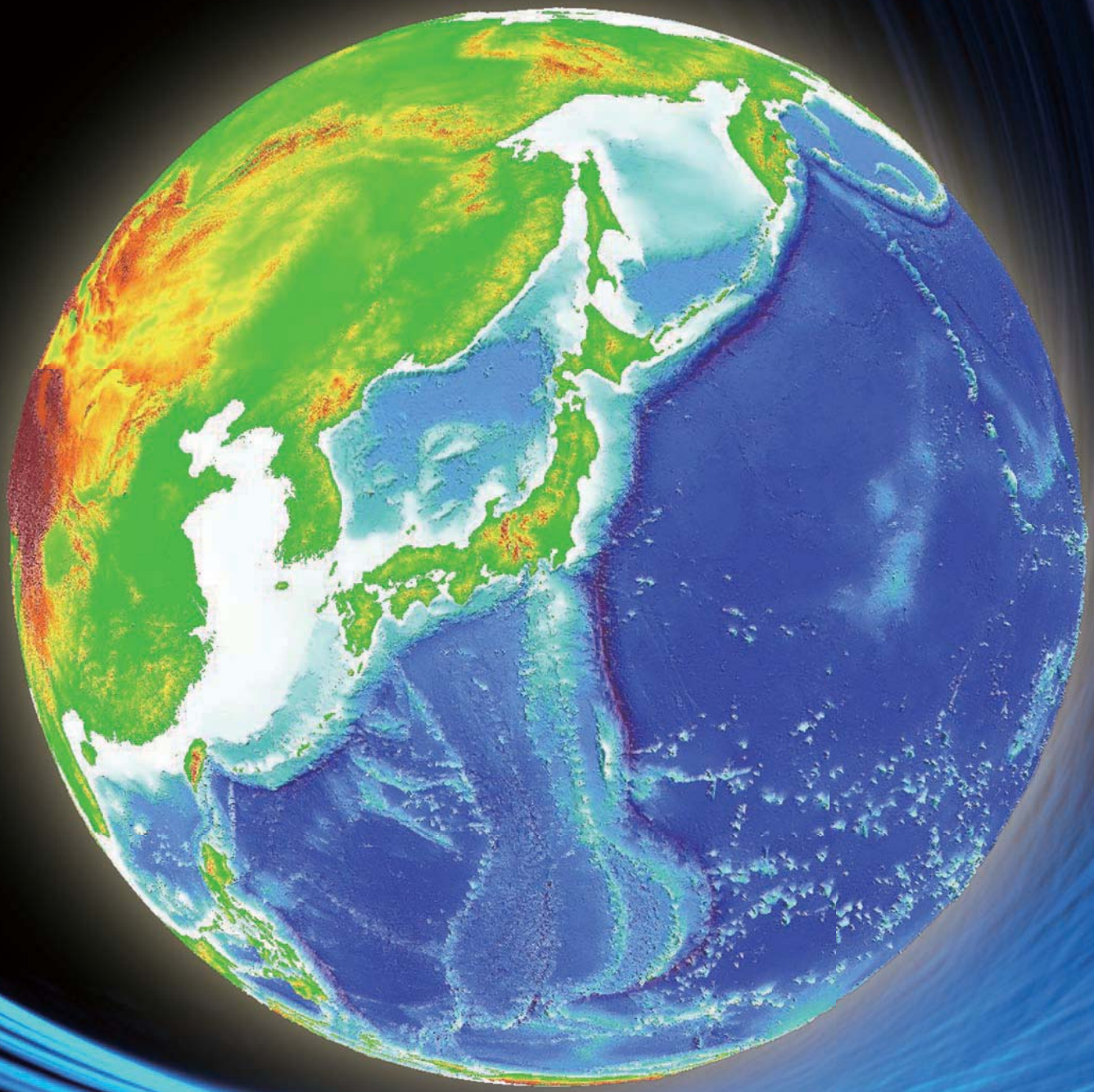
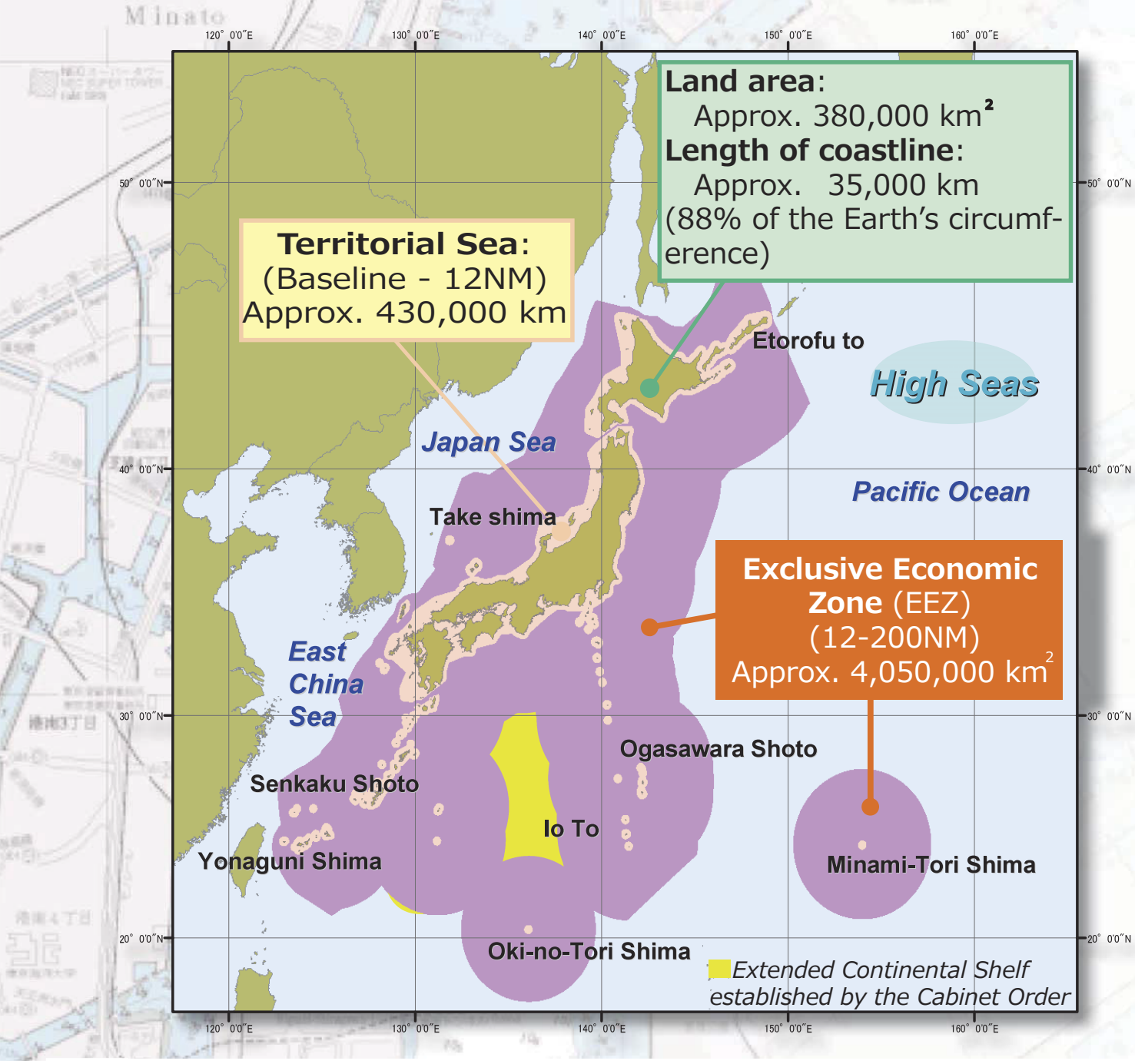


Exploring the sea

Hydrographic and Oceanographic Department of
the Japan Coast Guard (JHOD)



The map tentatively schematizes the concept of maritime jurisdictional area of Japan and includes equidistant lines which are not mutually agreed w ith adjacent countries.

Marine Information is to lead the Future

For 145 years, the Hydrographic and Oceanographic Department of the Japan Coast Guard (JHOD) has been providing nautical publications, such as nautical charts, which are essential information for maritime traffic supporting the Japanese economy.
In recent years, the JHOD has also been providing necessary information for marine activities to meet a variety of maritime demands.
In particular, since 2004, the JHOD has been taking a leading role in united effort of the Japanese government to define the limits of Japan's continental shelf in accordance with the United Nations Convention on the Law of the Sea, and promoting surveys of seafloor topography and crustal structure in order, to secure Japan's maritime interest
In this circumstance, the Basic Act on Ocean Policy came into effect in July 2007, the goal of which is to promote an integrated and organized approach in maritime policy.
The area of territorial waters and an exclusive economic zone surrounding Japan is as huge as 4.47 million square kilometers. In order to benefit most from the surrounding sea, we need to surveys to understand the sea maintain scientific data, and promote the appropriate maritime policy on the basis of the scientific data.
JHOD promotes organized and efficient research with the cutting-edge oceanographic technology and contribute to fulfill Japanese people's knowledge about the ocean. In addition, the JHOD is committed to contributing to Japan in establishing itself as a new oceanic state by appropriately managing the data and fulfilling provision of the obtained marine information.
With its research and information provision, JHOD is hoped that they can help to explore the future, as an oceanic state .

History

145 years of the Hydrographic and Oceanographic Department of the Japan Coast Guard (JHOD)

1871 New Meiji government began marine research. The government established the Hydrographic Bureau (JHB, national hydrographic research organization) in the Navy Department of the Ministry of the Military.

1872 JHB published the first nautical chart "Kamaishi".

1921 The International Hydrographic Bureau (present International Hydrographic Organization) was established. Japan became a member state.

1923 JHB surveyed Sagami Bay due to the 1923 Great Kanto Earthquake.

1925 JHB started using an echo sounder.

1938 JHB began observation of ocean currents.

1945 The Ministry of Transport established the Hydrographic Department (JHD) as its external bureau.

1949 The Hydrographic Department became part of the Japan Coast Guard.

1952 The distress of "KAIYO NO. 5" during the survey of Myojin Reef.

1953 Practical application of geomagnetic electrokinetograph (GEK).

1965 The cooperative Study of the Kuroshio and Adjacent Regions (CSK) commenced. The Oceanographic Data Center (present Japan Oceanographic Data Center) was established.

1969 JHD began research by the submersible research vehicle "SHINKAI"

1983 JHD began research on the continental shelf in the territorial waters (completed in 2008).

1984 The survey vessel "TAKUYO" explored the deepest spot in the ocean (Challenger Deep), and determined the depth (10,924 m).

1995 JHD began research on active faults on seafloor.

1998 JHD began research on offshore volcanoes.

2000 JHD began observation of seafloor geodetic observation.

2002 The Hydrographic Department of the Japan Coast Guard was reorganized into the Hydrographic and Oceanographic Department (JHOD).

2003 JHOD began research on environmental conservation (recovery of the marine environment).

2008 JHOD began research on Japan's territorial waters and exclusive economic zone.

2011 JHOD moved to the new office building at Aomi.

2016 JHOD moved to the new office building at Kasumigaseki.

Contents

Column

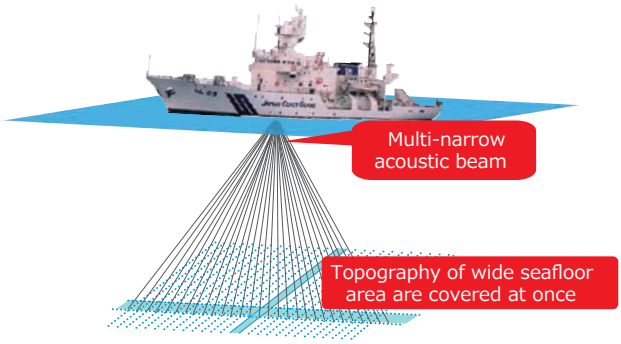
Ocean Surveys Related to the Preservation of Marine Interests

The collection and compilation of basic information such as seafloor topography in the jurisdictional marine zones, the territorial sea and the exclusive economic zone and so on, are essential for our country Japan, an oceanic state, in order to enforce comprehensive governance on the sea and secure Japan's marine interests.
However, Japan has not acquired enough data in some sea areas, such as the East China Sea and the Sea of Japan where the boundaries of Japan's jurisdictional marine zones are in contact with those of other countries, due to the lack of sufficient surveys because Japan had given priority to the surveys necessary for the establishment of the outer limits of continental shelf according to the article 76 of United Nations Convention on the Low of the Sea.
In this circumstance, Japan enacted the Basic Act on Ocean Policy in July 2007, and drew up the Basic Plan on Ocean Policy in March 2008 (amended in April 2013) in accordance with the Act. JHOD, standing on these Act and Basic Plan, has been carrying out intensively systematic surveys on sea bottom topography, crustal structure and territorial sea baseline, which are indispensable for preserving Japan's marine interests.

Territorial Sea and Exclusive Economic Zones

Bathymetric survey

Multi-Beam Echo Sounder (MBES) equipped on the bottom of a vessel transmits very narrow acoustic beams and receives the pulses reflected at the seafloor. This technique enables us to cover the wide range of sea bottom topography at once.

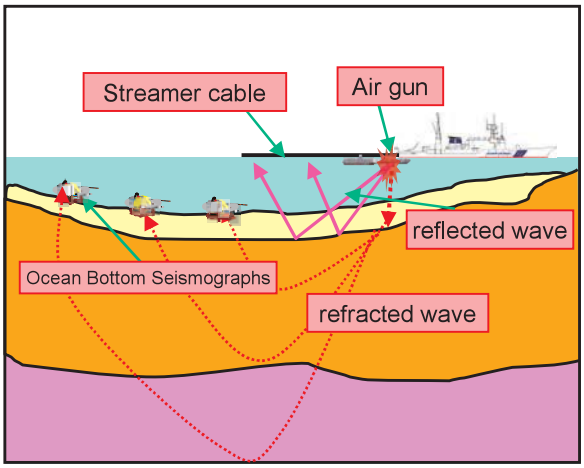


Multi-beam sounding

Operation of the bathymetric survey in the vessel

Crustal Structure Survey

This is a survey to probe under the seafloor using artificially generated seismic waves generated by air gun to obtain information on the crustal structure under the seafloor such as the thickness of the geological layers and the distribution of faults.



Air gun: is to generate strong sound wave (seismic wave) by explosion of compressed air.
Streamer cable (hydrophone cable): is a receiver of the sound waves with built-in hydrophones.

Survey on territorial sea baselines

JHOD uses an airborne LIDAR system, which enables us to carry out surveys in the shallow water region safely and efficiently, to determine the coastlines and the low-water lines that are the baselines to measure the breadth of jurisdictional marine zones such as the territorial sea and the EEZ.

Survey of airborne LIDAR bathymetry

Operation of the LIDAR bathymetry

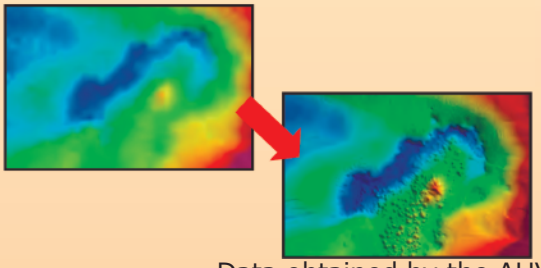
COLUMN 01

Seafloor topography survey with AUVs

In addition to the standard surveys using survey vessels, JHOD started the operation of the AUVs (Autonomous Underwater Vehicles)in 2013, which enable us to survey the detailed seafloor topography in the deep sea and enhance our research ability for securing Japan's marine interests.

