



Comprehensive Port/Airport/Coast Technical Center

Niigata Research and Engineering Office for Port and Airport



Ministry of Land, Infrastructure, Transport and Tourism Hokuriku Regional Development Bureau
Niigata Research and Engineering Office for Port and Airport

Role of the Niigata Research and Engineering Office for Port and Airport

Aiming to work in harmony with the region, as a comprehensive technical center for ports, airports, and coasts!

As the comprehensive technical center for ports, airports, and coasts in the Hokuriku region, which faces harsh natural conditions such as high winter waves, we continuously strive to enhance our technical capabilities, while systematically and reliably handling surveys, designs, technological development, and other tasks related to the implementation of projects for ports, airports, and coasts within the region, which are essential for regional revitalization in Hokuriku, as well as providing precise construction support and other technical assistance.

- (1) Sound implementation of surveys, designs, and other tasks
- (2) Development of technologies and utilization of new private-sector technologies for the implementation of projects
- (3) Modification and scheduled maintenance of working vessels for smooth project implementation
- (4) Initiatives aimed at strengthening the framework for earthquake and tsunami preparations
- (5) Improvement of functionality as an engineering center

Overview of Operations by the Niigata Research and Engineering Office for Port and Airport




◆ Jurisdiction of the Hokuriku Regional Development Bureau (regarding ports and airports)

Niigata, Toyama, Ishikawa, Fukui, and Nagano Prefectures

◆ Major Roles

The following tasks related to ports, airports, and coastal projects:

- (1) Surveying
- (2) Designing
- (3) Technological development
- (4) Maintenance of vessels and other equipment
- (5) Disaster response
- (6) Regional collaboration and revitalization activities

-  Central International Port
-  Major Port
-  Port of Refuge
-  Hub Airport
-  Joint-Use Airport



① Surveying

Oceanographic Phenomenon Survey

● Observation of Wave Height, Wave Direction, etc., Using Ultrasonic Wavemeters

The data collected is centrally processed and analyzed by the Nationwide Ocean Wave Information Network for Ports and Harbours (NOWPHAS), and is used widely for the development, utilization, and disaster preparedness of coastal areas.

● Tidal Level Observation

The data collected is disclosed through NOWPHAS, and used for managing datum levels, tracking sea level changes associated with global warming, and more.

● Strong-Motion Earthquake Observation at Ports

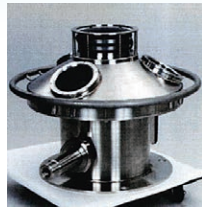
The data collected is used to elucidate earthquake motion characteristics that vary by port, as well as for other purposes.

Hydraulic Model Experiments

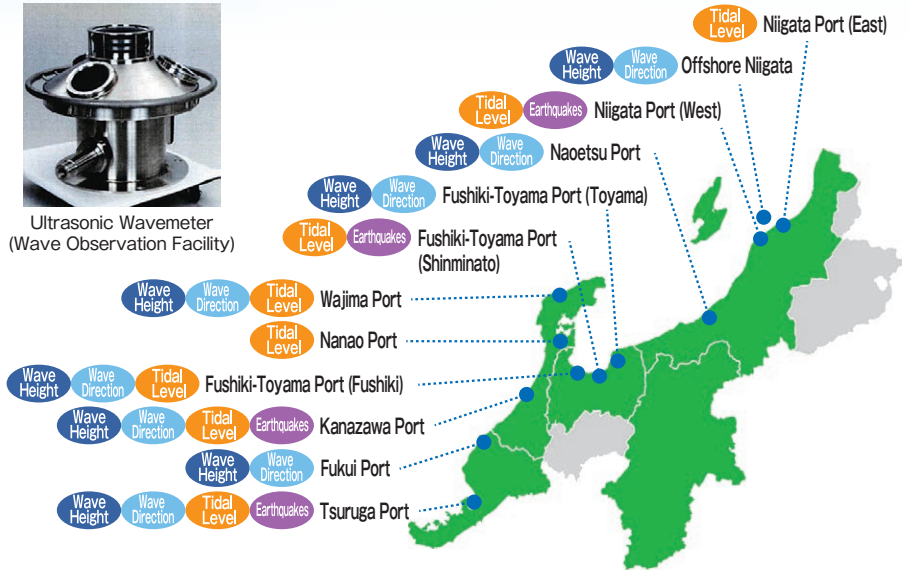
● Complex hydraulic phenomena are reproduced using models to obtain empirical solutions.

