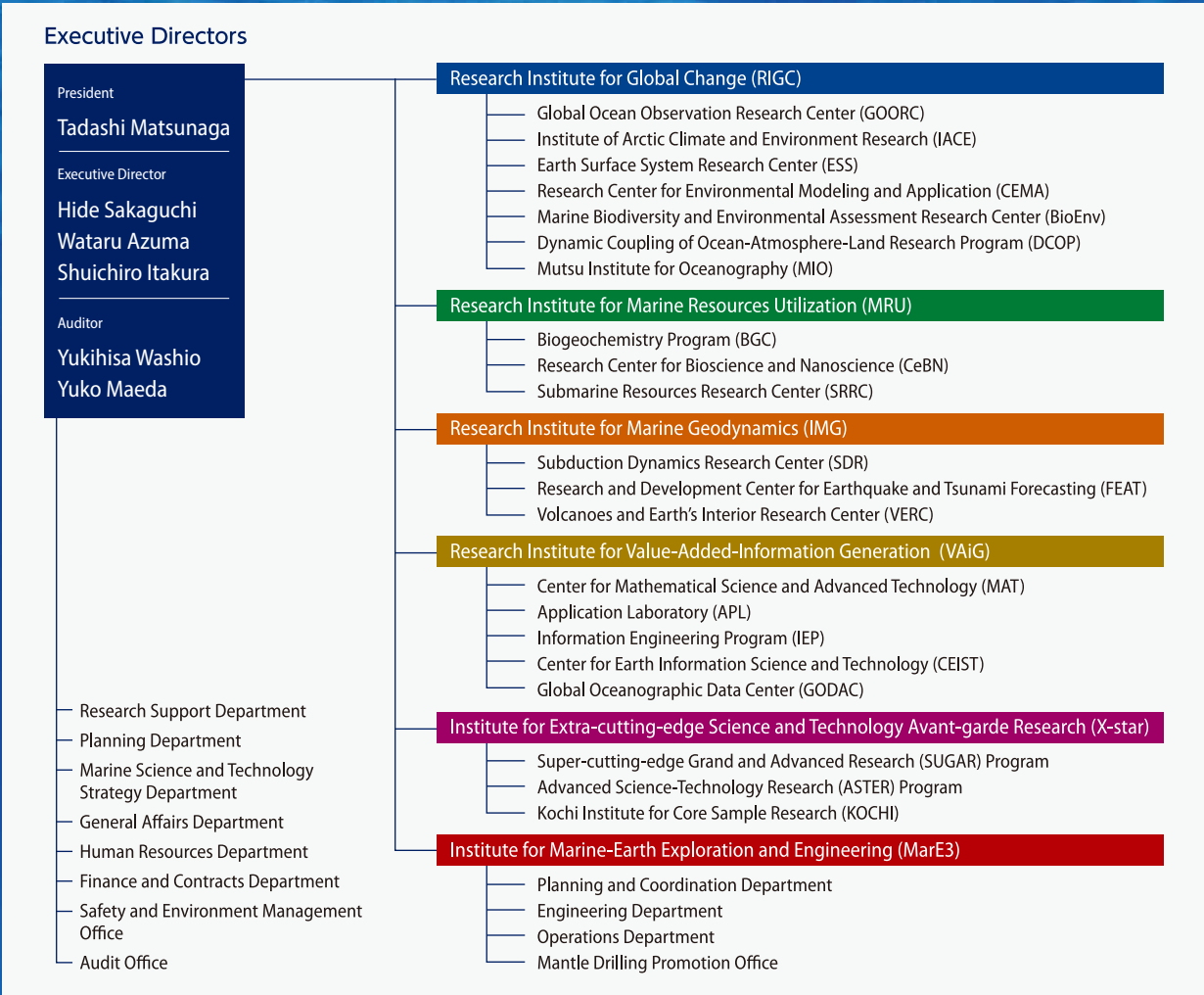
**JAMSTEC** 国立研究開発法人  
海洋研究開発機構  
Japan Agency for Marine-Earth Science and Technology



History of JAMSTEC

October	1971	Japan Marine Science and Technology Center established	August	2011	Dense oceanfloor network system for earthquakes and tsunamis (DONET1) full-scale operation launched
May	1989	Research vessel HAKUHO MARU completed	March	2012	Autonomous underwater vehicles YUMEIRUKA, OTOHIME and JINBEI completed, SHINKAI 6500 upgraded
April	1990	Deep sea survey support vessel YOKOSUKA completed	October	2012	JAMSTEC long-term vision formulated
April	1990	SHINKAI 6500 deep sea research system completed	April	2014	3rd mid-term plan launched
October	1995	Mutsu Institute for Oceanography opened	April	2015	Change in status to National Research and Development Agency
March	1997	Deep sea research vessel KAIREI completed	March	2016	Wide-area seabed research vessel KAIMEI completed
October	1997	Oceanographic research vessel MIRAI completed	March	2016	Dense Oceanfloor Network system for Earthquakes and Tsunamis (DONET2) deployment completed
November	2001	Global Oceanographic Data Center (GODAC) opened	April	2016	DONET2 transferred to National Research Institute for Earth Science and Disaster Resilience (NIED)
April	2002	Earth Simulator recorded the world's highest computing performance.	April	2017	Deep sea debris database made publicly available
August	2002	Yokohama Institute for Earth Sciences opened	September	2017	Deep-sea Bio Open Innovation Platform established
April	2004	Japan Agency for Marine-Earth Science and Technology established	October	2018	First single-pilot operation of SHINKAI 6500
July	2005	Deep sea drilling vessel CHIKYU completed	April	2019	4th mid-term plan launched
October	2005	Kochi Institute for Core Sample Research opened			
April	2009	2nd mid-term plan launched			

Organization Chart





We will promote research and development towards solution of global issues by understanding the current status and projecting the future of the global change.

