

# INTRODUCTION TO MARINE SCIENCE AND TECHNOLOGY/ MARINE INFORMATION CENTERS IN JAPAN

Tatsunosuke Tsuzuku

Technical Information Services  
Japan Marine Science and Technology Center  
2-15 Natsushima-cho, Yokosuka, 237, JAPAN

**ABSTRACT:** This paper introduced the basic guidelines for the promotion of marine science and technology and R & D in marine science and technology in Japan. The following sections summarize marine information activities in Japan.

## JAPAN

### *Topography*

The Japanese archipelago is a part of the island arc that borders the eastern edge of the Asian continent and corresponds to the edge of the continental crust that forms the Asian continent. The eastern side of the Japanese islands directly touches the oceanic crust of the Pacific Ocean. The fact that the islands are located near the border of the two crusts has much to do with their geological characteristics.

Topographically, the Kuril Arc; the Sakhalin-Hokkaido Arc; the Honshu Arc; connecting Kyushu, Shikoku, Honshu, and the western part of Hokkaido; and the Ryukyu and Izu-Ogasawara arcs make up the Japanese islands, with each arc assuming a form projecting toward the Pacific Ocean. The Kuril, Japan, and Izu-Ogasawara trenches constitute one continuous trench that assumes the form of an arc projecting toward the west. This trench is a narrow, submarine channel with a depth of about 9,000 meters (30,000 ft) in some areas. The Japan Trench, however, is not connected to the shallower Nankai Trough in the opening between Shikoku and Kyushu, nor is the Nankai Trough connected to the Ryukyu Trench. The Philippine Basin is separated from the Pacific Ocean by the Izu-Ogasawara Arc, and the Nankai Trough and Ryukyu Trench together correspond to the northern edge of the Philippine Basin.

The Sea of Okhotsk, the Sea of Japan, and The East China Sea separate Japan topographically from the Asian continent. They are called marginal seas, which are generally shallow, although some basins in the Sea of Okhotsk and The Sea of Japan are 3,000-4,000 meters (9,000-13,000 ft) deep.

The geological structure of Japan is reflected in the facts that the Japan Trench is not connected to the Nankai Trough and that the Kuril Arc, the northeastern part of the Honshu Arc, and Izu-Ogasawara Arc are one continuous island arc. The southwestern part of the Honshu Arc and Ryukyu Islands are a separate arc formed in a comparatively older period. Geologically the former is called northeastern Japan and the latter southwestern Japan.

### *Japan and the Ocean*

Japan has approximately 380,000 km<sup>2</sup> of land on four major islands (Hokkaido, Honshu, Shikoku, and Kyushu) and over 3,000 smaller islands spanning 4,000 km along the north-south axis. Nearly 80 percent of this land is mountainous and covered in dense forest. The remaining land is divided between farmed plains (17 percent) and the tightly-packed urban centers (3 percent). Most of these urban centers occur in coastal areas where the majority of Japan's 123 million people live. This distribution of land use gives Japan one of the highest population densities in the world.

Japan is heavily dependent on ocean resources. Forty-four percent of Japan's food is provided by the ocean and the annual per capita consumption of fish is the highest in the world at approximately 70 kg. Japan is the world's leading nation in fisheries production and international fisheries trade. The ocean also offers space to the crowded Japanese coastal cities and towns through land reclamation and building structures above and in the sea.

## **INTRODUCTION TO MARINE SCIENCE AND TECHNOLOGY IN JAPAN**

Varied forms of marine life, untapped mineral resources and abundant energy sources make ocean development a promising area. As ocean dynamics have a great influence on the global climate changes and crust dynamics do on earthquakes and volcanism, it is urgent to elucidate mechanisms related to the ocean. Accordingly, the promotion of ocean science and technology is essential to encourage ocean development and to elucidate various ocean phenomena.

### *Basic guideline for R&D*

"The Council for Ocean Development" is an advisory committee to the Prime Minister which deliberates basic and general issues related to ocean development. The Council's Recommendation pursuant to the Prime Minister's Inquiry on *Basic Concepts and Promotional Guidelines for Long-term Ocean Development*, submitted in May 1990, identifies the following basic principles for the advancement of ocean science and technology.

- The promotion of oceanographic studies and development of technologies for the elucidation of global environment changes and ocean phenomena.
- The promotion of science and technology which is useful for creating new ways of ocean development as overcoming severe oceanic conditions.

The recommendation also proposes the promotional guidelines in various fields as follows.