Survey with the AUVs

Data obtained by the survey vessel



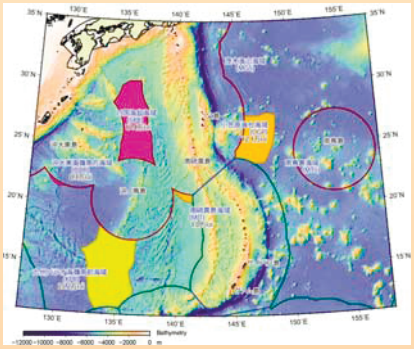
Data obtained by the AUV

※An AUV (Autonomous Underwater Vehicle) can navigate autonomously along the programmed route down to near sea bottom and collects the detailed seafloor topographic data.

COLUMN 02

Continental Shelf Surveys

The United Nations Convention on the Law of the Sea (UNCLOS) defines seabed and subsoil of the submarine areas up to 200 nautical miles (NM) from the coasts as coastal State's continental shelf. In addition, coastal State can establish the outer limits of its continental shelf beyond 200 NM where its geomorphological and geological features fulfill the specific conditions described in the UNCLOS. JHOD started to conduct the continental shelf survey in 1983 and had completed the survey by June 2008. Based on those survey results, Japan submitted information on extended continental shelf that covers 740,000 km2 (in seven areas), approximately twice as large as the land area of Japan, to the Commission on the Limits of the Continental Shelf (CLCS) in November 2008 and received the recommendation about the extension extension excluding a part of area (250,000 km2) from the Commission in April 2012. In October 2013, the Cabinet Order to establish two areas as the extended continental shelf of Japan. For the other two areas, coordination with adjacent state has been proceeded. JHOD has contributed to the all-Japan project of the extension of the continental shelf in step with relevant ministries.



Extended continental shelf established by the Cabinet Order.
The area where further coordination with relevant states is required.
The area where the review by the Commission was postponed.

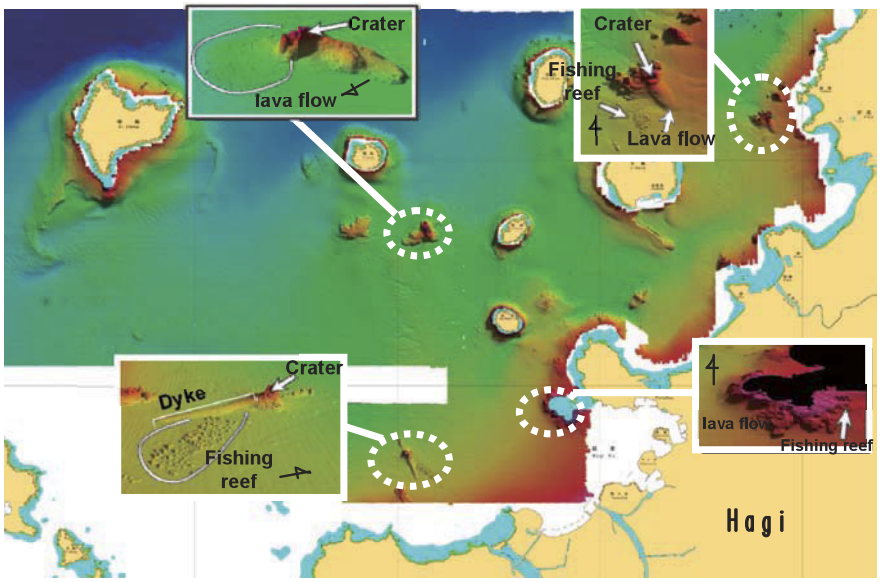
Ocean surveys for safety of navigation at the sea

Nautical charts are essential for safe navigation on the sea. In order to keep the charts updated, JHOD conducts surveys on the depth of water in harbors and sailing routes mainly using echo sounders to reveal the seafloor topography.
Recently, multi-beam echo sounders (MBES) and airborne LIDER have facilitated collecting highly dense soundings, enabling us easily to obtain three-dimensional sea bottom topographic images.
JHOD also carries out Satellite Laser Ranging (SLR) observation at the Shimosato Hydrographic Observatory where we have a fiducial point for determining the precise location of the Japanese islands.
In addition JHOD carries out surreys of tidal current, tide, ocean current etc. that are necessary for safety of navigation.

Surveys of geomorphological and geological features on seafloor

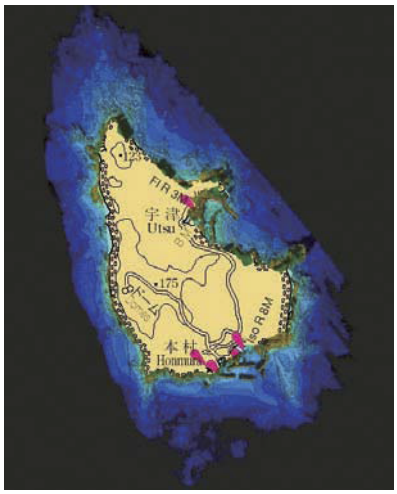
JHOD conducts geomorphological and geological surveys using state-of-arts survey instruments

An example of a survey result obtained by multi-beam sounding

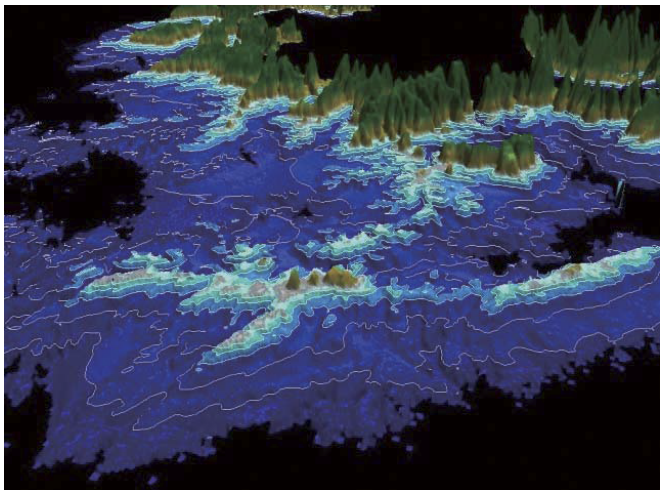


The seafloor topography off Hagi, Yamaguchi Prefecture, obtained by multi-beam sounding

An example of survey result obtained by airborne LIDAR bathymetry



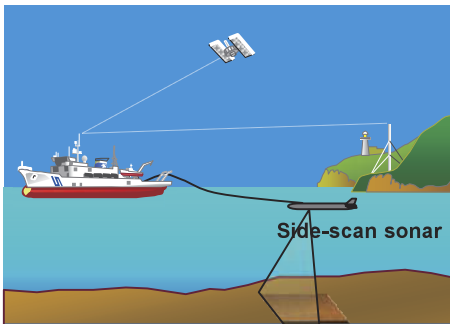
The seafloor topography of Mishima, Yamaguchi Prefecture obtained by airborne LIDAR bathymetry



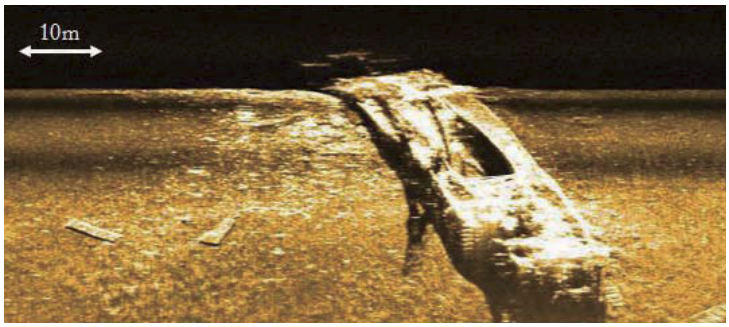
The seafloor topography near Haenohase, Tsushima Island, Nagasaki Prefecture, obtained by airborne LIDAR bathymetry

Side-scan sonar

The seafloor condition varies place to place; it can be sandy, muddy or rocky; there can be even shipwrecks or obstructions. In order to find these situations in the opaque seawater, we use a side-scan sonar, which shows us the underwater situation with acoustic images like those taken by optical camera. The side-scan sonar is also utilized to search for the shipwrecks by the maritime accidents.
A side-scan sonar transmits acoustic signals downward from a towed vehicle in a fan-like profile and receives reflection from a sea bottom. The reflections are intense from solid objects like rocks and faint from places like flat sandy soil. It provides us visual images like photographs of the seafloor by rendering the intensity of the reflections into grayscale images.



Schematic picture of observation



The seafloor image around the shipwreck obtained by a side-scan sonar

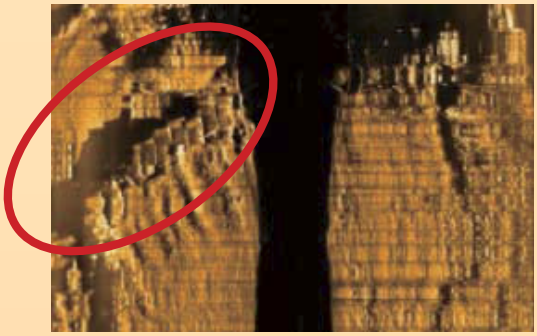
COLUMN 031

Actions taken after the Great East Japan Earthquake (1)

● Hydrographic surveys for rapid recovery of affected ports and harbors

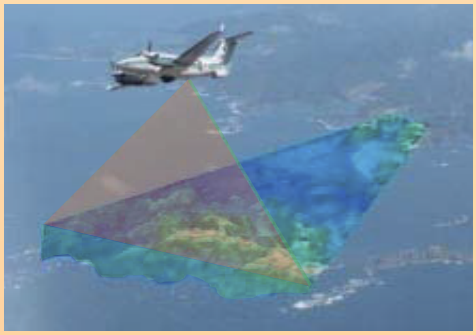
JHOD contributed to rapid recovery of the functions of ports an d harbors affected by the earthquake and tsunami in cooperate with the port authorities.
JHOD completed the hydrographic surveys of 11 harbors, mainly i n the International hub ports and the Important ports, and helped port authorities open these ports and harbors for partial usage by March 26.

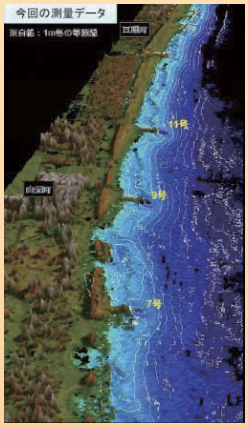

On-board survey craft of survey vessel "SHOYO" in operation at Port of Ofunato


The damaged breakwater at Port of Ofunato

● Airborne LIDAR bathymetry in the coastal Tohoku region

JHOD conducted airborne LIDAR bathymetry in the affected areas such as Sendai Bay, and revealed the situation of seafloor topography in large area after the tsunami of the 2011 earthquake off the Pacific coast of Tohoku.


Schematic picture of airborne LIDAR bathymetry

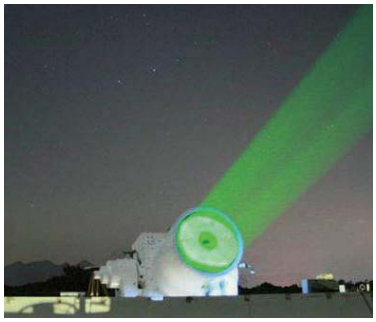


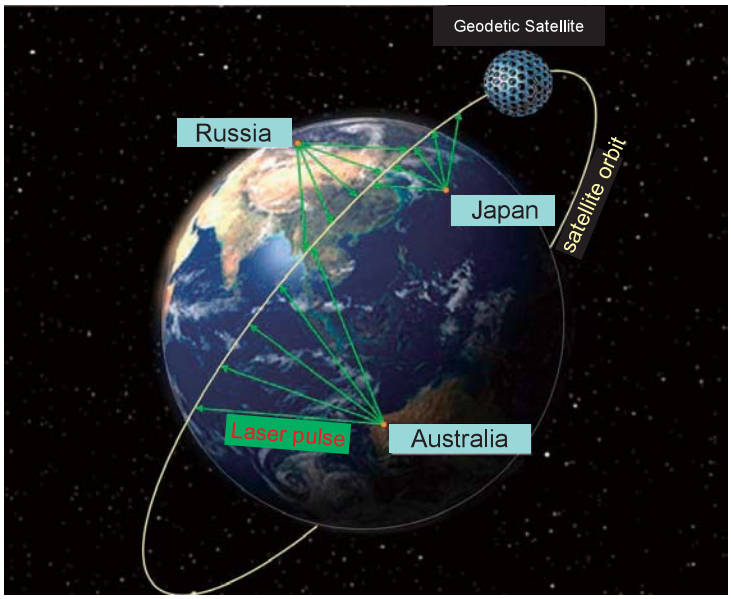
Survey data of south coast of Sendai Bay obtained by the airborne LIDER

Ocean surveys for safety of navigation at the sea

Satellite Laser Ranging

Satellite laser ranging (SLR) measures the round-trip time of laser pulses emitted from the ground station to travel to a satellite and return to the ground station. By multiplying half of the round-trip time by the speed of the light (about 300,000 km/sec), the distance from the ground station to the satellite is derived. Based on this principle, the relative position between the Earth-orbiting satellite and the ground station is determined. High-accuracy positions of off-lying islands, reefs and coasts are required for publishing/revising the nautical charts and delineating the limits of the jurisdictional marine zone including the territorial sea and the EEZ. SLR plays an important role in the precise positioning for those purposes.
JHOD also participate in the international collaborative laser ranging observations. The Shimosato Hydrographic Observatory contributes to construction of the international geodetic coordinate system as one of the important observatories in the Far East.



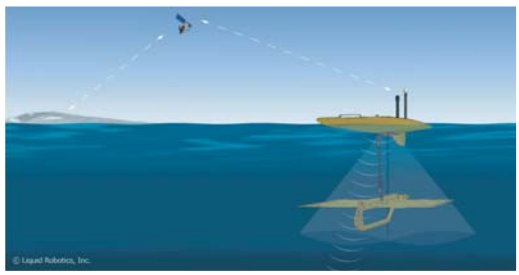


SLR at the Shimosato Hydrographic Observatory (Wakayama Prefecture)

Ocean observation by the AOV

In addition to the observation by the survey vessel, it will conduct a marine observation using the AOV from 2016. By the operation of the AOV, we can collect the marine information, such as ocean currents, wind, wave height, water temperature in quasi-real-time.

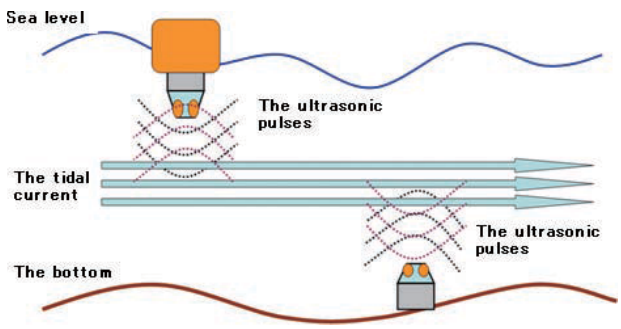
※AOV(Autonomous Ocean Vehicle) in the autonomous marine observation platform to the driving force of the force of the waves, we can long-term continuous operation at a pre-programmed observation waters.