To contribute to the resolution of global issues such as climate change, ocean acidification, and plastic pollution, we will lead international projects to conduct integrated research on oceans at all depths and on the close interactions of oceans with the atmosphere and land masses. We will apply the data obtained from this research to formulate both short-term seasonal predictions and mid- to long-term predictions covering centuries.

We will actively disseminate our research results through international frameworks such as the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement, the UNESCO Intergovernmental Oceanographic Commission (IOC), the Intergovernmental Panel on Climate Change (IPCC), and the Arctic Council (AC). We will contribute to the achievement of the United Nations Sustainable Development Goals (SDGs), in particular Goal 13 (climate action) and Goal 14 (life below water), as well as Japanese government policies.



1 Observing and understanding ocean environmental change and developing observation technologies

We will maintain our conventional ocean observation network while at the same time working to develop a new optimized observing system that integrates various observation platforms, including research vessels, drifting floats, and moored systems. Our goal is to understand the physical and chemical states of the ocean and their temporal development, and to uncover the mechanisms of various oceanic phenomena with the aim of producing more reliable forecasts. We also plan to miniaturize and automate observation instruments to better monitor the global ocean.



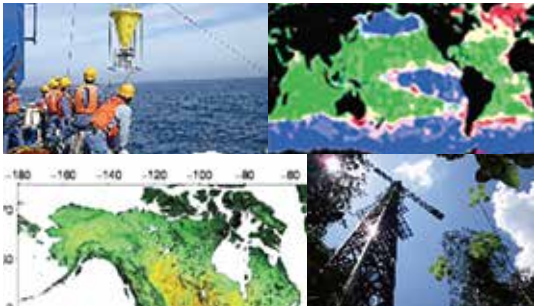
2 Understanding environmental change in the Arctic region and developing technologies for making observations under sea ice

The impacts of global warming are currently most conspicuous in the Arctic region, and we will conduct observation and prediction research there to better understand interactions between oceans and sea ice and other aspects of Arctic climate systems, and help reduce prediction uncertainties. To this end, we will also develop underwater drones and other new observation technologies to enable us to observe what is going on beneath sea ice, a difficult endeavor up to now.



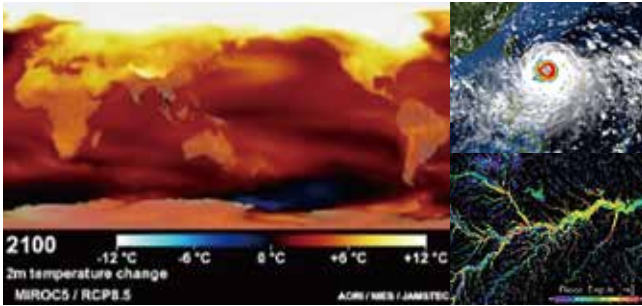
3 Understanding ecosystems/geochemistry dynamics linking Earth surface sub systems to reveal their interactions with human activities

Based on oceanic and atmospheric observations, lab experiment and model simulations, we understand and evaluate the impacts of ocean acidification, warming, hypoxia, and environmental pollution on changes and processes of ecosystems/geochemistry linking Earth surface sub systems (ocean/atmosphere/land systems) to reveal their interactions with human activities. We also focus on "hotspot" areas, Arctic region, and on Tsugaru Strait driving/representing global or near-Japan climate and environmental changes.



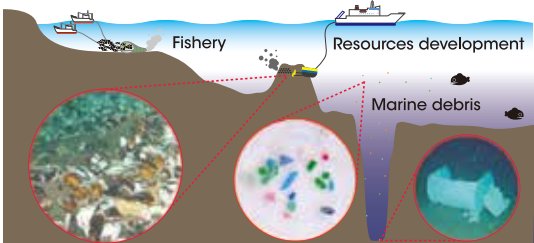
4 Projection of global environment

We work on further sophistication of the simulation models that have been developing at JAMSTEC to better project the environment on various temporal and spatial scale. We promote collaborations among different models taking the best of them, in order to obtain novel insights on phenomena ranging from short-term events such as torrential rain and typhoon, medium-term ones such as El Nino, and long-term ones such as global warming, including interactions among them.



5 Assessing the impact of human activity and global environmental change on biodiversity

In order to evaluate the impacts of human activities on the marine ecosystems, we will seek to understand the changes in marine biodiversity, which are sensitive to variations of the global environment. Particularly to fill the current data and knowledge gaps in the deep-sea ecosystems, we will develop analytical methods for environmental DNA and measuring methods of pollutants such as microplastics. Through these approaches, we aim to establish and upgrade the integrated environmental impacts assessment measures.