- Utilization of ocean resources
- Utilization of ocean space
- Contribution to global environmental issues and conservation of the environment
- Ocean surveys and research
- Ocean-related technology development
- Ocean-related international issues
- Provision of the basis technologies for support ocean R&D

Related governmental ministries and agencies are engaged in promoting R&D in ocean science and technology under their respective jurisdictions in accordance with the guidelines of the Council's recommendation. Further, the various ministries and agencies coordinate closely to ensure comprehensive promotion under "the Liaison Council for Ocean Development-related Ministries and Agencies", which compiles annually "the Ocean Development Promotion Program", which ministries and agencies follow to make their annual plan.

#### *Research and Development*

The Science and Technology Agency (STA) promotes comprehensive R&D concerning a number of ocean science and technology fields conducted mainly by Japan Marine Science and Technology Center (JAMSTEC). JAMSTEC developed submersible vessels in order to provide information in the following areas.

- Mapping of the ocean floor concerning the prediction of seismic activity
- Studies on deep-sea animals and microorganisms
- Studies on crustal movements in deep sea floor
- Studies on circulation of substance in deep sea areas

In August 1989 the manned research submersible *Shinkai 6500* set a world record by making a descent to a depth of 6,527 meters in the Japan Trench. Deep-sea studies are also underway using the manned *Shinkai 2000* and the unmanned *Dolphin 3k; Kaiko*, a 10,000 m class unmanned submersible has been constructed and is presently undergoing field trials.

JAMSTEC has conducted R&D, such as the development of shipboard laser technology to measure the distribution of plankton in the sea, and the development of acoustic tomography technology for three-dimensional observations of temperature, current and density field over an area of 1,000 square km. In the field of diving technology for undersea operations, JAMSTEC carried out experimentation with the objective of establishing saturation diving techniques to a depth of 300 m. JAMSTEC conducts joint projects with local governments in order to create a basic framework for the effective utilization of ocean areas at regional and local levels by taking into account the marine characteristic of each area.

STA also organizes joint R&D projects among several related organizations, usually JAMSTEC as a member, by allocating "the Special Coordination Funds for Promoting Science and Technology". These joint R&D projects include the research on ocean-flux in East China Sea in

the form of Japan-China cooperative work, the survey of the meandering flow of the Kuroshio to evaluate its effect on weather and fishing of Japan and East Asia, and development of the effective utilization technology of deep-sea water.

The Ministry of Education is conducting ocean-related academic activities mostly through the Ocean Research Institute of the University of Tokyo (ORI). Programs include research on ocean flux for the clarification of carbon cycles in the ocean, participation in the international deep-sea drilling program (ODP), and the cooperative study in the West Pacific Ocean (WESTPAC).

The Ministry of Agriculture, Forestry and Fisheries, through the Fisheries Agency, is making surveys of both fish resources and fishing environment, and promoting R&D concerning sea farming.

The Ministry of International Trade and Industry, through the National Institute for Resource and Environment and the Geological Survey of Japan, is conducting research on ocean floor mineral resources and carrying out surveys on carbon flux in the North Pacific.

The Ministry of Transport is conducting regular surveys on oceanographic items for hydrographic services through the Hydrographic Department, the Maritime Safety Agency, and on meteorological items at sea for meteorological services through the Meteorological Agency.

The Ministry of Construction is conducting land and sea surveys in connection with its coastline operations.

#### *Administrative Structure and Organizations related to Marine Science and Technology in Japan*

##### **Cabinet**

##### **Prime Minister's Office**

Council for Ocean Development

##### **Science and Technology Agency**

National Research Institute for Earth Science and Disaster Prevention (NIED)

Japan Marine Science and Technology Center(JAMSTEC)\*

National Space Development Agency of Japan (NASDA)\*

Institute of Physical and Chemical Research (RIKEN)\*

##### **Hokkaido Development Agency**

Civil Engineering Research Institute

##### **Environment Agency**

National Institute for Environmental Studies (NIES)

##### **National Land Agency**

##### **Ministry of Foreign Affairs**

##### **Ministry of Finance**

##### **Ministry of Education**

Ocean Research Institute of the University of Tokyo(ORI)

Other Universities

**Ministry of Agriculture, Forestry and Fisheries**

**Fisheries Agency**

- Regional Fisheries Research Laboratory (7 sites)
- National Research Institute of Aquaculture
- National Research Institute of Fisheries Engineering (NRIFE)
- Japan Marine Fisheries Resource Research Center (JAMARC)\*
- Japan Fisheries Resource Conservation Association (JFRCA)\*