Schematic picture of Ocean observation by the AOV

Tidal Current Observation

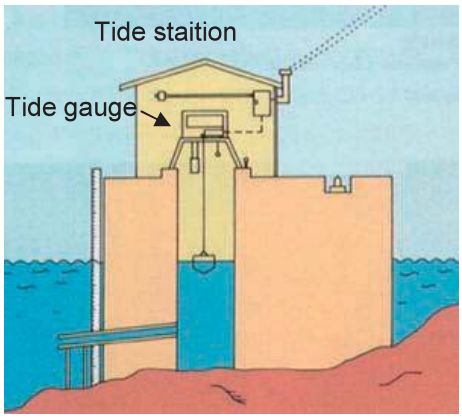
JHOD conducts the tidal current observation (direction and strength), with a current meter (it emits ultrasonic pulses and measures the current velocity and direction from the reflected pulses) at the busy straits and ports. We provide the results in the tidal current charts, nautical charts, the Internet, and so forth.
The information of tidal current is useful not only for safety of navigation at sea, but also for marine leisure activities and conservation of marine environment.



Tidal current observation
(shows the installation method of flow meters)

Tidal Observation

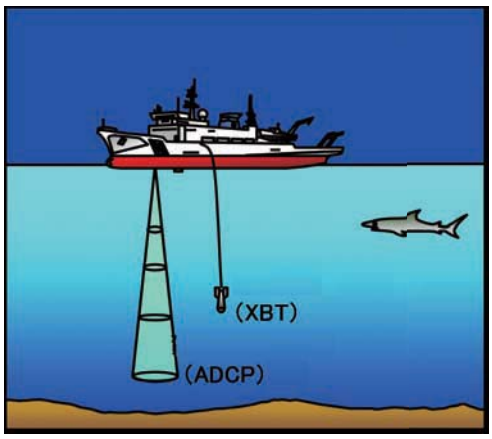
JHOD has installed the tide stations at 20 locations in Japan, and observes the tidal changes from vertical movement of a float in the station. JHOD monitor all the data at the JHOD headquarter in Tokyo and provide the calculated tidal curve through the internet. The observed tidal changes are utilized for tidal prediction, tidal correction for the surveyed bathymetry, calculation of the ocean current, monitoring of the crustal displacement as well as detection of tsunamis.



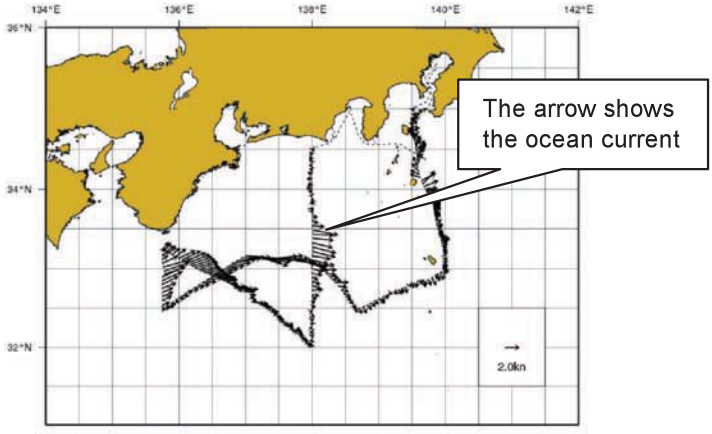
JHOD tide stations (20 locations in Japan)

Ocean Current Observation

JHOD observes the vertical profile of the ocean currents (direction and velocity) and water temperature around Japan. The obtained data are used to describe the Quick Bulletin of Ocean Conditions, which shows the basic information for the safety of navigation. Those data are also used to predict the trajectories of the drifting objects. These predicted trajectories are necessary for the Search and Rescue operation of the JCG as well as the disaster prevention in the case of oil spill.



Major observation method



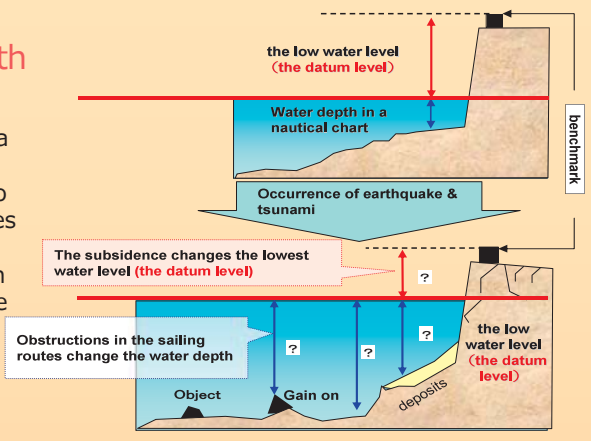
Ocean current chart
(the length and direction of arrows represent the strength and direction of ocean currents respectively)

COLUMN 03-2

Actions taken after the Great East Japan Earthquake (2)

● Determination of the low water level (datum level), a depth reference in nautical charts

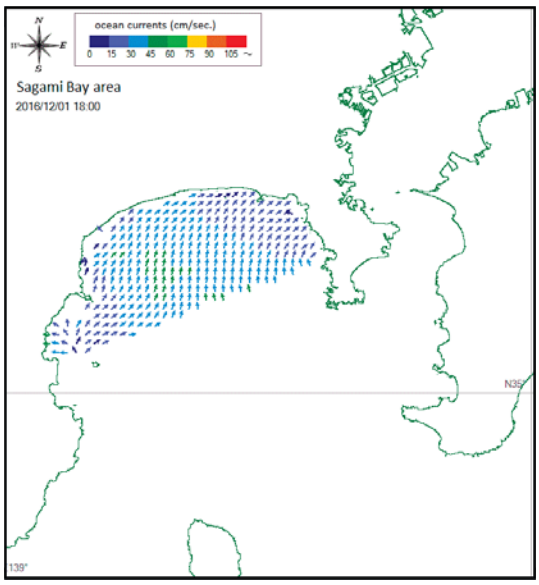
The lowest water level is the level of the sea surface at the lowest tide: a datum for the water depth on the nautical charts. It is also used as a datum level for the harbor facilities at its construction especially when the construction is planned and designed. When the Great East Japan Earthquake caused the subsidence, the bench marks became unavailable to determine the lowest water level. JHOD resurveyed all the lowest water levels in that region after the earthquake.



Ocean surveys for safety of navigation at the sea

High Frequency (HF) Radar

Ocean HF radar system consists of two remotely located stations. Each station has a pair of transmitting and receiving antennas.
The radio wave emitted to the surface of seawater changes its frequency when it bounces off the moving surface. JHOD measures the ocean currents by analyzing the frequencies of two sets of reflected radio waves.
JHOD has HF radar stations at Kazehaya Saki Lighthouse in Izu O shima and near Ara Saki in the Miura Peninsula for Sagami Bay area to observe ocean currents.
Observation results are published on JHOD website.



Ocean current chart with the data observed by HF radar

HF radar stations for Sagami Bay area
(Left: Ara Saki station, right: O shima station)

Sea Ice Observation

Ice Information Center of the 1st Regional Coast Guard Headquarters has provided information of sea ice for local ships and vessels in order to prevent accidents caused by the sea ice around Hokkaido Island. The Headquarters observes the distribution and the movement of sea ice with the Coast Guard aircraft, patrol vessels equipping ice-breaker and helicopters from patrol vessels.

Sea ice observation by an aircraft

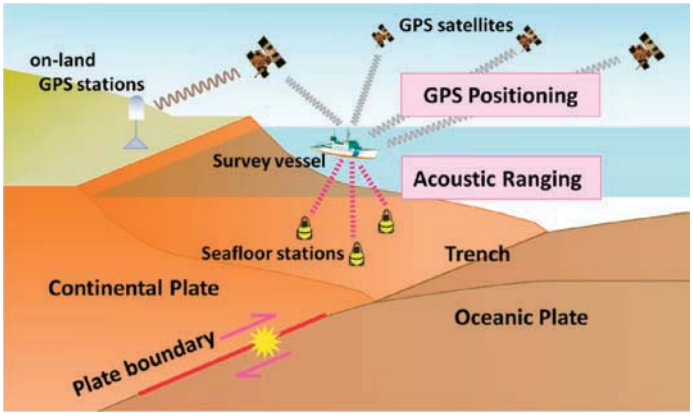
Sea ice observation by a patrol boat

Ocean surveys for disaster prevention and environmental conservation

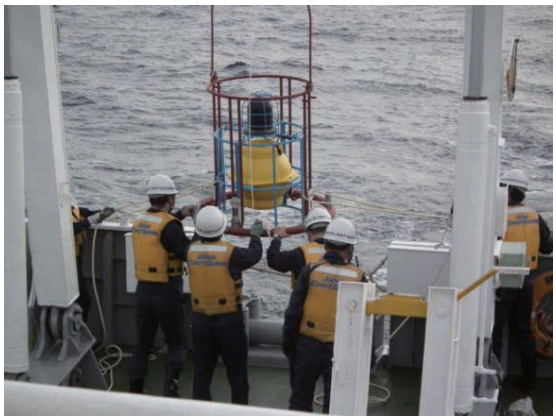
JHOD conducts surveys for disaster prevention, such as seafloor geodetic observation and surveys of volcanoes in sea area, and trajectory predictions in order to ensure safe and secure lives of the citizenry by minimizing the damage of natural disaster such as earthquakes and volcanic eruptions or the damage by maritime accidents or disasters including spill of oil or harmful liquid from a stranded or destroyed vessel. JHOD also conducts environmental conservation research, such as marine pollution and radioactivity surveys to preserve the irreplaceable marine environment.

Seafloor Geodetic Observation

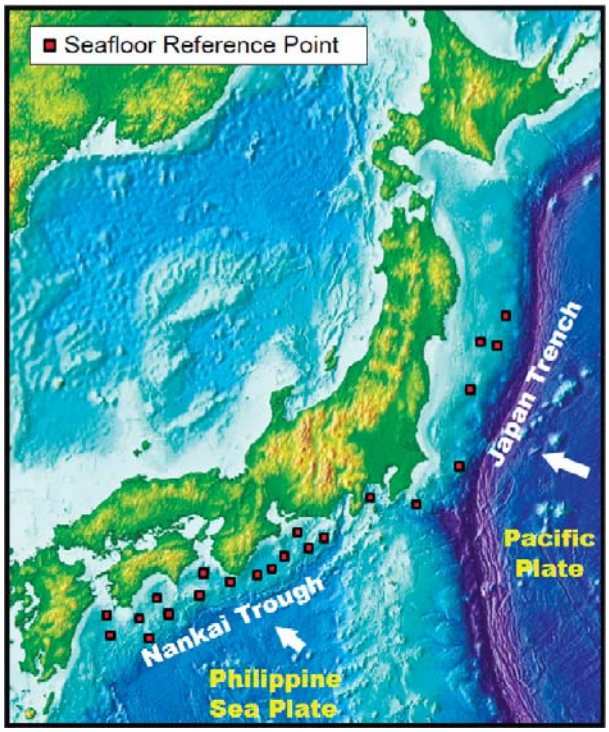
Japan is located in a tectonically active region where multiple tectonic plates interact with each other. Along the plate boundary, followed by the subduction of the oceanic plate, the strain accumulates in the continental plate. When strain accumulated to some extent, the coupling suddenly breaks and causes a huge earthquake. JHOD developed a system for detecting seafloor crustal movement by combining GPS and undersea acoustic ranging techniques, and has been carrying out the seafloor geodetic observation at seafloor reference points installed on the landward slope of the major trenches such as the Japan Trench and the Nankai Trough from 2000. This observation contributes to understandings of the mechanism of huge earthquakes.



Schematic picture of seafloor geodetic observation



Installing a seafloor station



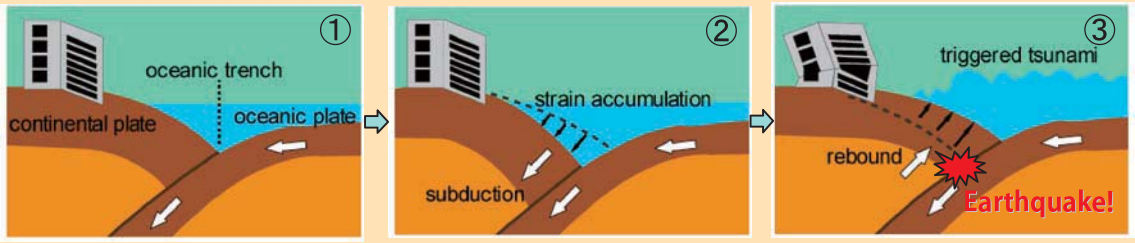
Location of seafloor reference points (as of November 2016)

COLUMN 03-3

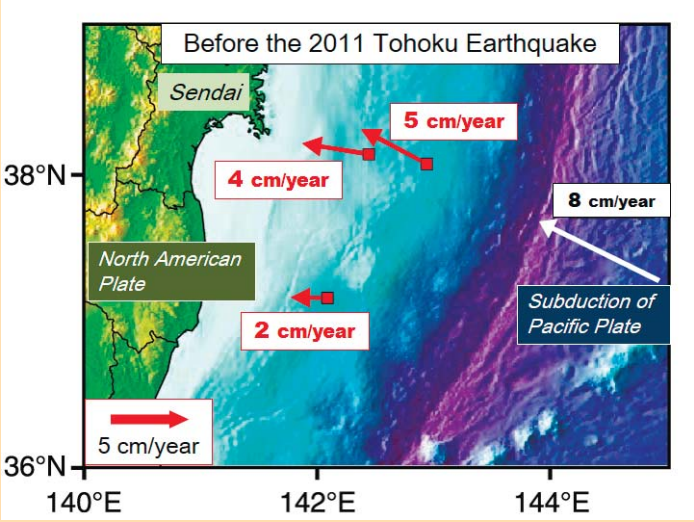
Actions taken after the Great East Japan Earthquake (3)

● Detection of the substantial seafloor movements

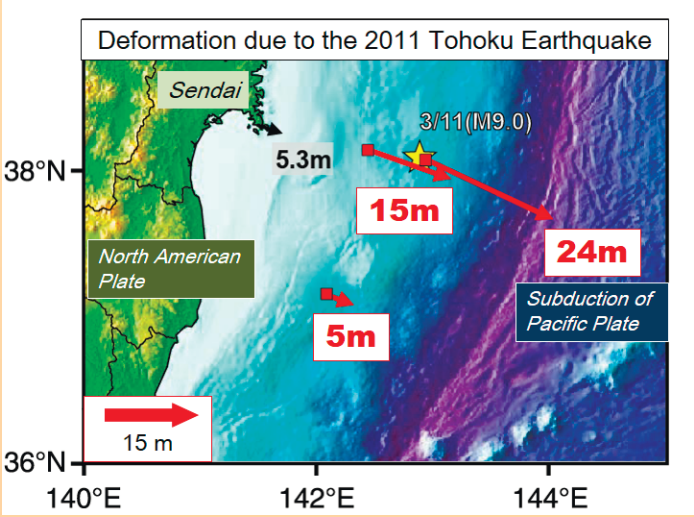
Before the 2011 Tohoku-oki earthquake, JHOD had detected the seafloor movement toward west-northwest at the reference points off Miyagi and off Fukushima. From the observation after the earthquake, JHOD detected opposite movement toward to east-southeast associated with the earthquake. In particular, the seafloor reference point near the epicenter moved about 24 m east-southeast.
The mechanism of interplate earthquake is shown in the figure below. JHOD succeeded in directly detecting this type of seafloor movement by seafloor geodetic observation



Mechanism of interplate earthquake



The crustal movement corresponding to ② in the figure above

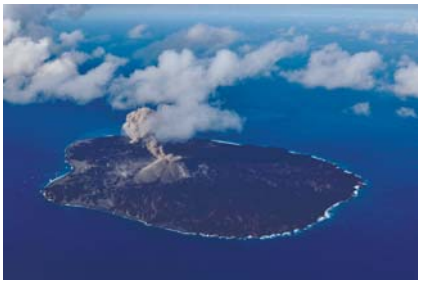


The crustal movement corresponding to ③ in the figure above

→ Movement of Oshika GPS station (GSI) ☆ epicenter

Surveys of Volcanoes in Sea Area

JHOD regularly conducts monitoring activities of volcanic islands and submarine volcanoes of the Nanpo-Shoto (Izu-Ogasawara (Bonin)-Mariana Island Arc) and Nansei-Shoto (Ryukyu Island Arc) with aircrafts. In addition, JHOD also conducts researches on seafloor topography, geological structure and geomagnetic characteristics by using survey vessels and high-tech autonomous survey boats, "Jinbei" and "Manbo II" to collect the basic information of the volcanoes in the sea area. "The Basic Information Maps of Volcanoes in Sea Area" are published based on the survey results.