# Understanding material circulation and origin of marine resources to ensure sustainable use

Our primary goal is to understand the formation processes of marine resources, including organisms, minerals, and energy resources found in the ocean. In addition to conducting the research that contributes to the sustainable use of oceans, we will seek collaborations with other institutions and industries through providing marine samples and sharing data, technologies, and scientific knowledge to accelerate the utility of the ocean.



## 1 Effective use of marine organisms and biological functions

We will endeavor to develop a precise understanding of oceanic material circulation through conducting chemical and molecular biological analyses of marine biological, geological, and other specimens, identifying the environmental, physiological, and evolutionary factors controlling circulation, and developing a quantitative understanding of marine bio-resources. We will also investigate the unique capabilities acquired by organisms in the process of adapting to extreme deep-sea environments. We will contribute to society by disseminating the environmental analysis technologies and methodologies developed by JAMSTEC.



Photosynthetic bacteria inhabiting gypsum deposited by seawater evaporation



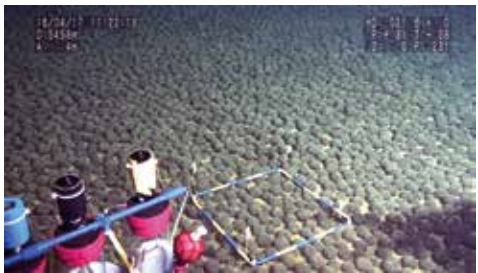
Collecting sediment from the bottom of the Challenger Deep (depth: 10,896 m) in the Mariana Trench. Our efforts will hopefully lead to the discovery of novel microbial resources.



Nano EA (elemental analyzer) / IRMS (isotopic mass spectrometer) capable of measuring the smallest amounts of trace sample isotopes by this type of device worldwide

## 2 Effective use of submarine resources

We have sought to shed light on the processes by which submarine resources are formed by conducting field research, collecting and analyzing specimens, analyzing data, and developing numerical models. These efforts have shown that both physical and chemical processes influence the concentration of elements in complex ways over a broad spatiotemporal scale. We will conduct research and development using these research methods to identify correlations between chemical and physical processes and to apply the knowledge gained to build submarine resource formation models that would enable us to theoretically pinpoint promising marine locations. We will also support the development of marine industries by broadly disseminating the knowledge and technologies we have acquired among relevant industries.

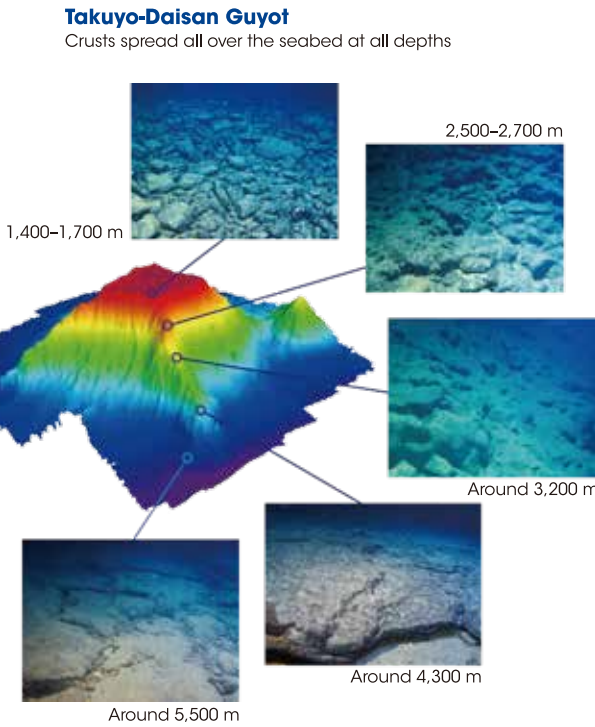


An area rich in manganese nodules discovered around Minamitorishima at a depth of 5,500–5,800 m



### A ferromanganese crust collected in the vicinity of Takuyo-Daisan Guyot

This cobalt-rich crust, which is a type of ferromanganese crust, is 13 cm thick. (It was collected by the remotely operated KAIKO Mk-IV.)





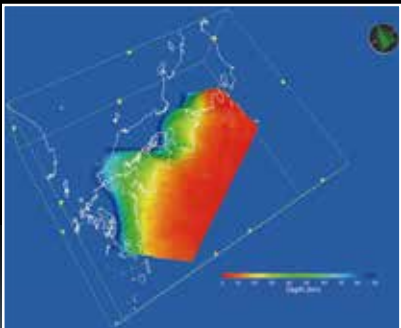
# Illuminating Earthquakes and Volcanic Activities for Disaster Mitigation

To reveal earthquakes and volcanic activities, the scientists and staff of the Research Institute for Marine Geodynamics will conduct large-scale observations around Japan and the western Pacific using JAMSTEC vessels and various state-of-the-art marine exploration technologies. In particular we will conduct geophysical-geological surveys in the Nankai Trough, Japan Trench, Kuril Trench, and other tectonically active zones that may be subject to a forthcoming megathrust earthquake or volcanic eruption. Moreover, we will develop, improve, and upgrade the methods and systems to acquire and process data.