Other Technical Surveys

Observation Sites



Ultrasonic Wavemeter (Wave Observation Facility)



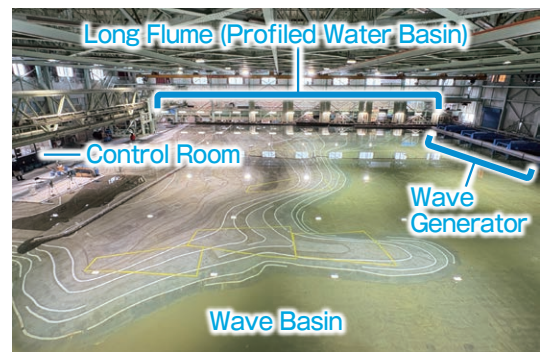
Wave condition data for each port is available on the NOWPHAS website.
https://www.mlit.go.jp/kowan/nowphas/index_eng.html



Hydraulic Model Experiments

Our hydraulic laboratory conducts experiments using models to study how waves propagate into ports, the stability of harbor structures, and other related topics. While computer-based numerical analyses have come a long way, hydraulic model experiments still play a substantial role in elucidating complex hydraulic phenomena that cannot be fully addressed through simulations.

The laboratory features a wave basin capable of three-dimensionally reproducing a wide area, and a long flume (profiled basin) that allows two-dimensional observation from lateral angles of models placed inside. The building's floor area is approximately 4,000m².

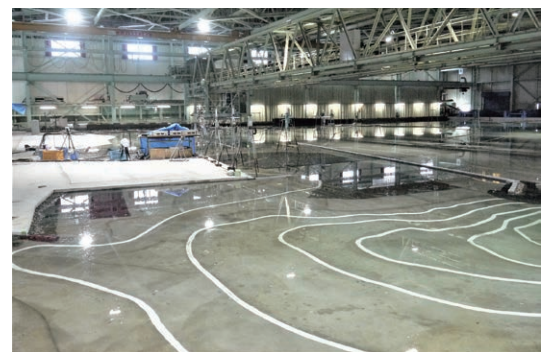


Wave Basin (56.5m × 48m)

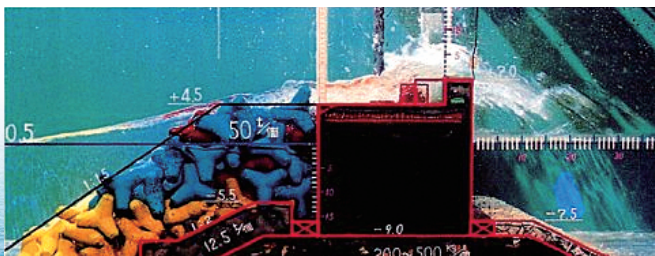
The wave basin, which can accommodate models over a wide area, is equipped with a single-directional irregular wave generator capable of generating single-directional regular and irregular waves. By repositioning the wave generator, it is also possible to perform experiments with different wave directions without moving the models inside the water basin.

Wave Basin Experiment

Models of ports and coastlines are placed, and wave heights and current velocities are measured under various wave conditions to examine the optimal layout and design of structures.



Long Flume (Profiled Water Basin; 59m × 1.25m)



Cross-Sectional Model Test of a Back-Parapet Breakwater

Stability Experiments

The behavior of port structures, blocks, and other objects against waves is measured and observed to evaluate their safety against waves.