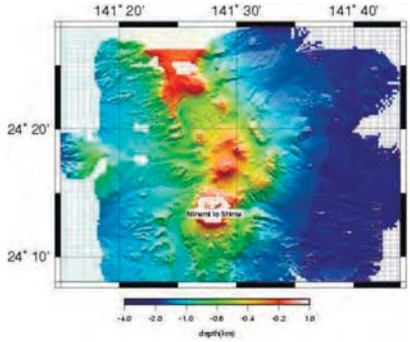


Volcanic activity of Nishinoshima from 2013 to 2015 (960km south of Tokyo)

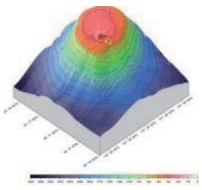
Eruption of Fukutoku-Oka-no-Ba in Feb. 2010. (1,200km south of Tokyo)

Autonomous survey boat "Jinbei"
When a submarine volcano becomes active, surveys of detailed seafloor topography, discolored water, water temperature and so on are safely conducted using "Jinbei" and "Manbo Ⅱ" equipped with sophisticated survey instruments.

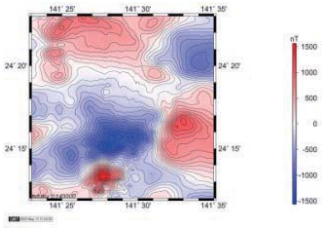
The Basic Information Map of Submarine Volcanoes in Sea Area (Fukutoku-Oka-no-Ba)



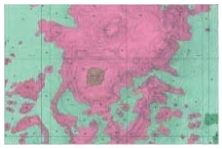
Bathymetric image around submarine volcano



3D image of submarine volcano



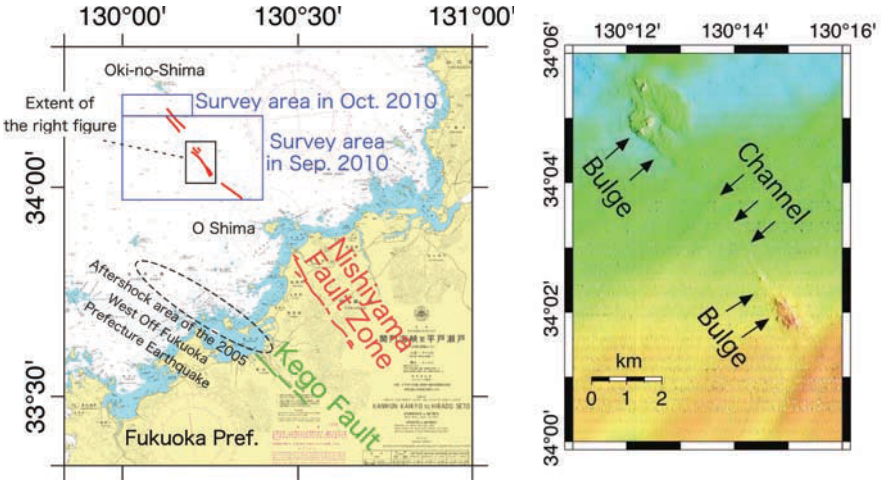
Geomagnetic total intensity anomalies



Submarine Structural Chart

Research for Submarine Active Faults

Since the Southern Hyogo prefecture Earthquake in 1995, JHOD has been conducting geographical and geological researches on active faults in Japan's coastal area starting in those of three major bays, Tokyo Bay, Osaka Bay and Ise Bay. The research results have been utilized for the long-term evaluation of active faults conducted by the Headquarters for Earthquake Research Promotion.



Fault topography in Genkai Nada off the north of Fukuoka Pref.

※The tectonic bulges and channels on the seafloor due to the active faults were discovered off the north coast of Fukuoka Prefecture. These faults are considered as the seaward extension of the Nishiyama Fault Zone existing in the northern Fukuoka Prefecture

Marine Pollution Survey

Preventing marine pollution and protecting the marine environment, JHOD conduct marine pollution survey every year in and out of the main bays and inland seas of Japan (Tokyo Bay, Osaka Bay, Ise Bay, Seto Inland Sea and so on). Seawater and bottom sediment is sampled from the survey vessels and the oil, PCB, heavy metals and organotin concentration is published from the chemical analysis of those in situ samples.

Sampling of bottom sediment

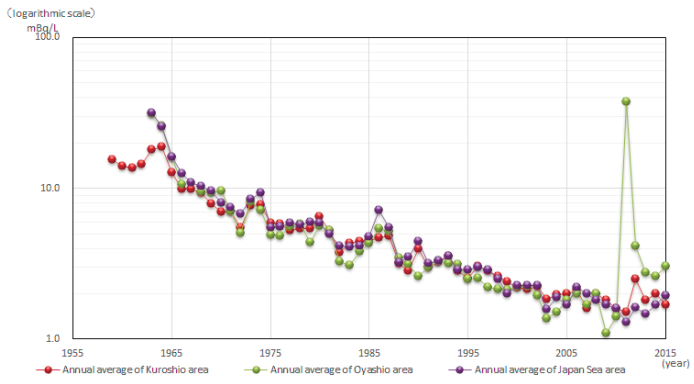
Analyzing heavy metals

Radioactivity Survey

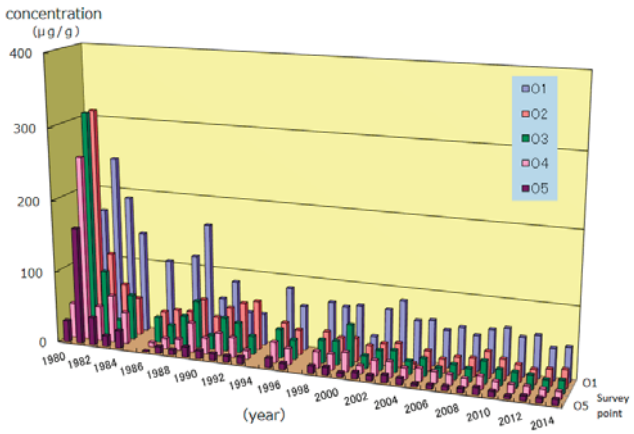
Monitoring the environmental distribution of the anthropogenic radioactive substances produced from the nuclear experiments or by the dumping of nuclear waste to the sea, JHOD is sampling the seawater and bottom sediment around Japan including the Japan Sea, Sea of Okhotsk. JHOD is also monitoring the radioactive substances in the water and the bottom sediment every three months at the Ports of Yokosuka, Sasebo and Kin-Nakagusuku where the US NAVY nuclear ship calls.
JHOD conduct chemical analyses of seawater and bottom sediment samples collected by the survey or patrol vessels of the JCG and open the result to the public through the internet.

Sampling of seawater

Analyzing Cobult-60



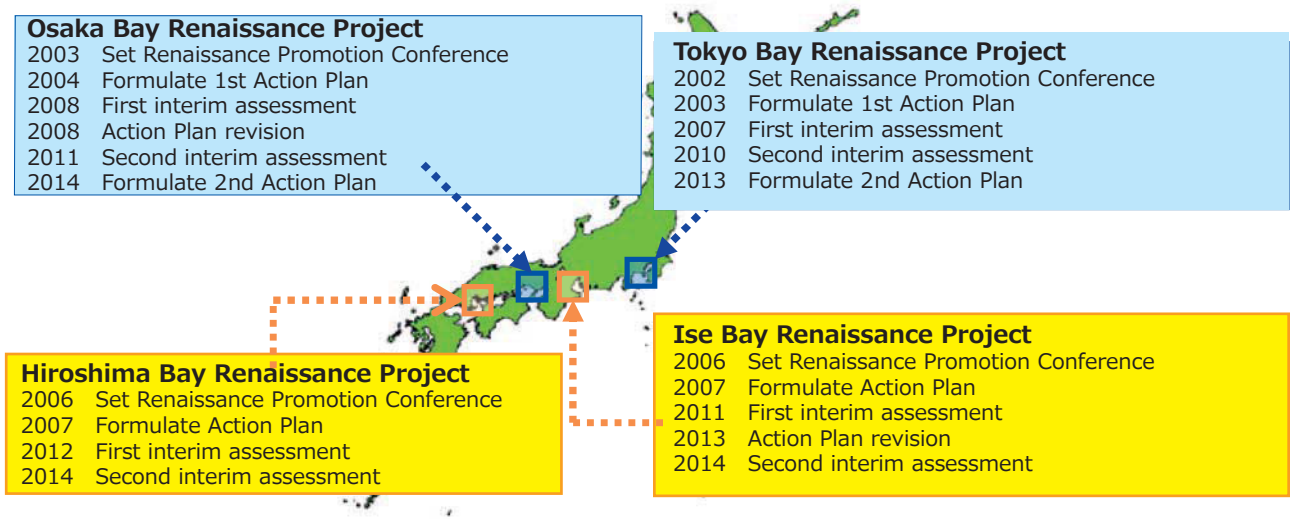
Temporal change of Cesium-137 in surface waters around Japan



Temporal change of Oil Concentration
(Osaka Bay)

Environmental Conservation Research (Marine Renaissance)

In a highly enclosed sea situated just next to a metropolitan area such as Tokyo Bay, there is frequent occurrence of chronic red tide caused by increased nutrient and flow of sewage-containing water, as well as the terrain characteristic there that the seawater is hardly exchanged with that in the open sea. In addition, oxygen deficient water has been generated due to organic pollutant. These conditions greatly influence marine animals and plants.
The Marine Renaissance Project is an integrated collaborative effort for conservation of marine environment among the parties concerned, including the Ministry of Land, Infrastructure, Transport and Tourism, the JCG, and local municipalities. The project promotes several policies to the reduction of water pollution, the marine environment improvement in the sea areas, and the environment monitoring. The project has started in 2002 in Tokyo, as "Tokyo Bay Marine Restoration Project", and it has been in progress at four locations in Japan; Tokyo Bay, Osaka Bay, Ise Bay, and Hiroshima Bay. JHOD has been monitoring marine environment such as seawater quality, at the monitoring post (water quality observation at a fixed location of Chiba light beacon), with survey boats, and with satellites. For Tokyo Bay and Osaka Bay, the first phase of the project for ten years was finished and the second Action Plan has been implemented.



Osaka Bay Renaissance Project
2003 Set Renaissance Promotion Conference
2004 Formulate 1st Action Plan
2008 First interim assessment
2008 Action Plan revision
2011 Second interim assessment
2014 Formulate 2nd Action Plan

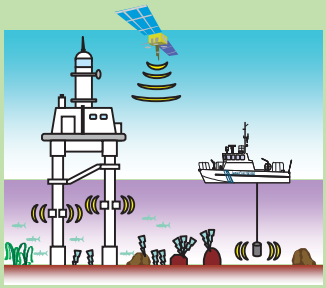
Tokyo Bay Renaissance Project
2002 Set Renaissance Promotion Conference
2003 Formulate 1st Action Plan
2007 First interim assessment
2010 Second interim assessment
2013 Formulate 2nd Action Plan

Hiroshima Bay Renaissance Project
2006 Set Renaissance Promotion Conference
2007 Formulate Action Plan
2012 First interim assessment
2014 Second interim assessment

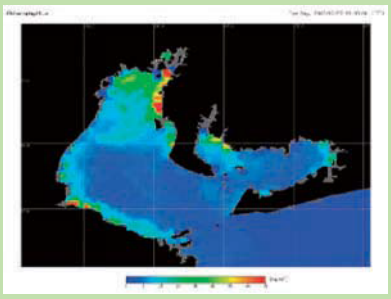
Ise Bay Renaissance Project
2006 Set Renaissance Promotion Conference
2007 Formulate Action Plan
2011 First interim assessment
2013 Action Plan revision
2014 Second interim assessment

Action of JHOD : Environmental Monitoring

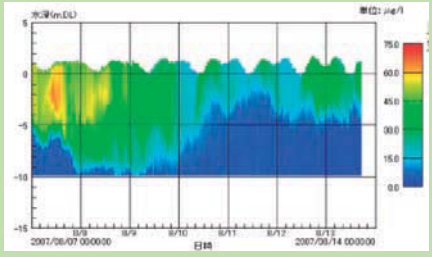
- Observation of water quality, current profile and wind profile by monitoring post and survey ships
  http://www4.kaiho.mlit.go.jp/kaihoweb/index.jsp
- Surveillance of red tide by satellites
  http://www1.kaiho.mlit.go.jp/KANKYO/SAISEI2/saisei_html/top.htm
- Informed in real-time on Internet



Outline screen of observation



Satellite image



Date image of monitoring post

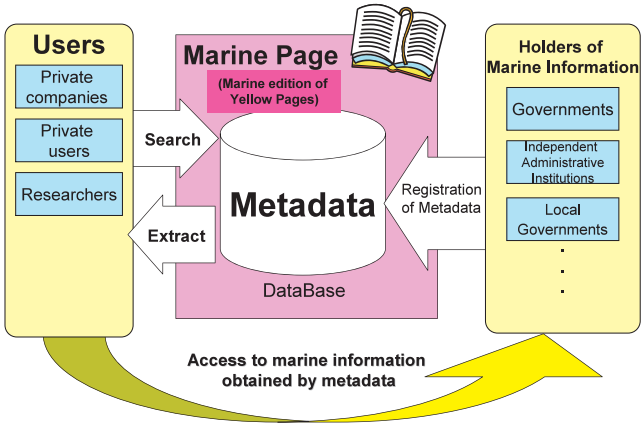
Managing and providing marine information

JHOD manages the marine information obtained from various marine research institutions and also provides several platforms for data users depend on user purpose.