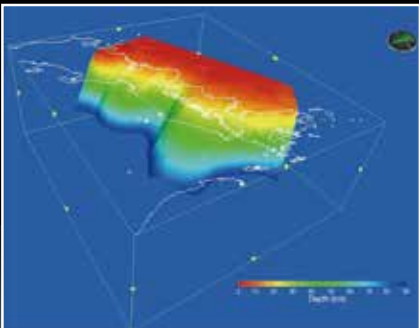
Furthermore, in line with SDGs 11 (sustainable cities and communities), our institute will contribute to disaster mitigation by sharing the scientific knowledge we have gained with society. We will also endeavor to conduct observational surveys and apply our research results in countries that are vulnerable to frequent natural disasters such as earthquakes, tsunamis, and volcanic activities.



Remotely operated vehicle HYPER-DOLPHIN collecting rocks



Three-dimensional plate geometry model of the Nankai Trough subduction zone viewed from SW and NW of Japan. Vertical exaggeration is 2.5.



## 1 Understanding seismogenic zones through offshore survey and observation

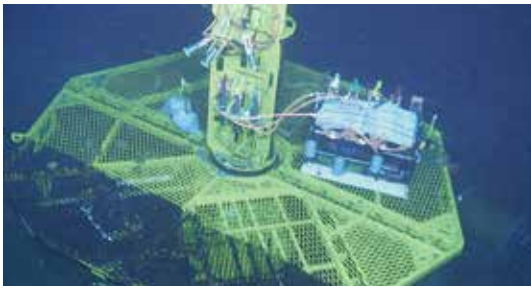
Compared with onshore earthquakes, we still know very little about offshore events. To improve this situation and make a better understanding of the current status of seismic activity, we develop and deploy a real-time observation system of seafloor crustal deformation and seismic activity. Focusing on regions having high urgency and importance as the presumed source area of large earthquakes and tsunamis, we conduct seismic surveys and observations to investigate three-dimensional crustal structure, seismic activity, the physical properties of faults, paleoseismic record, and other factors. The data we have obtained from our surveys and observations are broadly shared with relevant institutes and universities.



A laboratory on board vessel KAIMEI

## 2 Understanding about the generation process and forecasting of earthquake and tsunami

To contribute monitoring of the current status and long-term evaluation of seismogenic zones, we will accumulate and disseminate knowledge that promotes our understanding of earthquake generation mechanisms and our ability to grasp and forecast the status of the inter plate locking and slipping based on the latest data obtained from observations and research on seismogenic zones. To this end, we will integrate various data to improve the precision of our seismogenic zone models and upgrade our real-time tsunami forecasting system.



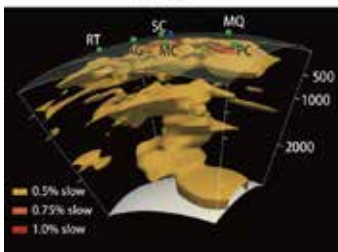
Installation of long-term borehole monitoring point C0006G (just after the KS-18-J04 HYPER-DOLPHIN connected the DONET cable)

## 3 Understanding current status of the Earth's interior and forecasting its variation as a cause of volcanic activity and the Earth's evolution

Submarine volcanic eruptions have caused sudden, large-scale disasters. Because of their huge impact on the human society and global environment, forecasting their occurrence and evaluating their impact on the environment are of vital importance. To address these issues, we will conduct ocean drilling surveys using our Deep-sea Scientific Drilling Vessel CHIKYU and investigate the internal structures of the Earth that control volcanic activity, the mechanisms controlling circulation of fluids and energy within the Earth, and magma supply systems from both single volcano and global perspectives.



Investigation of oceanic volcanoes



Behavior and circulation of solid, fluid and volatile components in the Earth's mantle (top) and a seismic tomographic image of a mantle upwelling flow beneath French Polynesia in the South Pacific (bottom)



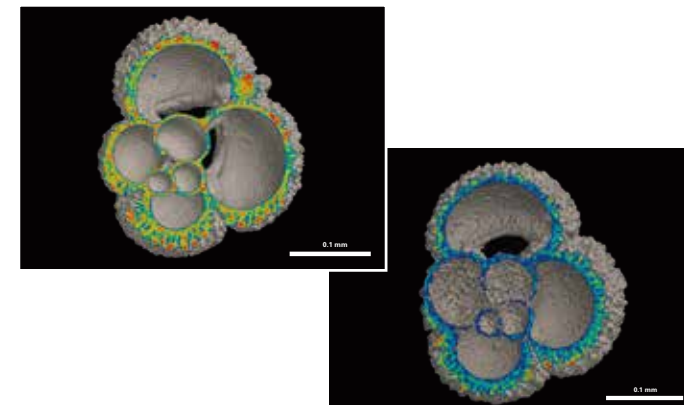
## 8



We will develop data conversion tools to unify the formats of research and development-generated data sets for the various phenomena comprising Earth systems that are based on very different scales of time, space, and other parameters. In order to mathematically process data that has been integrated by unifying formats, we will then carry out time evolution calculation and data assimilation, and develop a large-scale repository of numerical analysis methodologies of various kinds including AI and other advanced functions. As a part of repository development, we will also develop verification technologies to guarantee the quality of the numerical analyses it is used for.

