We aim to observe and survey the ocean across the world for understanding the present state and possible future changes in the atmosphere, in the ocean, on the deep sea floor, and even beneath the seafloor.

Exploring submarine resources

We will contribute to the studies on the origin of the submarine resources and on the establishment of environmental assessment methodologies by operating deep sea vessels and developing survey technologies to explore effectively the seafloor hydrothermal deposits, cobalt-rich crusts, deep sea mud rich in rare earth elements, and methane hydrates.

We aim to establish four-dimensional integrated ocean survey and observation systems.

Exploring extreme biosphere

Utilizing the manned submersible Shinkai 6500 and other unmanned vehicles, we will contribute to the studies on the functions and evolution of the ecosystem, and on the role of organisms by exploring the extreme environment biosphere spreading over the deep seafloor and beneath it.

Surveying seismogenic zones

We will contribute to imaging, with advanced seismic survey systems, of geological layers and faults in boundary regions of continental plates which are considered as major seismogenic zones, in understanding of impacts of earthquakes and tsunamis on the marine ecosystem and its recovery process, and to constructing the Disaster Countermeasures Network System for Earthquakes and Tsunamis (DONET) for disaster prevention and reduction.

Observing global environmental change

We will contribute to constructing the long-term comprehensive observing system in a wide area that can detect environmental changes and impacts associated with global warming, such as the ocean acidification caused by the dissolution of CO₂ gas into the seawater and its effect on the marine ecosystem.

Changes in geological layers before and after the large earthquake in the Japan Trench are observed using the marine seismic systems on DONET and the ROVs. The seismic lead data is mapped for significant displacement of geological layers.

RV Mirai is used for a comprehensive research on the ocean and atmosphere in the South Ocean, where significant climate change-related signals such as a decrease in sea ice extent would appear.

A surface mooring buoy developed by JAMSTEC can monitor the ocean temperature at various depths for a long term.

A conductivity-temperature-depth (CTD) profiler is used to measure ocean temperature and salinity parameters for understanding the ocean circulation and the marine ecosystem.

Changes in geological layers before and after the large earthquake in the Japan Trench are observed using the marine seismic systems on DONET and the ROVs. The seismic lead data is mapped for significant displacement of geological layers.

In the tropical ocean, the surface mooring buoy monitors the ocean temperature at various depths for a long term.
We will develop next-generation ocean technologies based on assured technological capabilities.

For realizing deeper, wider, and quicker surveys and observations, we conduct research and development of next-generation ocean technologies such as underwater vehicle technology, underwater acoustic technology, observing technology of oceanic and atmospheric environments, and fundamental technologies related to ocean renewable energy and submarine resources.

Basic technological research Fostering next-generation ocean technologies

Underwater laser communication

Ultra-high-speed underwater laser communications technology is being developed by using the acoustic delay wave. By the end of 2019, the researchers aim to achieve a data communication rate of 10 gigabits per second, which is enough to transmit the information of video streaming. Once the technology is established, underwater laser communication will be realized.

Acoustic tracking technology

We are studying acoustic tracking technology based on sound velocity inversion technique to observe underwater sound received by a hydrophone by utilizing sound velocity information. Our objective is to achieve the near-perfect tracking of navigation signals with the use of navigation signal itself, which is considered to be difficult to achieve by conventional methods.

Microfluidic devise

Applications of advanced microfluidic devices and techniques are expected to develop the next generation of high-performance analytical systems for marine minerals, petroleum, and biological samples and organisms that can be monitored on AUVs and ROVs.

Automatic sampling equipment

As an automatic sampling and tracking instrument has been developed to obtain high-quality data for the analysis of the marine environment.

Wave coverager generator for moored buoy

A high-efficiency wave coverager generator is being developed to enhance the status and durability of the buoyant system. It will make the observation period longer by supplying power to the sensors and data collection unit.

Synthetic aperture sonar

A synthetic aperture sonar has been developed to survey a wider area and enable higher-resolution imaging from moving high-speed ships in the world.

Corrosion protection coating

A corrosion protection technology that is expected to significantly extend the useful life of underwater equipment is being developed.