**Ministry of International Trade and Industry**

**Agency of Industrial Science and Technology**

- Electrotechnical Laboratory (ETL)
- National Institute for Resource and Environment (NIRE)
- Geology Survey of Japan (GSJ)
- Government Industrial Research Institute, Shikoku (GIRIS)
- Government Industrial Research Institute, Chugoku (GIRIC)
- Marine Biotechnology Institute (MBI)\*

**Ministry of Transport**

- Ship Research Institute (SRI)
- Port and Harbour Research Institute (PHRI)
- Electronic Navigation Research Institute (ENRI)

**Maritime Safety Agency**

- Hydrographic Department
- Japan Oceanographic Data Center (JODC)
- Maritime Safety Agency Research Center

**Meteorological Agency**

- Meteorological Research Institute (MRI)

**Ministry of Posts and Telecommunications**

- Communications Research Laboratory (CRL)

**Ministry of Construction**

- Public Works Research Institute (PWRI)
- Geographical Survey Institute (GSI)
- Building Research Institute (BRI)

\*Semi-government and Non-profit research organizations

***Major Research Projects on Marine Science and Technology (in FY 1992)***

**Science and Technology Agency**

**\* Special Coordination Funds for Promoting Science and Technology**

- World Ocean Circulation Experiment (WOCE)
- International joint research concerning the elucidation of the substance circulation mechanism in the coastal sea
- Japanese Pacific Climate Study (JAPACS)

**\* Research and Development Bureau**

- Comprehensive survey of Kuroshio area

- \* Japan Marine Science and Technology Center (JAMSTEC)
  - Research on deep-sea phenomena and R&D of deep-sea research technologies
  - Comprehensive observation of the North Pacific Ocean and Arctic Sea areas, and R&D of selected research technologies
  - Development and utilization of Coastal Seas
- \* National Space Development Agency of Japan (NASDA)
  - Promoting the development and use of Marine Ocean Observation Satellite (MOS-1)
  - The development of the Advanced Earth Observing Satellite (ADEOS)

#### **Environment Agency**

- \* Research funding to the national research institutes engaged in environmental pollution research
  - Research concerning nitrogen cycle of deposits in inland bays
- \* Water Maintenance Bureau
  - Research on red tide
- \* National Institute for Environmental Studies (NIES)
  - Research concerning the elucidation and the maintenance of the ecosystem in the water of closed-type sea areas

#### **National Land Agency**

- Surveys for the Promotion of the fisheries in the Amami Islands

#### **Ministry of Education**

- \* National universities and other research institutions
  - Ocean Drilling Program (ODP)
  - Cooperative study of the Western Pacific (WESTPAC)
  - Ocean Fluxes-Their Role in the Geosphere and the Biosphere

#### **Ministry of Agriculture, Forestry and Fisheries**

- \* Regional Fisheries Research Laboratories
  - Regular surveys of fishery's resources and fishing environment
  - R&D of the fish breeding technology
- \* National Research Institute of Fisheries Engineering (NRIFE)
  - R&D of new fisheries technologies
- \* Japan Marine Fisheries Resource Research Center (JAMARC)
  - Research project on oceanic fisheries resource

#### **Ministry of International Trade and Industry**

- \* National Institute for Resource and Environment (NIRE)
  - R&D of mining systems for underwater manganese nodule
  - Survey of carbon flux in the ocean
- \* Geological Survey of Japan (GSJ)
  - Marine geological study of continental shelves in the eastern margin of the central Japan Sea

- \* Marine Biotechnology Institute (MBI)
  - R&D of biotechnology utilizing the biological resources in the sea

#### **Ministry of Transport**

- \* Hydrographic Department, Maritime Safety Agency
  - Operating of the Japan Oceanographic Data Center
  - Regular oceanographic observations
- \* Ports and Harbour Research Institute (PHRI)
  - Research on civil engineering of ports and harbors, and coastal structures
- \* Meteorological Agency
  - Regular meteorological observations
- \* Meteorological Research Institute (MRI) , Meteorological Agency
  - Research of oceanic variations through ocean circulation models

#### **Ministry of Posts and Telecommunications**

- \* Communications Research Laboratory (CRL)
  - R&D of ocean observing aircraft and satellite technology