We will develop a four-dimensional virtual earth as a large-scale data system equipped with advanced data analysis functions and capable of efficiently aggregating and managing data generated by the numerical analysis repository and other sources. Using this four-dimensional virtual earth, we will seek to discover and elucidate the complex relationships between intertwined Earth systems, and based on those relationships, generate information optimized to best serve user needs, making it more valuable to society as a whole.

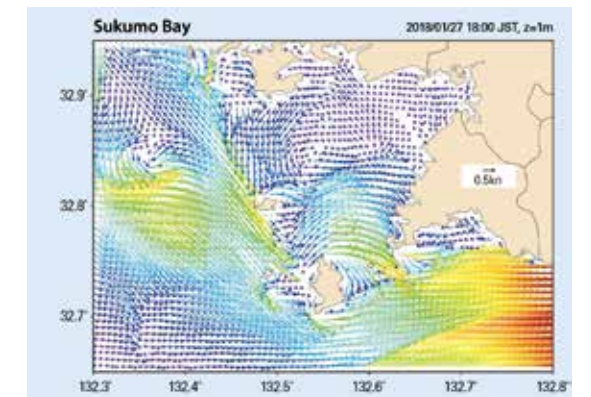
As an execution platform for the numerical analysis repository and four-dimensional virtual earth, we will build a high-speed computing system capable of handling the huge amount of information stored in the data server, connecting the system and server through a high-speed network. To further advance and support enrichment of this platform, we will also focus on security and compatibility in its development and operation so as to facilitate sharing and collaboration with other organizations and gain more users as a result.



Comprehensive assessment of the health of the marine environment



Effect of crustal movement on biota (microbial community)  
(Formation of a bacterial mat (white part) in conjunction with  
outflow of spring water from a seabed)

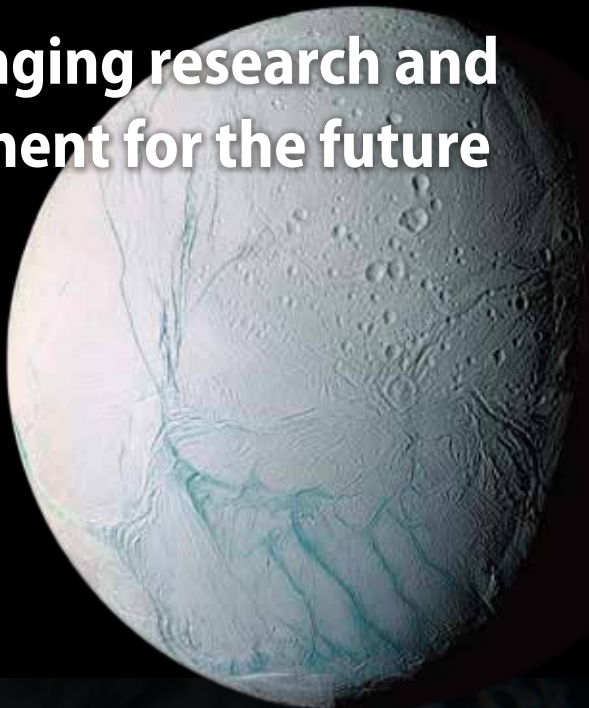


For fisheries and agriculture  
Providing fishermen with fishery area forecast information



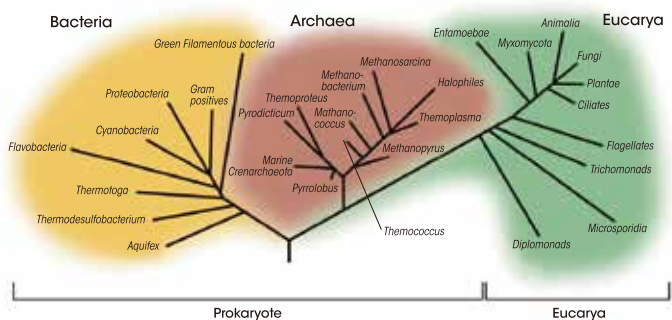
# Exploratory and challenging research and technological development for the future

Our exploratory and challenging research and development on deep-sea extreme environments, or so to be called the Earth's last frontiers, will build a scientific, technological, and intellectual platform which will lead to generating diverse knowledge and innovation to support future Japan as a maritime nation. It is expected to raise public interest in science and technology, and contribute significantly to the promotion of Japan's science and technology policies. We also lead JAMSTEC basic research and development, promote research collaboration between different fields, and accelerate mission achievement.



## 1 Basic, exploratory and challenging research based on out-of-the-box thinking

We will conduct challenging and highly speculative research with the aim of making breakthroughs and generating systematic understanding that will lead to future paradigm shift in science. Japan has already gained worldwide recognition for the originality of its exploratory research on the role of the ocean in the origin of life and the co-evolution of life and the environment, and on microbial dark matter (unknown microbes occupying dark and extreme environments) and the physiological functions supporting such life forms; by focusing on these themes, we will establish a new academic field in which Japan will lead the world.