Marine Information Clearinghouse (Marine Page)

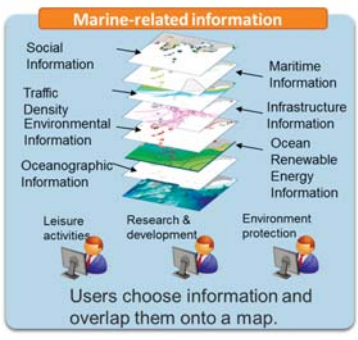
Marine Information Clearinghouse is an integrated database system that helps users search what sort of marine information owned by which of the party such as governmental institutions, universities, and local governments. The database provides any form of information, either online or offline, not only natural scientific information such as seawater temperatures, ocean currents and marine weathers, but also the social information such as Law of the Sea and disaster prevention.

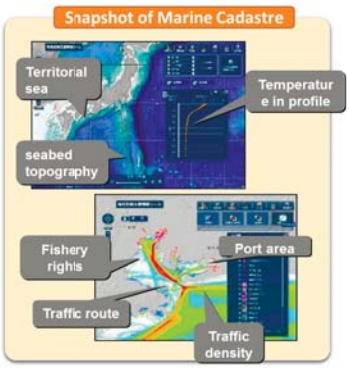
Address of the Website : http://www.mich.go.jp (Japanese Only)



Marine Cadastre

The Marine Cadastre is a Web-GIS service enable users to overlay various marine data on a basemap using some GIS functions, for example writing memo, measuring distance without installing a GIS software in user's PC. It has been promoted under the coordinating initiative of the Headquarters for Ocean Policy of the Prime Minister of Japan and His Cabinet ,marine data owned by other ministries are also available in the Marine Cadastre and it is expected to be used for various purposes such as marine development ,environment conservation ,disaster mitigation and education.





Address of the Website : http://www.kaiyodaicho.go.jp (Japanese Only)

COLUMN 03-4

Actions taken after the Great East Japan Earthquake (4)

● Providing information about the Great East Japan Earthquake by the Marine Information Clearing House

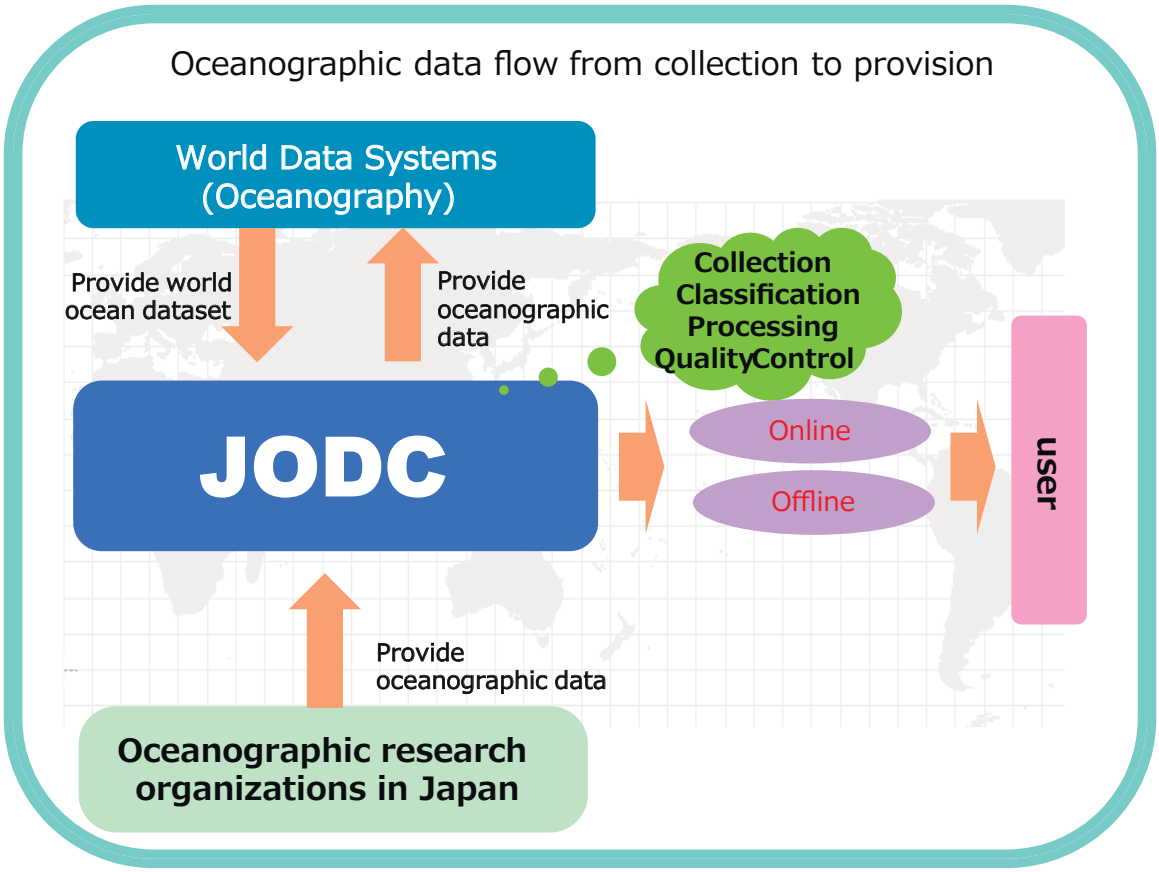
In order to promote sharing of marine information related to the Great East Japan Earthquake, JHOD has made a webpage with a collection of links for disaster information of earthquakes and tsunamis and marine information such as maritime traffic, fisheries, etc., owned by the governmental institutions.

Webpage for the Great East Japan Earthquake related information

Japan Oceanographic Data Center (JODC)

The JODC is a representative institution of Japan in the International Oceanographic Data and Information Exchange (IODE) System, promoted by the UNESCO Intergovernmental Oceanographic Commission (IOC). Along with the IODE data-exchange scheme, JODC has been comprehensively collecting the observation data, in cooperation with marine research agencies such as governmental agencies including JHOD, universities and institutions, which are members of National Board for Oceanographic Data Exchange. JODC has been providing information for many users through the online portal service and in other offline ways.

Address of the Website : http://www.jodc.go.jp/index.html



Marine Consultation Service

JHOD offers consultation services for marine researchers, companies and maritime leisure activities.
Marine Consultation Service provides data and information on marine information and data for survey, research and marine leisure. Visitors can also view nautical charts of foreign countries as well as new and old charts of Japan.
JHOD has Marine Consultation Service in Hydrographic and Oceanographic Department (Tokyo) and 11 other Regional Coast Guard Headquarters.

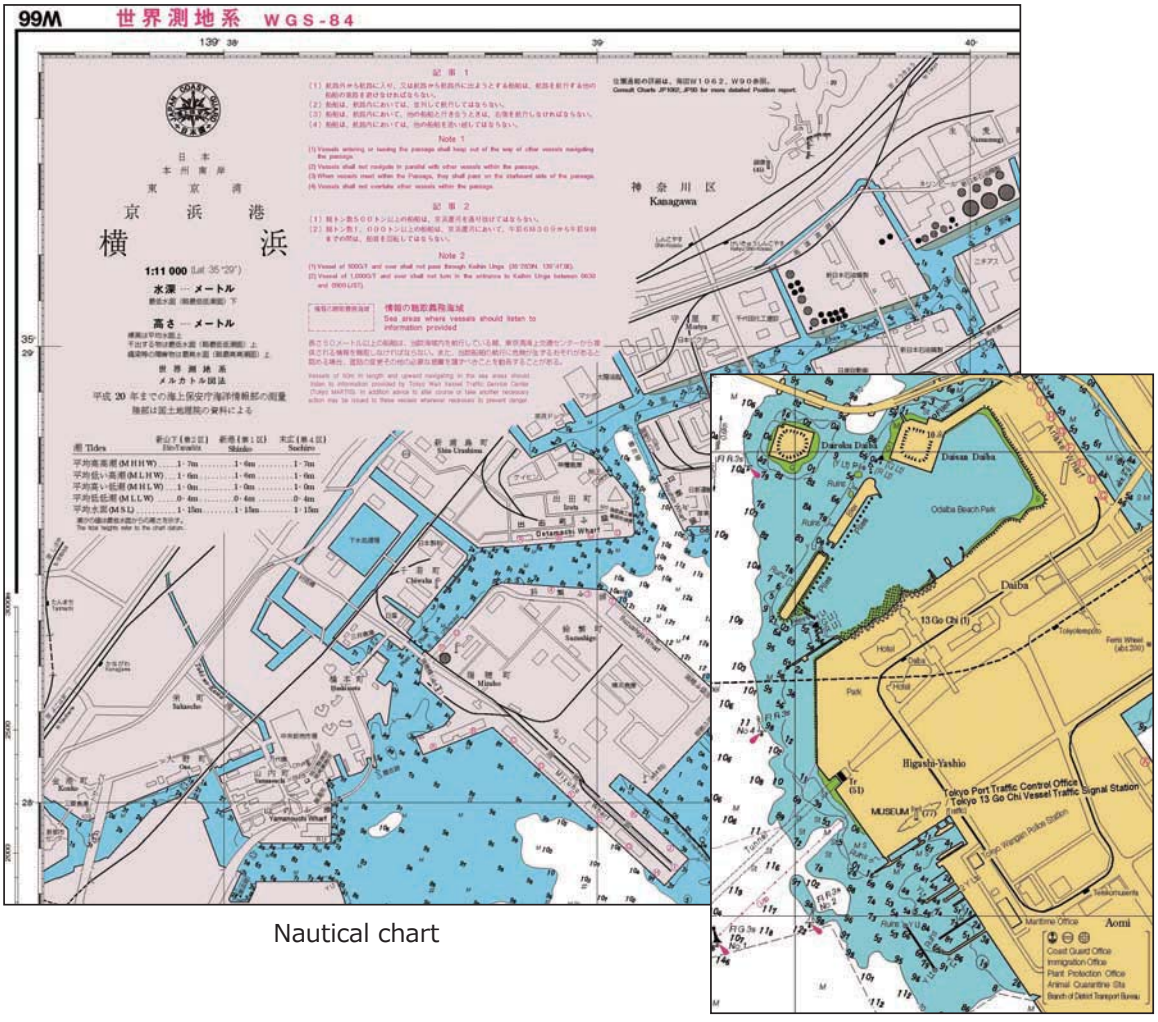
Information supporting safety of navigation

JHOD complies the information on tracks and routeing measures that are necessary for safety of navigation, and the hydrographic information such as water depths, tidal currents and tide observed by surveys; and publishes nautical charts and publications. JHOD provides the latest information by Notices to Mariners, Navigational Warnings and Quick Bulletin of Ocean Conditions.

Charts Compilation & Publication

JHOD uses the navigational safety information – tracks, routeing measures, etc. -, the hydrographic survey results and the observation data of ocean and tidal currents at each area and port; and adopts their schematic layout based on international specifications. JHOD compiles all of them, not only depths, but also other information to assist in navigation – prominent land features such as capes, coastline, structures on the coast and navigational marks such as lighthouses -; and completes accurate and user-friendly charts, choosing appropriate scale and limits of the chart.
Not only Japanese vessels but also foreign vessels enter ports in Japan. Therefore JHOD/JCG has published some English version of Japanese nautical charts series for foreign mariners. Those charts have the same scale, limits and contents as Japanese ones except for written in English only.

Compiling a nautical chart



Nautical chart

Nautical Chart / (English version)

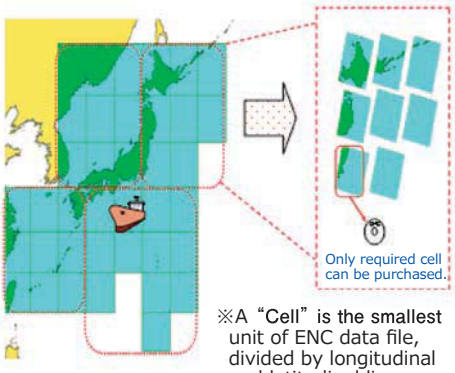
Electronic Navigational Charts

JHOD/JCG publishes Electronic Navigational Charts (ENCs) for safety and efficiency of navigation.
Small scale ENCs (smaller than 1:80,000) cover entire sea area around Japan whereas large scale ENCs cover major ports and sailing routes over the Japanese coastal sea. Each area of an ENC is delimited in rectangular unit (cell) by longitudinal and latitudinal lines. Users have only to purchase cells covering the area they need.
To update ENCs, JHOD provides the latest information as the “Electronic Notices to Mariners” over the Internet.
JHOD also promotes collaboration with the East Asian countries, to improve the contents of ENCs for the East Asian regions.

Small scale ENCs　　Large scale ENCs

Cell zone
Coverage

ENCs Coverage published by JHOD/JCG

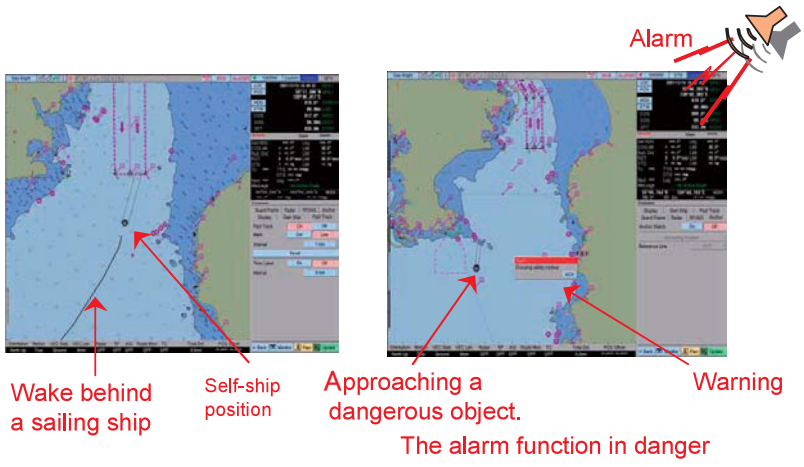


※A “Cell” is the smallest unit of ENC data file, divided by longitudinal and latitudinal lines.

The concept of providing ENCs in each cell

By using the ENCs on the ECDIS, various navigational safety information - location, track, sailing course speed of the vessel, etc. -, is shown on the display of ECDIS and mariners can use various functions for safety and convenience.
Moreover, workload of mariners is reduced by using these functions - providing superposition of radar image over the ENCs, issuing automatic warnings and alerts when users approach the dangerous sea area, etc. -, hence, the safety and efficiency of navigation is increased.

Electronic Chart Display and Information System (ECDIS)



Displaying the ENCs and various functions on ECDIS

Displaying functions for safe navigation.