Inertial navigation system (INS)

A world-class compact and high-performance INS has been developed by using MEMS. It has been mounted on the newly developed AUVs for the ROV.

Lightweight high-strength cable

We have developed a lightweight high-strength cable that can be used for the ROV. The cable is made of high-strength composite materials and is expected to be able to connect high-performance instruments to an ROV.

High-strength buoyant material

In order to strengthen and allow ROVs to move more freely in the deep sea, we have developed a high-strength buoyant material which withstands high pressure in the deep sea. It has been applied to equipment on an ROV.

New fuel cell system for underwater equipment

A high-efficiency fuel cell system is being developed for longer operation of various kinds of submarine equipment.

New GF for ROV system

In order to make an ROV system operate in the deepest ocean, we will upgrade the system equipment with the high-pressure-resisting instruments than we introduced developing.

Compact coring system for ROV

A small-size coring system is being developed and is to be equipped on ROVs for extruding sediment samples. This device can also be used to observe the geology of the sea floor.

Tsunami and seafloor deformation monitoring system

A sensor buoy system is being developed for monitoring tsunami and seafloor deformation. It will enable the real-time monitoring of a few thousand meters deep areas where the tsunami arrives like the Fukushima nuclear power.

Position-fixed underwater glider

An underwater glider is being developed to carry buoyancy sensors and marine observation equipment.

Program for Developing and Promoting Practical Application

To achieve social contribution by supporting practical application of our research achievements, JAMSTEC set up the Program in FY 2007 aiming at technological commercialization and transfer in collaboration with private companies.

New-generation OBS for extensive seismic study

A compact lightweight high-performance OBS for broadband OBS surveying is being developed.

Free-fall type deep-sea survey vehicle 'Edokko No.1'

The construction of two deep-sea survey vehicles and the free-fall type deep-sea survey vehicle will be completed in 2012. They will be capable of observing the sea floor in water depths greater than 2,500 meters.
We support research activities by operating and managing research vessels, underwater vehicles, and observational equipment.

### Research vessels

Taking researchers to the oceans in the world

<table>
<thead>
<tr>
<th>R/V YOKOSUKA</th>
<th>R/V KAIKEI</th>
<th>R/V MIRAI</th>
</tr>
</thead>
<tbody>
<tr>
<td>** Completion **</td>
<td>1990</td>
<td>1997</td>
</tr>
<tr>
<td>** Length overall (m) **</td>
<td>105 x 16</td>
<td>106 x 16</td>
</tr>
<tr>
<td>** Gross tonnage (tons) **</td>
<td>4,439</td>
<td>4,517</td>
</tr>
<tr>
<td>** Sea speed (knots) **</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>** Accommodation (crew/reserachers, etc.) **</td>
<td>60 / (27 / 33)</td>
<td>60 / (27 / 33)</td>
</tr>
<tr>
<td>** Main engine power **</td>
<td>2,206 kW x 2</td>
<td>2,206 kW x 2</td>
</tr>
<tr>
<td>** Major equipment **</td>
<td>MBE, GPS, ADCP, UQC</td>
<td>MBE, GPS, ADCP, UQC</td>
</tr>
</tbody>
</table>

### Underwater vehicles

<table>
<thead>
<tr>
<th>SHINKAI 6000</th>
<th>KAIKO</th>
<th>DEEP TOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>** Length (m) **</td>
<td>9.7 x 2.7 x 4.1</td>
<td>5.2 x 2.6 x 3.2</td>
</tr>
<tr>
<td>** Weight in air (t) **</td>
<td>27.0</td>
<td>5.8</td>
</tr>
<tr>
<td>** Depth (m) **</td>
<td>6,600</td>
<td>11,000</td>
</tr>
<tr>
<td>** Accommodation **</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>** Major equipment **</td>
<td>MBE, GPS, ADCP, UQC, Acoustic navigation system</td>
<td>MBE, GPS, ADCP, UQC, Acoustic navigation system</td>
</tr>
<tr>
<td>** Control method **</td>
<td>Tethered remote operation</td>
<td>Tethered remote operation</td>
</tr>
<tr>
<td>** Operation status **</td>
<td>Operational</td>
<td>Operational</td>
</tr>
</tbody>
</table>