The three domains of the tree of life

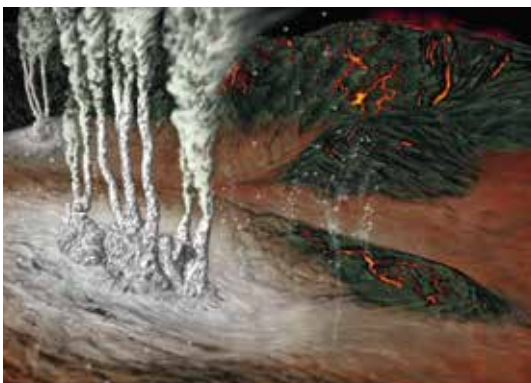


Illustration of deep sea hydrothermal activity of 4 billion years ago may have looked



Image of the birth of life in a small hole inside a deep sea hydrothermal chimney

## 2 Building the future of oceanographic technology through pioneering technological development research

With the goal of producing outcomes that transform oceanographic technology, we will engage in highly speculative and pioneering technological development research rather than endeavoring to extend existing technologies. We will focus in particular on developing original technologies that combine new exploratory technologies such as measurement using laser processing and electrochemical processing, and ultra-high resolution nanoscale analysis.



Ultra-high resolution nanoscale analysis (NanoSIMS)



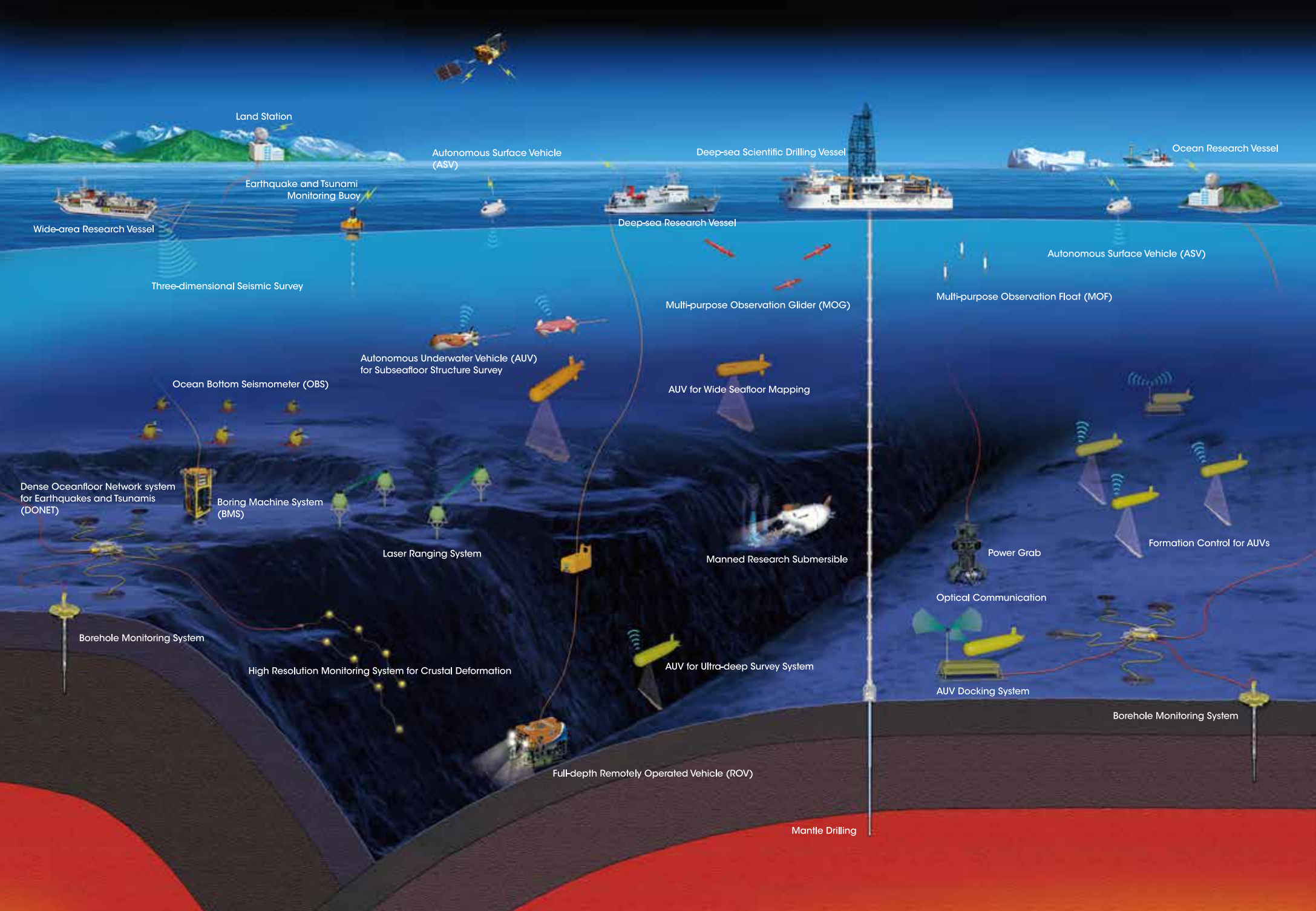
Development of deep sea organism identification technology using underwater laser processing technology

Black smoker in the Beebe Hydrothermal Vent Field of the Mid-Cayman Rise in the Caribbean Sea



# Advanced technology bringing new insights of the Earth and its oceans

Oceans occupy about 70% of the Earth's surface, and are a significant source of dynamic global change. A wide range of important marine-Earth research targets, including ocean depths, tectonic subduction zones (with related earthquakes and volcanic eruptions), hydrothermal vents, and the deep seafloor, are the primary targets of our world-leading scientific research and development program. Implementing this, while also supporting Japan's ocean policies, we will maintain and improve our advanced capabilities for investigation and observation of the world ocean and seas. We promote the continual technological development and operation of our marine research facilities, capable of supporting research across large and diverse fields of investigation, as part of the greater scientific and research community.