#### **Ministry of Construction**

- \* Geographical Survey Institute (GSI)
  - Basic research of coastal sea areas

#### **MARINE INFORMATION CENTERS IN JAPAN (IN FY 1992)**

##### *Science and Technology Agency*

- \* Japan Marine Science and Technology Center (JAMSTEC)
  - Consultation service concerning marine science and technology information materials
  - Technical consultation service of marine science and technology
- \* Japan Information Center of Science and Technology (JICST)
  - Building and maintaining databases of scientific and technical literature and reference databases, including English-language databases.
  - Providing domestic and overseas information services.
  - International dissemination of Japanese government publications on science and technology

##### *Environment Agency*

- \* National Environment Research Institute(NIES)
  - Collecting data on the environment and building databases

#### **Ministry of Education**

- \* National Center for Science Information Systems (NACSIS)
  - R&D, planning, and coordination of systems for scientific information

#### **Ministry of Agriculture, Forestry and Fisheries**

- \* Office of the Agriculture, Forestry and Fisheries Research Council
  - Management of the Agriculture, Forestry and Fisheries Research Information Center, collection of information and maintenance of databases on genetic resources

- \* Japan Marine Resources Preservation Association
  - ASFA National Input Center in Japan

#### *Ministry of Transport*

- \* Japan Oceanographic Data Center(JODC)
  - National Oceanographic Data Center of Japan
- \* Meteorological Agency
  - Operating of the Global Warming Information Center

### **JAPAN MARINE SCIENCE AND TECHNOLOGY CENTER (JAMSTEC)**

#### *Outline*

The Japan Marine Science and Technology Center (JAMSTEC) was established in October 1971 under the "Japan Marine Science and Technology Center Law", as a non-profit research organization, and with the cooperation of government, academic and private sectors. For several years after its establishment, funds were supplied from government and industry on a 50-50 basis. But, because of the widening and deepening of JAMSTEC activities, the government contribution kept increasing, and this year it has reached 90%.

JAMSTEC is the only comprehensive central organization dedicated to the actual execution of marine science and technology in Japan. The mission of JAMSTEC is to promote the research and development of Japan's marine science and technologies.

*Budget for Fiscal Year 1993: 13.1 billion yen*

*Staff: 166*

#### *Activities*

##### **1. R&D**

As the social needs have changed with the times, the scope of research and development activity at JAMSTEC has changed and kept expanding. At present, the research and development of activities of JAMSTEC are into three major categories: the first is research and development relating to deep seas, the second is oceanographic observation and research in the open sea and the third is research and development for the utilization of coastal seas.

##### **2. Training and education**

Development of human resources with training courses on diving technologies and with marine engineering seminars, for researchers and technicians.

##### **3. Technical Information Services**

##### **4. Operation and maintenance of facilities for public use**



### *Research Support Equipment*

JAMSTEC constructs and operates research facilities used for various research on marine science and development of the related technologies, and provides them for public use to private corporations, universities and national research institutions.

JAMSTEC operates manned research submersible “Shinkai 2000 system” and “Shinkai 6500 system”, unmanned research submersible “Dolphin 3K”, research vessel “Kaiyo”, and has constructed 10,000 m class unmanned research submersible “Kaiko”. JAMSTEC constructed an undersea simulation and training facility, a high pressure test facility, a underwater anechoic test tank. Also, JAMSTEC has built “the deep-sea environment research building” to accommodate state-of-the-art equipment for deep-sea microorganisms research, including not only modern equipment required for RI and DNA recombination experiments, but also the Deep-sea Microorganisms Collecting and Cultivating System (DMCCS) which can isolate and grow deep-sea microbes without decompression.

### **TECHNICAL INFORMATION SERVICES (TIS)**

#### *Objectives*

The objectives of TIS, JAMSTEC are to provide a diverse of information for smooth promotion of JAMSTEC activities, especially giving support to R&D activities in JAMSTEC, as a component of the entire organization, and to play a role of a specialized information center in Japan for marine science and technology so as to collect and provide information for wider use.

#### *Policy of the Activities*

To fulfill the objectives above TIS undertakes to:

1. Collect literature on marine science and technology and provide information about them;
2. Get results of JAMSTEC activities spread and distributed for wider use;
3. Disseminate information about marine science and technology in Japan;
4. Make research on information about foreign/domestic marine science and technology;
5. Act as a consultant concerning marine science and technology.