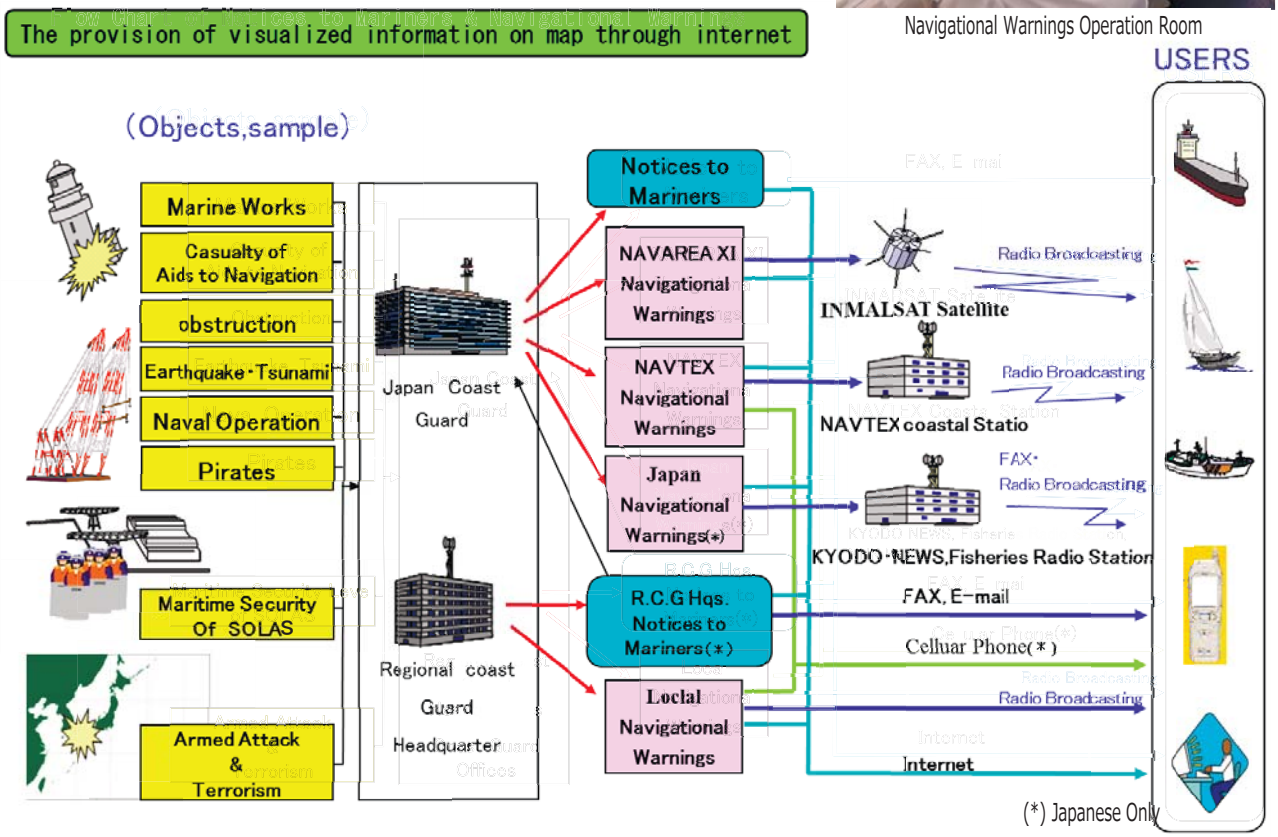
- The scale of a display screen
- Distance to a way point
- Route, passed track, anchorage surveillance, etc.
- The position of an own ship, direction, speed
- Safety depth
- etc.

Information supporting safety of navigation

Notices to Mariners & Navigational Warnings

For safety of navigation, JHOD provides information on newly installed navigational marks and signs, scheduled training exercises at sea, in the Notices to Mariners. JHOD broadcast, emergency information in NAVAREA XI Navigational Warnings, NAVTEX Navigational Warnings, Japan Navigational Warnings, and Local Navigational Warnings. Since 18 June 2014, JHOD has provided the online information service which visualizes Navigational Warnings. The visualization is useful for users to understand the dangerous area.

Navigational Warnings Operation Room



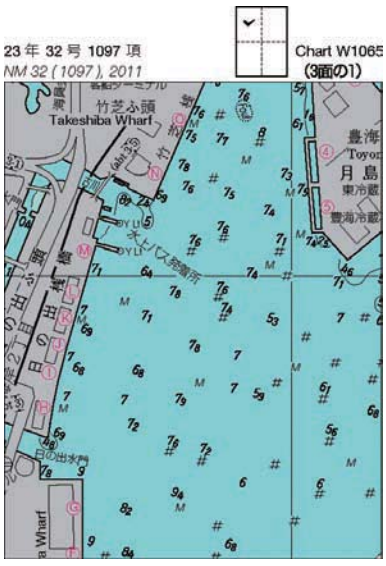
JHOD collects information within the JCG as well as from the other institutions and ordinary general vessels, to provide in the Notices to Mariners and Navigational Warnings. JHOD have been providing the information for users through the media that are appropriate to the contents and area.

JHOD provides been providing the Notices to Mariners through the Internet. JHOD provides the Regional Notices by fax as well.

JHOD distributes emergency information as Navigational Warnings in many media, such as radio or satellite broadcast, as well as over the Internet.

Updating Nautical Charts

Nautical charts must be always up-to-dated for safety navigation. When JHOD has changes in the chart contents, JHOD notifies the relevant parts (Notices to Mariners) for amendment. When JHOD has a substantial amount of amendment in a chart, JHOD makes a new edition of the chart. In the Notices to Mariners, JHOD provides the correction charts to be pasted upon, as shown in the right figure, in addition to manual amendment instruction.



Correction charts to be pasted on

Notices to Mariners

To provide information that is necessary for updating the charts, such as the changes of navigation marks, etc., and about temporary situation, such as the works at sea, etc.

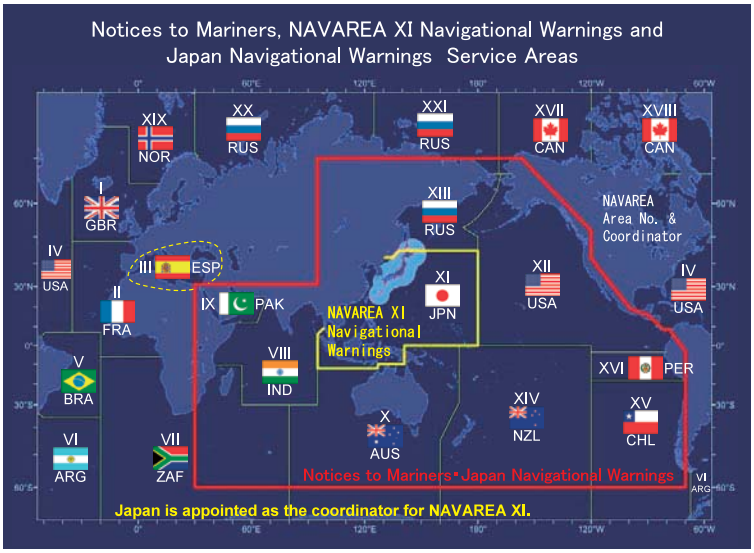
Types	Area	Provide Frequency	Language	Providing Methods
Notices to Mariners	In the Pacific Ocean, the Indian Ocean and their marginal seas	Every a week	English & Japanese	Internet
Regional Coast Guard Headquarters' Notices to Mariners	Responsible water and approach of Regional Coast Guard Headquarters	Every a week or any time	Japanese	Internet, E-mail, Facsimile etc.

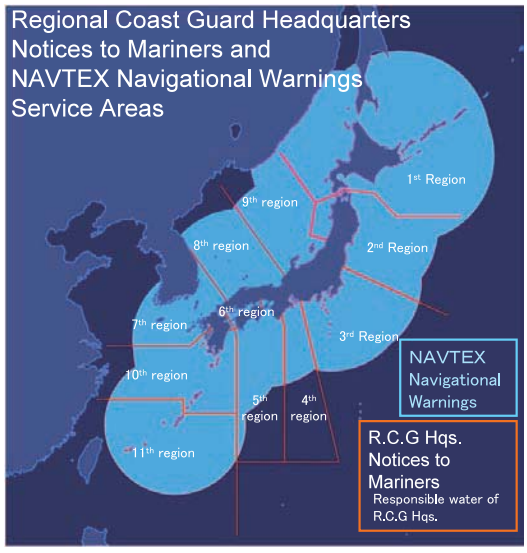
Navigational Warnings

To provide emergency information, such as the outage of lighthouse, floating obstructions, tugging of large object in congested area, training exercise at sea, etc.

Types	Area	Provide Frequency	Language	Providing Methods
NAVAREA XI Navigational Warnings	For the safety of Ships sailing in the Ocean	fixed time (Three times a day) & any time	English	Radio telegraphy and Internet
NAVTEX Navigational Warnings	For the safety of Ships sailing in the coastal area within about 300 miles from the Japanese coast	fixed time (Six times a day) & any time	English & Japanese	Radio telegraphy and Internet
JAPANESE Navigational Warnings	For the safety of Japanese Ships sailing in the Pacific Ocean, the Indian Ocean and their marginal seas	fixed time (Twice a day) & any time	Japanese	Internet, Radio Facsimile and Radio
LOCAL Navigational Warnings	For the safety of Ships sailing in port and approach	fixed time (Twice a day) & any time	English & Japanese	Radio telegraphy and Internet

＊The World-Wide Navigational Warning Service consists of 21 Navigation Warning Areas (NAVAREAs). Japan is appointed as the coordinator for NAVAREA XI



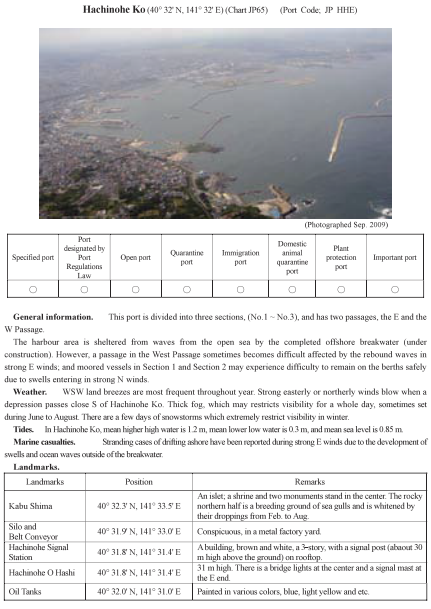


Internet Address http://www1.kaiho.mlit.go.jp/

Nautical Publications

Nautical publications are essential to safety of navigation together with charts. JHOD compiles the information on sailing routes, methods, and harbor facilities, and the results of hydrographic surveys, tide and tidal current surveys, and astronomical observation, and publishes them. Nautical publications include sailing directions and special publications. Sailing directions describe the outline of ports, sailing routes, weather, and marine weather information that does not display in nautical charts. Special publications describe the situation of navigation marks, tides, tidal current forecast, positions of planets and stars, etc.

Publications(Extract)
Sailing Directions (Domestic),
Sailing Directions (Foreign),
Tide tables,
List of Aids to Navigation,
Nautical Almanac



Hachinohe Ko (40° 32' N, 141° 32' E) (Chart JP65) (Port Code: JP HHE)

(Photographed Sep. 2009)

Specified port	Port designated by Port Regulations Law	Open port	Quarantine port	Immigration port	Domestic animal quarantine port	Plant protection port	Important port
○	○	○	○	○	○	○	○

General information. This port is divided into three sections, (No.1 ~ No.3), and has two passages, the E and the W Passage.

The harbour area is sheltered from waves from the open sea by the completed offshore breakwater (under construction). However, a passage in the West Passage sometimes becomes difficult affected by the rebound waves in strong E winds; and moored vessels in Section 1 and Section 2 may experience difficulty to remain on the berths safely due to swells entering in strong N winds.

Weather. WSW land breezes are most frequent throughout year. Strong easterly or northerly winds blow when a depression passes close S of Hachinohe Ko. Thick fog, which may restricts visibility for a whole day, sometimes set during June to August. There are a few days of snowstorms which extremely restrict visibility in winter.

Tides. In Hachinohe Ko, mean higher high water is 1.2 m, mean lower low water is 0.3 m, and mean sea level is 0.85 m.

Marine casualties. Stranding cases of drifting ashore have been reported during strong E winds due to the development of swells and ocean waves outside of the breakwater.

Landmarks.

Landmarks	Position	Remarks
Kabu Shima	40° 32.3' N, 141° 33.5' E	An islet; a shrine and two monuments stand in the center. The rocky northern half is a breeding ground of sea gulls and is whitened by their droppings from Feb. to Aug.
Silo and Belt Conveyor	40° 31.9' N, 141° 33.0' E	Conspicuous, in a metal factory yard.
Hachinohe Signal Station	40° 31.8' N, 141° 31.4' E	A building, brown and white, a 3-story, with a signal post (abaout 30 m high above the ground) on rooftop.
Hachinohe O Hashi	40° 31.8' N, 141° 31.4' E	31 m high. There is a bridge lights at the center and a signal mast at the E end.
Oil Tanks	40° 32.0' N, 141° 31.0' E	Painted in various colors, blue, light yellow and etc.

Articles in Sailing Directions
"S.&E.COAST OF HONSHU PILOT"

Types of nautical publications

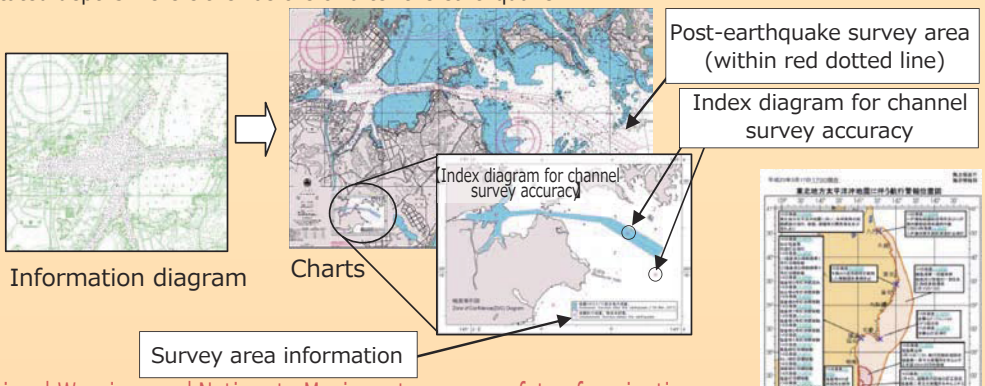
Classification		Language	Kinds
Sailing Directions	Domestic	Japanese	S.&E. COASTS OF HONSHU PILOT, NW COAST OF HONSHU PILOT, SETO NAIKAI PILOT, COAST OF HOKKAIDO PILOT, COAST OF KYUSYU PILOT
		English	Sailing Directions for South and East Coasts of Honshu, Sailing Directions for Northwest Coast of Honshu, Sailing Directions for Seto Naikai, Sailing Directions for Coast of Hokkaido, Sailing Directions for Coast of Kyushu
	Foreign	Japanese	COAST OF KOREA PILOT, COAST OF CHINA AND TAIWAN PILOT, SOUTH CHINA SEA AND MALACCA STRAIT PILOT etc. (Total 5 publications)
Special Publications		Japanese	OCEAN PASSAGE PILOT, COASTWISE PASSAGE PILOT, DISTANCE TABLE, LIST OF AIDS TO NAVIGATION (VOL.1 & VOL.2), ASTRONOMICAL NAVIGATION TABLE, NAUTICAL ALMANAC, ABRIDGED NAUTICAL ALMANAC, TIDE TABLES (VOL.1 & VOL.2), MANUAL FOR USE OF CHARTS AND PUBLICATIONS, CATALOGUE OF CHARTS AND PUBLICATIONS
		English	CATALOGUE OF CHARTS AND PUBLICATIONS

COLUMN 03-5

Actions taken after the Great East Japan Earthquake (5)

● Updating the nautical charts of the affected ports, aiming at fast recovery of the quake-hit areas

In order to disseminate the accurate status of the parts as soon as possible, JHOD provided port authorities with an "information diagram" containing newly surveyed sounding depths. JHOD later indicated the post-earthquake survey area in the nautical charts, and incorporated an index diagram to indicate that the stated depths were either before or after the earthquake.