## 1 Ocean research platform-related technology development

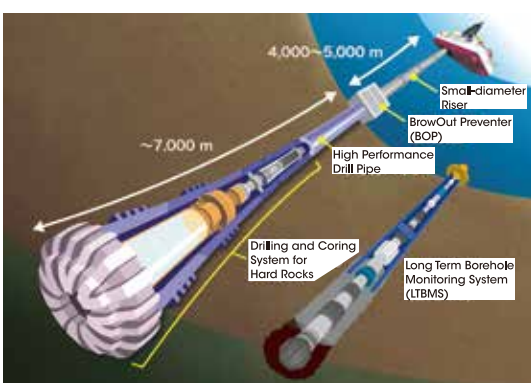
Addressing social issues related to oceans based on scientific knowledge and data requires the utilization of high-precision observation and research capabilities to appropriately understand and monitor marine environments. To that end, we will further equip ourselves with both remotely operated and autonomous underwater vehicles capable of supporting investigation over wide areas and deep zones, and will continue to consider development of the next generation of manned research submersibles. We will also continue to develop fundamental cutting-edge observation systems, sensors, and other relevant technology.



Implement remotely operated and autonomous underwater vehicles

## 2 Development of ultra-deep water and ultra-deep drilling technologies

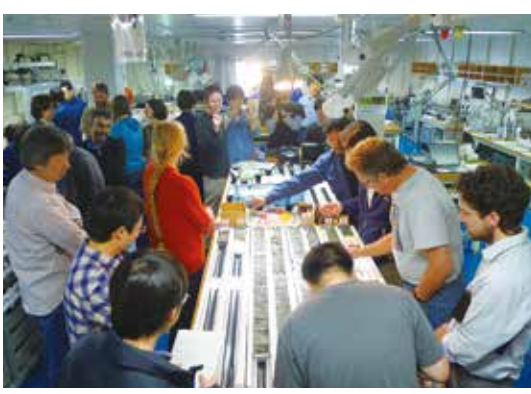
Ultra-deep water and ultra-deep drilling and related technologies, and borehole observation technologies are required to investigate mechanisms of earthquake generation, the subseafloor biosphere and its functions, and to carry out future mantle drilling. We will accordingly develop these necessary technologies in stages.



Development of ultra-deep water and ultra-deep drilling technologies

## 3 Operation of ocean research platforms

We will operate safe, efficient, and stable ocean research platforms that addresses R&D and societal needs. We will continue to upgrade the functions and performance of our equipment and facilities, and incorporate newly developed methodologies and technologies to enable the implementation of sophisticated research and observation. We will also provide users of our oceanographic research platform with scientific and technical support.