#### *TIS Organization*

Director Mr. Yoshito TSUJI

Assistant Director Mr. Tatsunosuke TSUZUKU

Assistant Senior Research Member Mr. Yasuhiko YAMASHITA

Research Member Miss Miyoko KUROSAWA

Staff members 7 individuals

Sections : Library

Publication

Research and Dissemination

## *Library* Collections

1. Books : 10,738
2. Serials : 682 (As of January 1, 1993)
3. Directories and pamphlets of research organizations and universities
4. Newsletters and reports

## Information Services

1. Books/journals
  - a) List of newly arrived books is distributed monthly (internal use).
  - b) Contents sheet of newly arrived serials is available regularly (internal use).
2. Current information
  - a) Important articles in newspapers are provided every day (internal use, Science and Technology Agency, and supporting members).
  - b) Index information of articles related to marine matters in newspapers are provided weekly (internal use, Science and Technology Agency, and supporting members).
  - c) Notices on conferences/exhibitions on demand (internal use)
  - d) Covering newly arrived IOC publications in JAMSTEC Newsletter, "Natsushima" and the Official Journal of the Oceanographic Society of Japan "Umi no Kenkyu", both in 6/year
  - e) International marine information is providing irregularly as "NEWS AND VIEWS" (internal use).

## References Services

Reference services cover books, journals and documents which TIS holds.

## *Publications*

1. Report of Japan Marine Science and Technology Center (JAMSTECR)  
Original papers of research results in JAMSTEC (Semiannually, Abstract in English)
2. Collected Abstracts of JAMSTECR (Every two years, in English)
3. JAMSTEC Journal of Deep Sea Research (Formally Proceedings of JAMSTEC Symposium on Deep Sea Research )  
Original papers of the results of deep sea research using "SHINKAI 2000/6500" (Annually, Abstract in English)
4. Collected Abstracts for JAMSTEC J. Deep Sea Res.<sup>\*1</sup> (Every two years, in English)
5. Journal, "JAMSTEC"  
Enlightenment of marine science and technology (Quarterly, in Japanese)
6. Annual Review of JAMSTEC Activity Report of activity done in JAMSTEC<sup>\*2</sup> (Annually, In Japanese)

<sup>\*1</sup> Newly issued in 1994

<sup>\*2</sup> In future, in English

7. *Japan Marine Science and Technology Center Publication List*<sup>\*3</sup> (Annually, In English)

<sup>\*3</sup>Newly issued in 1994

**Research and Dissemination**

1. Research and analysis on important information about marine science and technology (in future)
2. Use of external databases
  - a) Retrieval of external databases for users who want to know where needed literature is located
  - b) Providing information on particular topics using SDI (Selective Dissemination of Information) service of JICST (The Japan Information Center of Science and Technology), bimonthly (internal use)
3. Consultation and information provision for outside users as an information desk of marine science and technology
4. From the standpoint of wider dissemination of JAMSTEC activities, TIS intends to provide information through foreign publications such as newsletters (e.g. *Ocean Science News*) or through serials (e.g. *Sea Technology*) promptly and actively. Also TIS is considering to publish Annual Report in English which mainly cover research activities of JAMSTEC.

**International Activities**

**IOC (Intergovernmental Oceanographic Committee)**

IOC publications has been distributed to Japan Oceanographic Data Center (JODC) belonging to Hydrographic Department, Maritime Safety Agency. However, in 1993, JAMSTEC became the second organization (Key National Oceanographic Institution) in Japan to received IOC publications, so that it undertakes to organize/store the publications, to prepare the lists and to provide information to domestic organizations concerning marine science and technology.

**IAMSLIC (International Association of Aquatic and Marine Science Libraries and Information Centers)**

Libraries of major marine research organizations in the world are members of IAMSLIC. JAMSTEC became a member of IAMSLIC in 1993 as the first organization in Japan, following People's Republic of China, Hong Kong and Thailand in Asia. JAMSTEC is now ready to exchange information with foreign counterparts.

**Database for Marine Science and Technology**

ASFA (Aquatic Science and Fisheries Abstracts) is a public database covering comprehensive marine science and technology, which is promoted by four UN organizations (its secretariat is FAO). Its National Input Center in Japan is Japan Fisheries Resource Conservation Association (JFRCA) which sends about 700 items annually to FAO. However, management itself and the contents of ASFA are now being discussed due to the financial difficulty of FAO and

consideration of the importance of the global environment. Since the global environment is a worldwide issue, databases are expected to cover information not only in fisheries but also in various areas of marine science and technology. In this connection it may be assumed that Japan Oceanographic Data Center (JODC), Environment Agency and JAMSTEC are involved in the database construction in Japan. Accordingly TIS intends to pay attention to foreign and domestic movements related to ASFA.