### Observational equipment

Detecting changes in the atmosphere and ocean, and visualizing the seabed

<table>
<thead>
<tr>
<th>AUV</th>
<th>Autonomous Underwater Vehicle</th>
<th>ROV</th>
<th>Remotely Operated Vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>URAISHIMA</td>
<td>10.6 x 1.3 x 1.3</td>
<td>4.0 x 1.1 x 1.0</td>
<td>2.5 x 2.1 x 1.4</td>
</tr>
<tr>
<td>JINBEI</td>
<td>1.7</td>
<td>1.7</td>
<td>5.0 x 1.2 x 1.2</td>
</tr>
<tr>
<td>OTOMI</td>
<td>3.5</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>YUMERIKA</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>** Observation equipment **</td>
<td>Doppler meter, CTD, water sampling system, ADCP, acoustic Doppler current profiler, multi-channel system, high-definition television camera</td>
<td></td>
<td></td>
</tr>
<tr>
<td>** Control method **</td>
<td>Unmanned autonomous control</td>
<td>Unmanned autonomous control</td>
<td>Unmanned autonomous control</td>
</tr>
<tr>
<td>** Operation status **</td>
<td>Under development</td>
<td>Under development</td>
<td>Under development</td>
</tr>
</tbody>
</table>

### Undersea Ecosystem

Oceanic Bottom Seismograph (OBS): A seismic sensor system used to detect the age of geologic faults beneath the seafloor. The OBS sonar transmits a pulse of energy in an acoustic wave, and the returning signal is used to determine the age of the seafloor. OBSs are distributed to several thousand meters below the seafloor to provide data on the deep ocean. OBSs are deployed on the seafloor, and data are transmitted using a sub-bottom profiler and/or cables. After receiving seismic data, they are transmitted through the seafloor. The OBS system can be used to conduct 2D and 3D seismic surveys, which can detect the age and depth of geologic faults beneath the seafloor.

The Doppler meter is equipped on ROV Atago to monitor the direction of the flow of water in the ocean. It can be used to detect changes in the direction of the flow more accurately.
Research vessel KAI MEI launched

Principal particulars

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length overall</td>
<td>100.5 m</td>
</tr>
<tr>
<td>Beam</td>
<td>20.5 m</td>
</tr>
<tr>
<td>Designed load draft</td>
<td>6.0 m</td>
</tr>
<tr>
<td>Gross tonnage</td>
<td>5,747 tons</td>
</tr>
<tr>
<td>Sea speed</td>
<td>12.0 knots (22 km/hr)</td>
</tr>
<tr>
<td>Cruising distance</td>
<td>9,000 nautical miles (approx. 17,000 km)</td>
</tr>
<tr>
<td>Accommodation</td>
<td>95 (crew 27, researchers and others 38)</td>
</tr>
</tbody>
</table>

Major equipment

Seismic Survey System
(2D, 3D, High-resolution 3D)

40 m Piston corer
(Maximum Depth: 10,000 m)

Boring Machine System
(Maximum Depth: 3,000 m,
Core length: 30 m)

10,000 m CTD / water sampler

“KAI MEI” is one of the world’s most advanced research vessels which is enabled to conduct total scientific research. It is capable of closely monitoring the general make up of mineral substances and deposits, while performing broad investigations into the sea bed such as the distribution of seabed resources. It is equipped with state-of-the-art research facilities, sampling equipment and research laboratories in which obtained samples can be analyzed under fresh conditions.

On-site snapshots

Organization of MARITEC

Planning and Coordination Office
Marine Technology Development Department
- Marine Key Technology Group
- Underwater Vehicle Technology Group
- Long-Term Observation Technology Group
- Underwater Acoustic Technology Group
- Marine Sensor Technology Group

Director-General

Research Fleet Department
- Planning Group
- Ship Operations and Engineering Group
- Underwater Vehicle and observation system Operation Technology Group
- Coastal Area and EEZ Coordination Group
- Seafarer Team

Contact

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

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May 2016