Research Facilities



Length  
210.0m

Gross tonnage  
56,752 tons

Complement  
200 persons

Commissioned  
2005

Deep-sea Drilling Vessel **CHIKYU**




Length  
100.5 m

Gross tonnage  
5,747 tons

Complement  
65 persons

Commissioned  
2016

Research Vessel **KAIMEI**



Length  
105.2 m

Gross tonnage  
4,439 tons

Complement  
60 persons

Commissioned  
1990

Support Vessel **YOKOSUKA**



Length  
106.0 m

Gross tonnage  
4,517 tons

Complement  
60 persons

Commissioned  
1997

Deep Sea Research Vessel **KAIREI**



Length  
128.5 m

Gross tonnage  
8,706 tons

Complement  
80 persons

Commissioned  
1997

Oceanographic Research Vessel **MIRAI**



Length  
100 m

Gross tonnage  
3,991 tons

Complement  
89 persons

Commissioned  
1989

Research Vessel **HAKUHO MARU**



Length  
66 m

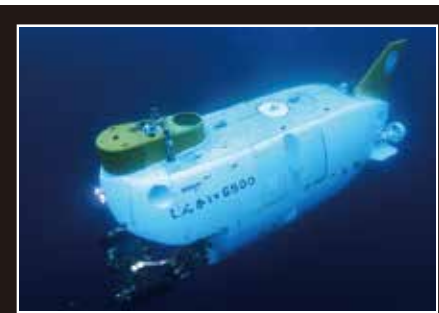
Gross tonnage  
1,635 tons

Complement  
41 persons

Commissioned  
2013

Research Vessel **SHINSEI MARU**

Research Facilities



Depth capability  
6,500 m

Complement  
3 persons

Length  
9.7 m

Weight in the air  
26.7 tons

Manned Research Submersible  
**SHINKAI 6500**

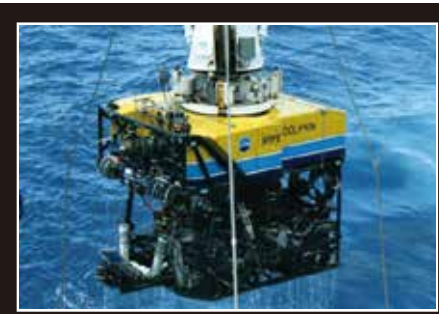


Depth capability  
(launcher)11,000 m  
(vehicle Mk-IV)7,000 m

Length  
(launcher)5.2 m  
(vehicle Mk-IV)3.0 m

Weight in the air  
(launcher)5.8 tons  
(vehicle Mk-IV)5.5 tons

Remotely Operated Vehicle (ROV)  
**KAICO**




Depth capability  
4,500 m

Length  
3.0 m

Weight in the air  
4.3 tons

Remotely Operated Vehicle (ROV)  
**HYPER-DOLPHIN**




Depth capability  
3,500 m

Length  
10.0 m

Weight in the air  
7.0 tons

Autonomous Underwater Vehicle (AUV)  
**URASHIMA**




Depth capability  
3,000 m

Length  
4.0 m

Weight in the air  
1.7 tons

Autonomous Underwater Vehicle (AUV)  
**JINBEI**




Depth capability  
6,000 m

Length  
3.3 m

Weight in the air  
1.0 tons

Deep Ocean Floor Survey System  
**DEEP TOW**



Number of processors  
5,120

(Number of Core)  
(20,480)

Peak performance  
1.31 PFLOPS

Main memory capacity  
320 TB

(Yokohama Institute for Earth Sciences)  
**Earth Simulator**



Storage capacity  
About 250km  
at a maximum

Storage environment  
Temperature  
about 4 degrees  
Humidity  
about 80%

(Kochi Institute for Core Sample Research)  
**Core Repository**



## Databases

The following databases are available on the JAMSTEC website.

**JAMSTEC Data Catalog**  
JAMSTEC データカタログ

Data Catalog

**JAMSTEC 文書カタログ**  
JAMSTEC Document Catalog

JAMSTEC Document Catalog

**BISMaL** Biological Information System for Marine Life

BISMaL (Biological Information System for Marine Life)

**JAMSTEC Grid Data Archive System**

JAMSTEC Grid Data Archive System

**DARWIN** JAMSTEC 航海・潜航 Data and Sample Research System for Whole Cruise Information in JAMSTEC データ・サンプル探索システム

Data Research System for Whole Cruise Information (DARWIN)

**J-EDI** 深海映像・画像アーカイブス  
JAMSTEC E-library of Deep-sea Images

JAMSTEC E-library of Deep-sea Images (J-EDI)

### Documents and Reports

- Earth Simulator Research Results Repository
- JAMSTEC Repository
- JAMSTEC's Patent List

### Images and Samples

- JAMSTEC E-library of Deep-sea Images (J-EDI)
- Marine Biological Sample Database
- Deep Seafloor Rock Sample Database (GANSEKI)
- COre Electronic Database of Ocean floor (COEDO)

### Marine Observation Data

- Argo JAMSTEC
- TRITON web
- Indo-Pacific\*
- Subsurface ADCP mooring dataset
- JAMSTEC Compact Arctic Drifter (J-CAD, POPS)\*
- JAMSTEC OceanSITES
- Database for time-series stations K2 and S1
- Paleoclimate-Ocean Database
- Extremo Base
- Image database of planktonic foraminifera
- Okinotorishima Island Observations\*

### Terrestrial Observation Data

- Cryosphere Data Base

### Earthquake and Geoscience Data

- Crustal Structural Database Site
- JAMSTEC Ocean-bottom Seismology Database (J-SEIS)
- Google Earth as geoscience data browser project

### Forecasts and Simulations

- Global Chemical Weather Forecast System
- Japan Coastal Ocean Predictability Experiment (JCOPE) System (ocean weather forecasts)
- Low-latitude Climate Prediction Research
- ALERA (AFES-LETKF experimental ensemble reanalysis)
- ALERA2
- General Ocean Circulation Model for the Earth Simulator Center (OFES)
- Estimated State of Global Ocean for Climate Research

\*Japanese only

## Collaboration with others

Through collaborations with countries, universities, private industry, and other parties, we actively participate in joint projects, personnel and information exchanges, and networking events with the aim of developing, enhancing, and raising the profile of our intellectual property. We will further pursue cooperation and collaboration with regional marine industry promotion and human resource development measures, and promote activities aimed at achieving the goals of collaborative initiatives with private industry and other stakeholders.



XPRIZE competition entry brought together 23 organizations from industry, academia and government.

## International cooperation

We actively engage in SDGs and other international frameworks, and will take on leadership roles as required. We also seek to drive the further growth of oceanographic research and technology and strengthen Japan's research and development capabilities in the field by building effective structures for cooperation with overseas organizations. We will continue to operate "CHIKYU" for international scientific drilling programs such as the Integrated Ocean Drilling Program (IODP), and will pursue a range of initiatives to drive scientific drilling projects.



Researchers discussing core samples collected on an IODP cruise

## Human resource development

We will pursue efficient and effective initiatives to nurture young talent in the field of marine science and technology and expand the human resource base by leveraging connections with other organizations. We will actively disseminate information on our human resource development initiatives through our website and other means in a way that encourages young people to consider a career as a researcher or technician.



Young researchers participating in a course on analytical techniques

## Public relations

We conduct strategic public relations according to the purposes to promote public awareness and understanding of our activities. We will pursue clear and effective public relations initiatives by leveraging the facilities and equipment of our sites and working with the media, private industry, and other parties.



Research vessel open day