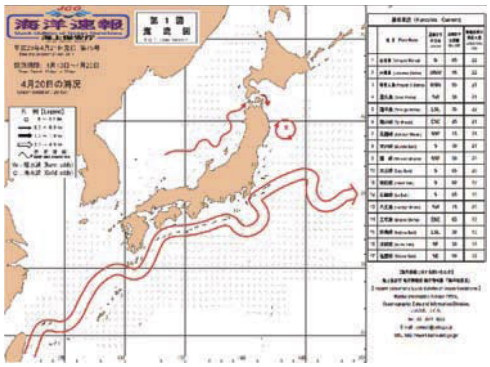
● Issuing Navigational Warnings and Notices to Mariners to ensure safety of navigation

Information of floating objects e.g. rubble and collapse of lighthouses were provided by navigational warnings via radio broadcast etc. and Mariners via the JHOD website. In addition. JHOD make an integrated navigational warning locati on diagram, for users' convenience, where JHOD have incorporated the valid NAVTEX Navigational Warnings, and posted on the JHOD website.

Navigational Warning Location Diagram

Quick Bulletin of Ocean Conditions

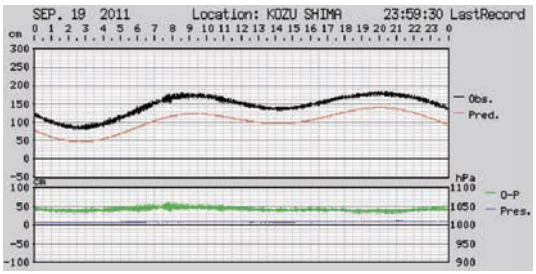
The Kuroshio Current around Japan has its fast velocity (3 to 4 knots) and influences the maritime traffic and fishery. The Quick Bulletin of Ocean Conditions provides the daily position of the Kuroshio Current and the vessels use this information to select the efficient shipping route.



Quick Bulletin of Ocean Conditions

Real-time tide gauge data

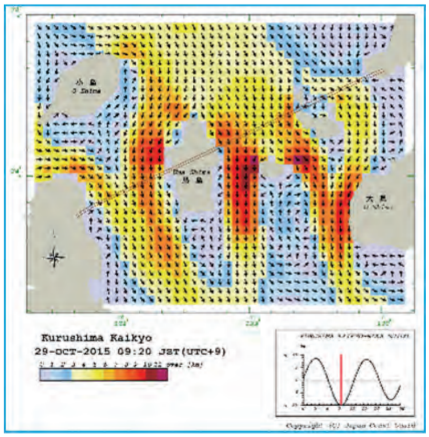
JHOD provides the real-time tidal height information obtained by the 20 tide gauges in Japan. The data of the tidal height is used for the tidal prediction, tidal correction for the surveyed bathymetry, calculation of the ocean current, monitoring of the crustal displacement as well as detection of tsunamis.



Real-time tide gauge data

Tide and Tidal Current Estimation

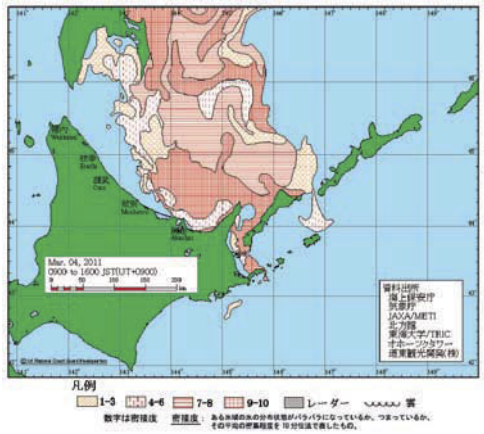
"The Tidal Current Information in Kurushima Strait" provides precise simulated tidal current over the strait every ten minutes. Users can also plot the position of their vessels through smartphones with GPS receivers.
JHOD provides the estimates of tidal currents in Tokyo Bay, Ise Bay, and the Seto Inland Sea at arbitrary time and date.
JHOD provides the estimates of tides at hundreds of locations in Japan over the Internet.



The Tidal Current Informationin Kurushima Strait

Ice Information Center

Sea ice appears on the Sea of Okhotsk along the coast of Hokkaido in winter. The local news introduces the appearance of the sea ice every winter in their program. The information of sea ice such as the position or connectivity is essential to the vessels, because they sometimes cannot escape once surrounded by the sea ice. The First Regional Coast Guard Headquarter opens the Ice Information Center every year from December 20 to the end of April, providing information of the sea ice in the Sea of Okhotsk everyday by fax and through the internet as "Sea Ice Bulletin".



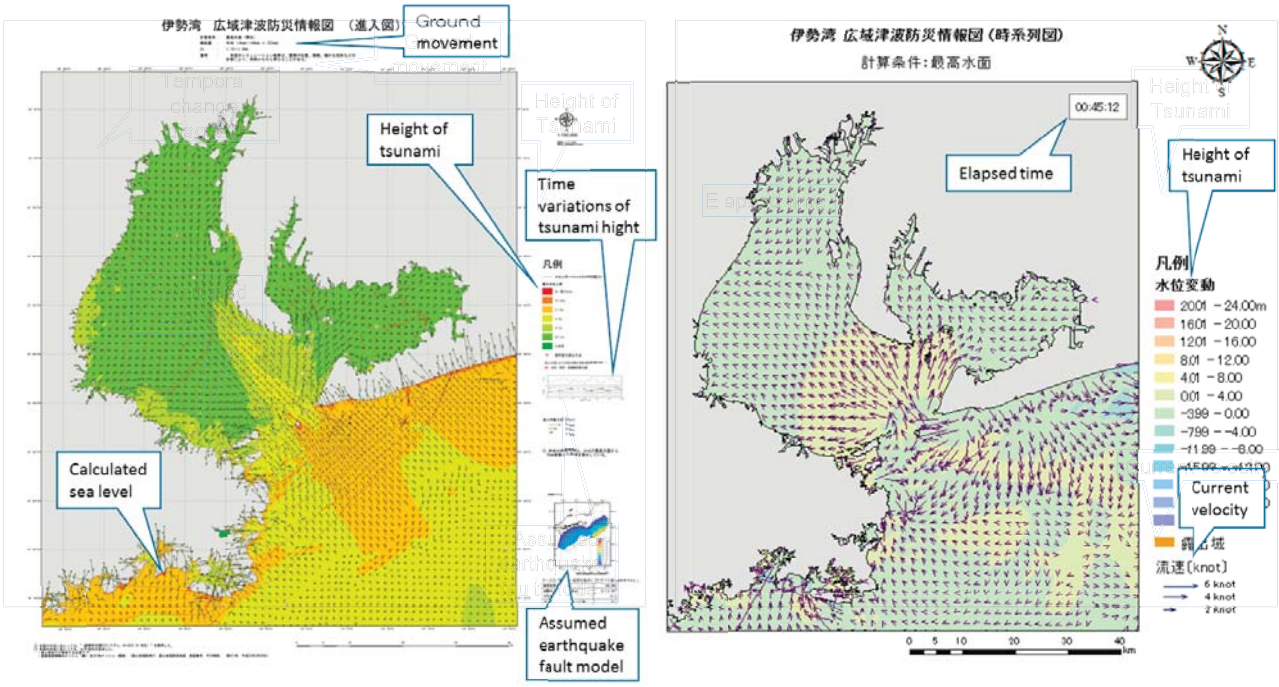
Ice condition chart

Information for disaster prevention

JHOD provides a variety of information for minimizing damages caused by natural disasters, such as earthquakes and tsunamis, and by maritime disasters like oil spills caused by the collision of the vessels.

Tsunami Information Map

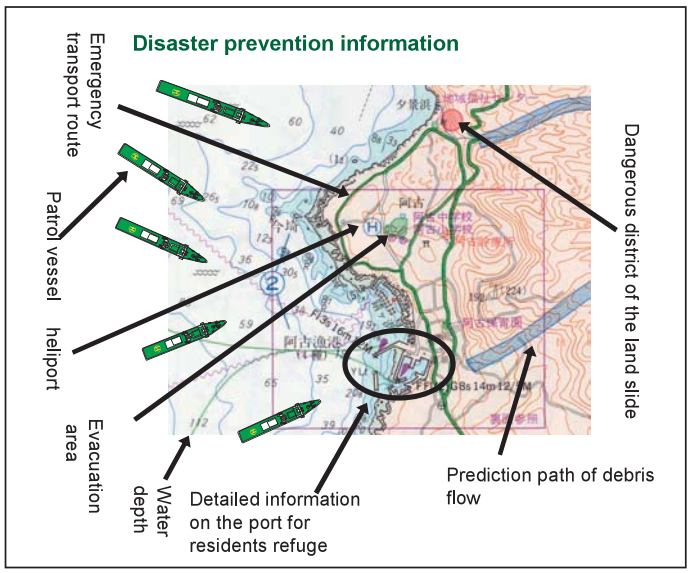
JHOD conducts numerical simulations of tsunami behavior based on detailed bathymetric data we have and provides the tsunami information maps in the harbors and coastal areas where are assumed to suffer tsunami damage when large earthquake occurs. These maps are used as basic information for preparing measures to take against tsunami disasters in harbor areas and for rescue activities.



Tsunami Information Map (Owase Port)

Coastal Disaster Prevention Information Map

JHOD publishes “The Coastal Disaster Prevention Information Map” helpful for prompt support operations, evaluation and delivery of relief aides, in remote islands and coastal area in case of natural disasters, for example, earthquakes and tsunamis. These maps provide information, witch we have collected, on natural characteristics such as seafloor topography as well as social information that includes locations of agencies for disaster prevention, medical institutions and available locations for heliports, and local populations. The maps are distributed to local authorities concerning disaster prevention to help them conduct rescue activities.



Coastal Disaster Prevention Information Map (Miyake Shima)

Coastal Environmental Information Service (Ceis Net, ESI Map)

CEIS (Coastal Environmental Information Service) Net

JHOD collects information on natural environment, disaster prevention, coastline ESI (Environmental Sustainability Index) in the coastal area of all over Japan, and organizes them as the “Coastal Environmental Information Service”, in preparation for oil spill accidents. JHOD provides these pieces of information under the name of “CEIS Net” over the Internet, so as to be used by any institutions anytime involved in the oil spill prevention and removal.

CEIS Net is able to superimpose a variety of information as a reference for oil spill prevention and removal on a map to display. It can also display the photographs of coastline and ports. It has been utilized to study the contingency plan for oil spill prevention and removal, and providing training exercise for possible accidents.

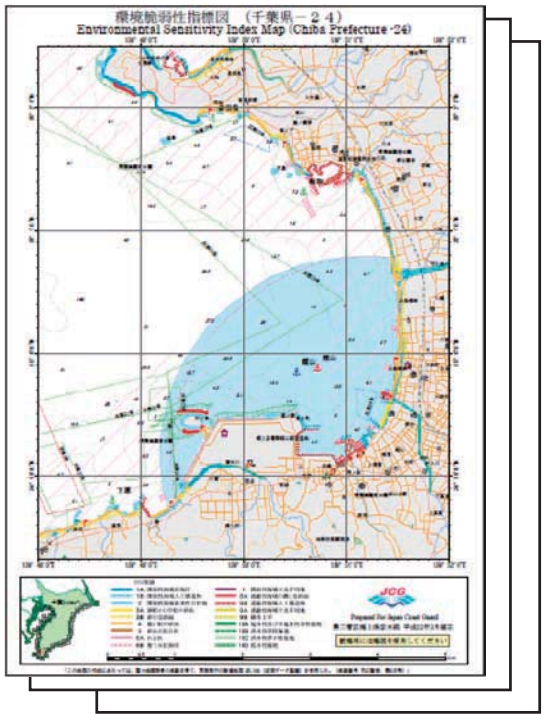
Screenshot of Ceis Net (Near Tokyo Wan)

Information for disaster prevention

ESI (Environmental Sensitivity Index) Map

JHOD provides the "ESI Map" in PDF file format. The "ESI Map" is a printable version of map which coordinates the information items chosen from the CEIS Net.

In case users cannot access the Internet, or can not use computers on the accident site, the printable "ESI Map" is designed for on-site use by those involved in oil spill prevention and removal. Therefore, JHOD prepared there maps so that users would be able to connect the adjacent maps seamlessly. Coastlines of entire Japan are covered by the 2,147 pieces of 1/25,000 scale map.



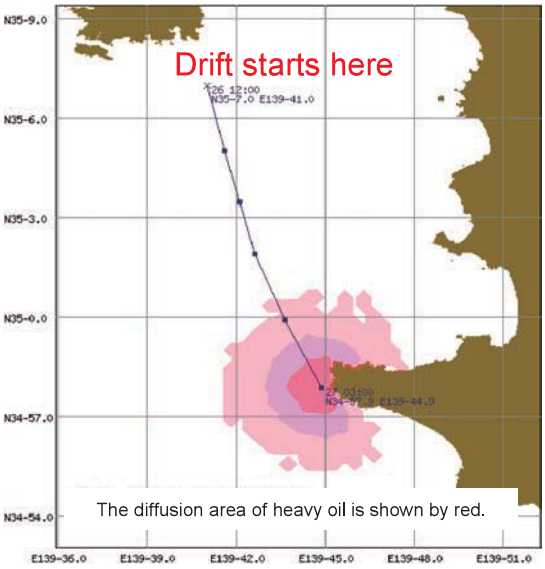
The ESI map of Tateyama

Trajectory Prediction

When there is an accident at sea, the JCG responds to it by dispatching its patrol vessels or aircrafts; for example, the JCG searches for missing crew of the capsized vessel, and responds to the oil spill from grounded tanker, etc.

In order to execute these search and rescue operations or oil spill prevention and removal operations, the JHOD has been predicting the trajectory of floating victims, the capsized vessel, or oil spills, from the ocean currents observed by survey vessels, patrol boats, and HF radar.

The trajectory of floating objects at sea depends on not only ocean currents but also winds and shape of the object. JHOD considers these factors to predict the trajectory.



Example of trajectory prediction chart

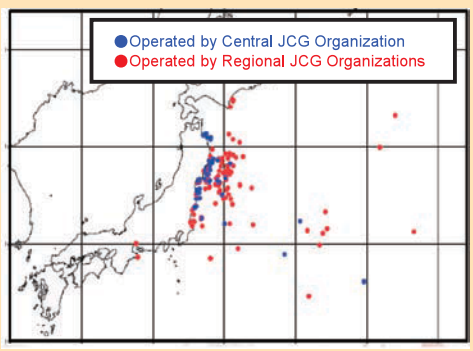
(JHOD made this chart assuming the oil spill occurred in the mouth of Tokyo Bay)

COLUMN 036

Actions taken after the Great East Japan Earthquake (6)

Conducting trajectory prediction of the drifting people and objects

Because the tsunami swept away a number of people and vessels to the sea, JHOD conducted many trajectory predictions: for example, to narrow down the search range of drifting victims, to predict the destination of drifting vessels, and to guess the cause of drift, etc.



Initial point of drift simulation

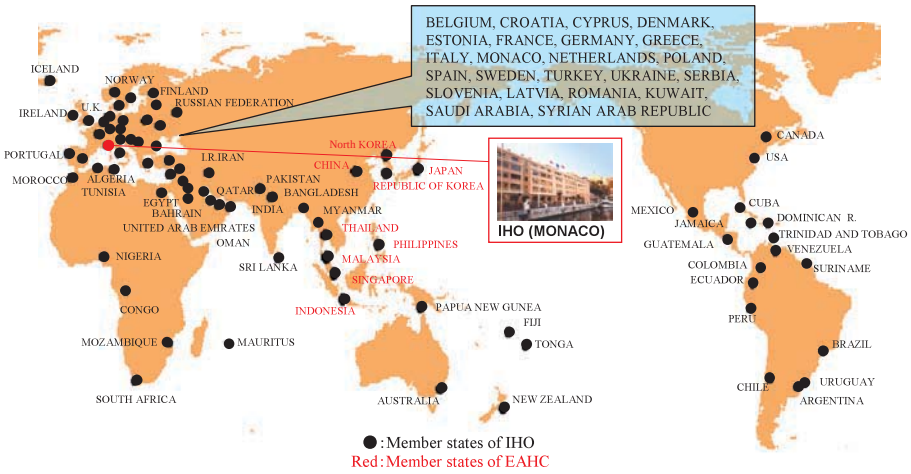
International activities

The International Hydrographic Organization (IHO) has been established for uniformity in nautical charts worldwide. Japan, as a member state of the IHO, has been participating in many international conferences to help make global standards in hydrographic field, and developing global partnership, exchanging hydrographic data and information with many countries. Japan has been also working as a member state of the Regional Hydrographic Commission, to develop regional partnership in the hydrographic services with the East Asian countries.

In the field of overseas technology cooperation, JHOD helps developing countries improve the hydrographic services by providing training opportunity for their hydrographers every year.

International Hydrographic Organization (IHO)

The IHO is an international organization established in 1970 under the "Convention on the International Hydrographic Organization," as an organization that handles consulting and technical issues (82 member states as of December 2014). The goal of the IHO is to make navigation all over the world easier and safer by improving nautical charts and publications. The International Hydrographic Bureau, headquarter, of the IHO, is located in the Principality of Monaco.



●: Member states of IHO
Red: Member states of EAHC

Regional Hydrographic Commissions (RHC)

JHOD participates in the East Asia Hydrographic Commission (member states: China, Indonesia, Japan, Malaysia, North Korea, Philippines, Republic of Korea, Singapore, Thailand), one of the Regional Hydrographic Commissions of the IHO, and has been contributing to developing regional hydrographic activities, as a permanent Secretariat.

The East Asia Hydrographic Commission

Capacity Building in Hydrography

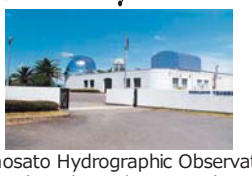
JHOD, in cooperation with JICA, an independent governmental agency, provides a group training course (for about six months) "Marine Information Management for Navigation Safety, Disaster Prevention, and Environment Protection (Internationally Accredited Category B for Hydrographic Survey)" every year for hydrographers in developing countries in Asia and Africa. More than 400 hydrographers from 42 countries have participated in the course so far. The participants have been assumed to hold important positions in hydrographic activities in their home countries.

JHOD has consistently supported the "CHART Project" including the precedent project of "Japan Capacity Building Project" since 2008. This initiative has been an important part of the capacity building project by the IHO with the support of the Nippon Foundation, to contribute to international standardization of nautical charts and publications. Under the project, the United Kingdom Hydrographic Office (UKHO) has provided training opportunities for more than 40 trainees in the world.

Group training course on hydrographic survey

Location of headquarters and regional headquarters

Hydrographic and Oceanographic Department,JCG



Shimosato Hydrographic Observatory (Geodetic Observation)

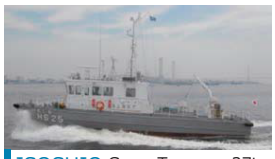
Yokohama Shinko Tide Station

Survey vessels

SHOYO (JHOD Hqs) Gross Tonnage:3,000 t Length 98.0 meters

TAKUYO (JHOD Hqs) Gross Tonnage:2,400 t Length 96.0 meters

HAMASHIO (3th RCGHqs) Gross Tonnage:27t Length 21 meters



ISOSHIO (4th RCGHqs) Gross Tonnage:27t Length 21 meters

MEIYO (JHOD Hqs) Gross Tonnage:550 t Length 60.0 meters

TEN-YO (JHOD Hqs) Gross Tonnage:430 t Length 58.0 meters

UZUSHIO (5th RCGHqs) Gross Tonnage:27t Length 21 meters

KURUSHIMA (6th RCGHqs) Gross Tonnage:27t Length 20 meters

KAIYO (JHOD Hqs) Gross Tonnage:550 t Length 60.0 meters

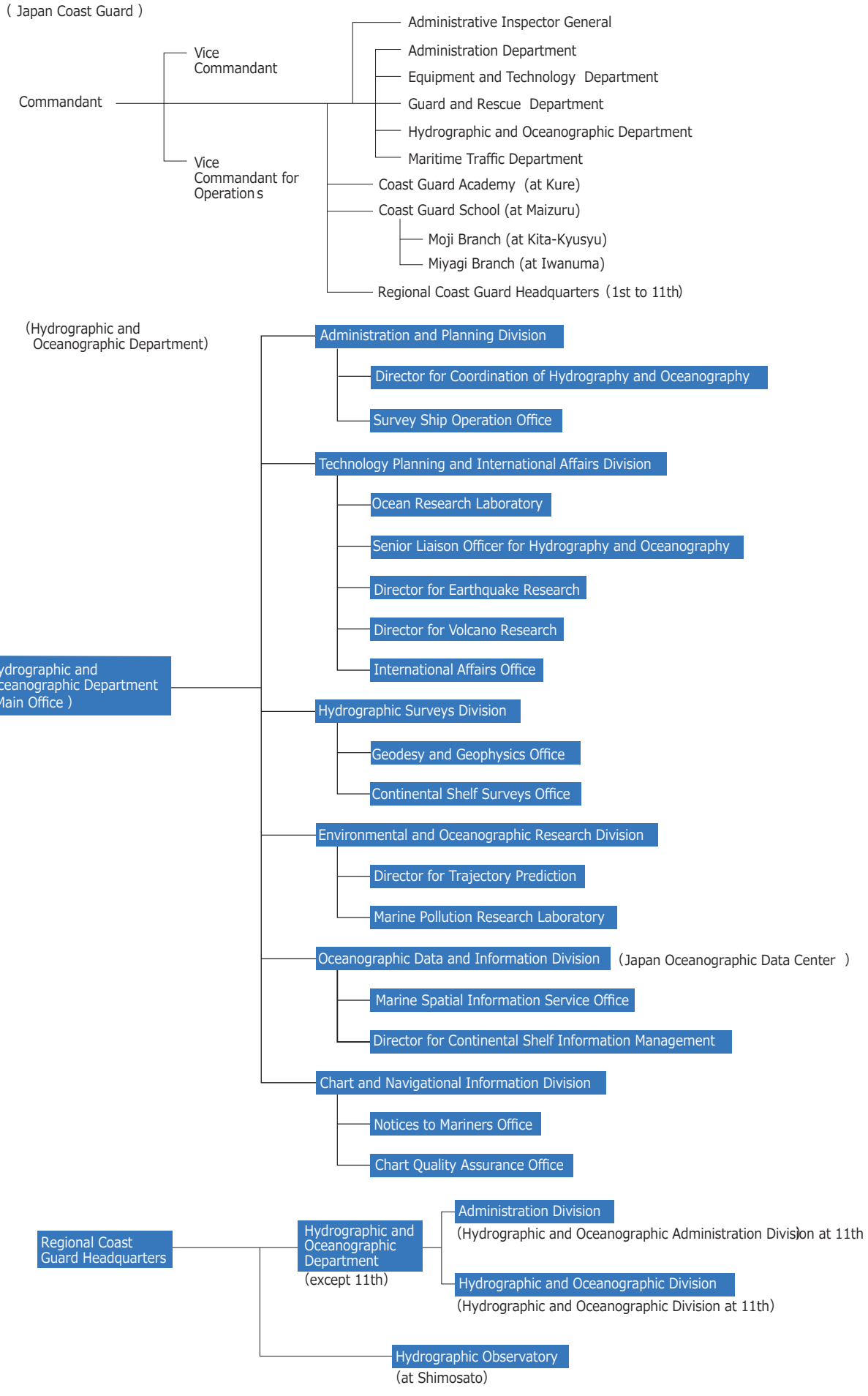
JINBEI (JHOD Hqs) Gross Tonnage:5t Length 11.0 meters

HAYASHIO (7th RCGHqs) Gross Tonnage:27t Length 21 meters

ISOSHIO (10th RCGHqs) Gross Tonnage:27t Length 21 meters

OKISHIO (11th RCGHqs) Gross Tonnage:27t Length 21 meters

Organization



Hydrographic and Oceanographic Department ,Japan Coast Guard

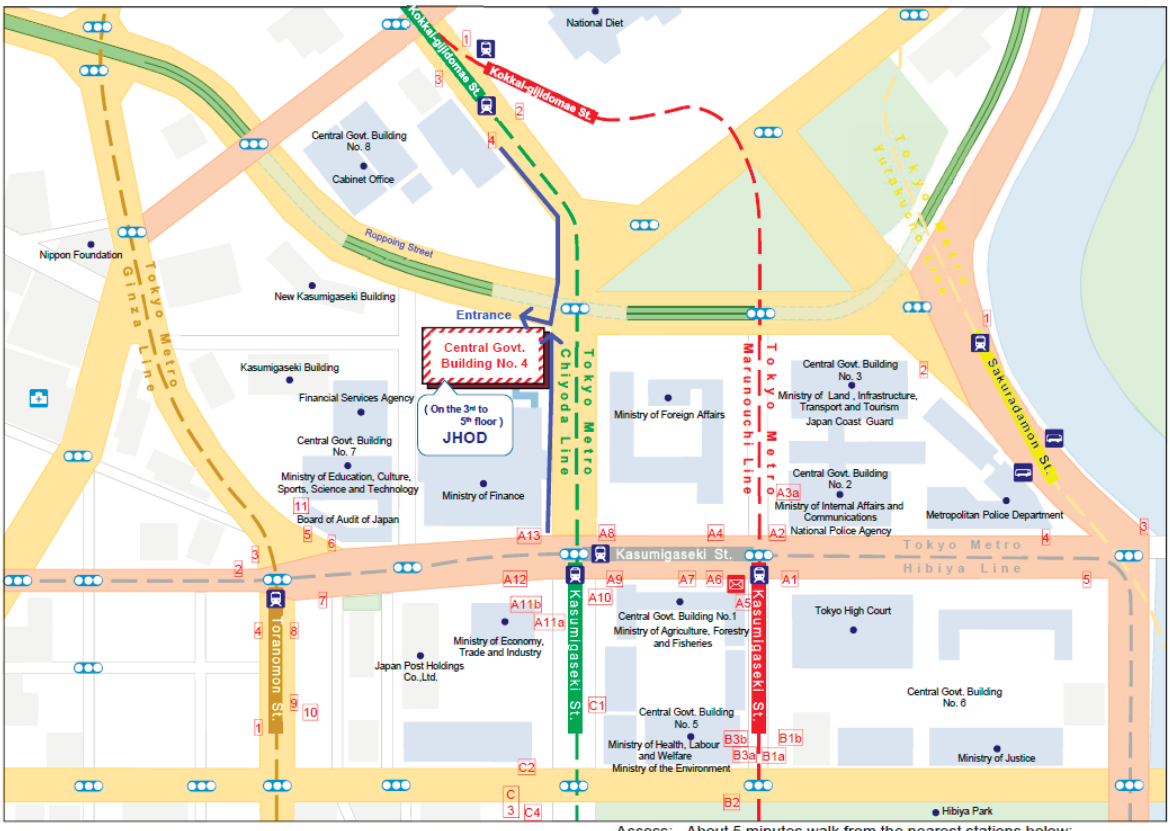
3-1-1, Kasumigaseki, Chiyoda-ku, Tokyo 100-8932, Japan
http://www1.kaiho.mlit.go.jp/

■ Headquarters

Administration and Planning Division	+81-3-3595-3601
Survey Ship Operation Office	+81-3-3595-3602
Technology Planning and International Affairs Division	+81-3-3595-3603
Ocean Research Laboratory	+81-3-3595-3604
International Affairs Office	+81-3-3595-3605
Hydrographic Surveys Division	+81-3-3595-3606
Geodesy and Geophysics Office	+81-3-3595-3607
Continental Shelf Surveys Office	+81-3-3595-3608
Environmental and Oceanographic Research Division	+81-3-3595-3609
Marine Pollution Research Laboratory	+81-3-5500-7129
Oceanographic Data and Information Division	+81-3-3595-3611
Japan Oceanographic Data Center	+81-3-3595-3612
Marine Spatial Information Management Office	+81-3-3595-3613
Chart and Navigational Information Division	+81-3-3595-3614
Notices to Mariners Office	+81-3-3595-3615
Chart Quality Assurance Office	+81-3-3595-3616

■ Regional headquarters

1st Regional Coast Guard Headquarters	Hydrographic and Oceanographic Department	+81-134-27-0118
2nd Regional Coast Guard Headquarters	Hydrographic and Oceanographic Department	+81-22-363-0111
3rd Regional Coast Guard Headquarters	Hydrographic and Oceanographic Department	+81-45-211-0118
4th Regional Coast Guard Headquarters	Hydrographic and Oceanographic Department	+81-52-661-1611
5th Regional Coast Guard Headquarters	Hydrographic and Oceanographic Department	+81-78-391-6551
6th Regional Coast Guard Headquarters	Hydrographic and Oceanographic Department	+81-82-251-5111
7th Regional Coast Guard Headquarters	Hydrographic and Oceanographic Department	+81-93-321-2931
8th Regional Coast Guard Headquarters	Hydrographic and Oceanographic Department	+81-773-76-4100
9th Regional Coast Guard Headquarters	Hydrographic and Oceanographic Department	+81-25-245-0118
10th Regional Coast Guard Headquarters	Hydrographic and Oceanographic Department	+81-99-250-9800
11th Regional Coast Guard Headquarters	Hydrographic and Oceanographic Administration Division	+81-98-867-0118



JHOD

Address:
3-1-1, Kasumigaseki, Chiyoda-ku, Tokyo 100-8932, Japan

Access: About 5 minutes walk from the nearest stations below:
- Chiyoda / Hibiya / Marunouchi Lines: Kasumigaseki St. (Exit A13)
- Marunouchi Line: Kokkai-gijidomae St. (Exit 4)

2017.01