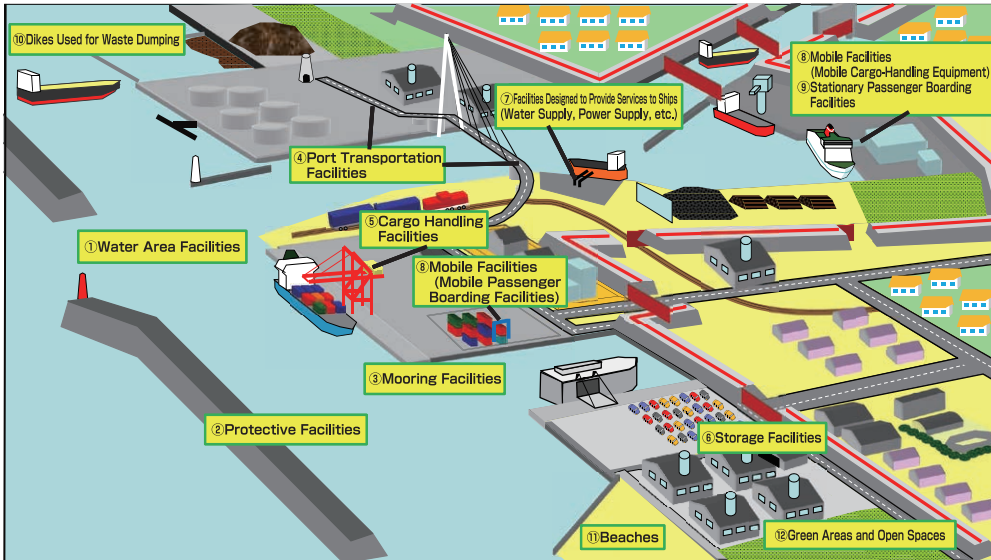
Wave Overtopping Experiments

Wave overtopping rates are measured for different heights of breakwaters, revetments, and other structures, and the conditions of the overtopping waves are observed. The results are used to design breakwaters, revetments, and other structures.

② Design of Port Facilities, etc.

We conduct design work related to breakwaters, quays (seismic-resistant berths, international maritime container terminals, and international logistics terminals), port transportation facilities, airports, and coastlines.

- | | | | | |
|-------------------------|----------------------------------|--|--|-------------------------------|
| ① Water Area Facilities | ④ Port Transportation Facilities | ⑦ Facilities Designed to Provide Services to Ships | ⑨ Stationary Passenger Boarding Facilities | ⑪ Beaches |
| ② Protective Facilities | ⑤ Cargo Handling Facilities | ⑧ Mobile Facilities (excluding mobile cargo-handling equipment incapable of handling cargo automatically or by remote control) | ⑩ Dikes Used for Waste Dumping | ⑫ Green Areas and Open Spaces |
| ③ Mooring Facilities | ⑥ Storage Facilities | Note: Items ①, ②, ③, ⑧, and ⑨ are not limited to port facilities. | | |



Niigata East Port International Container Terminal



Kanazawa Port International Logistics Terminal



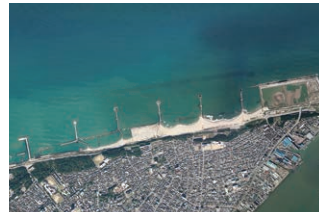
Tsuruga Port International Logistics Terminal



Niigata Minato Tunnel (Irifune Minato Tower)



Fushiki-Toyama Port Shinminato Bridge



Niigata Port Coast (West Coast Area)



Niigata Airport

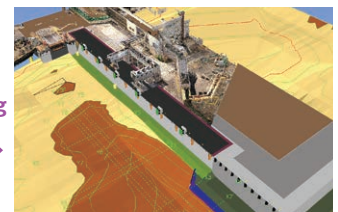
Creation of BIM/CIM Models

3D models are introduced from the planning, surveying, and design stages. These 3D models are also used for the subsequent construction and maintenance stages, and extended to facilitate information sharing among all stakeholders across the entire project.



Ryotsu Port (Minato District) Quay (-7.5 m) (Seismic-Resistant)

3D Modeling



③ Technological Development

Major Technological Development Achievements to Date

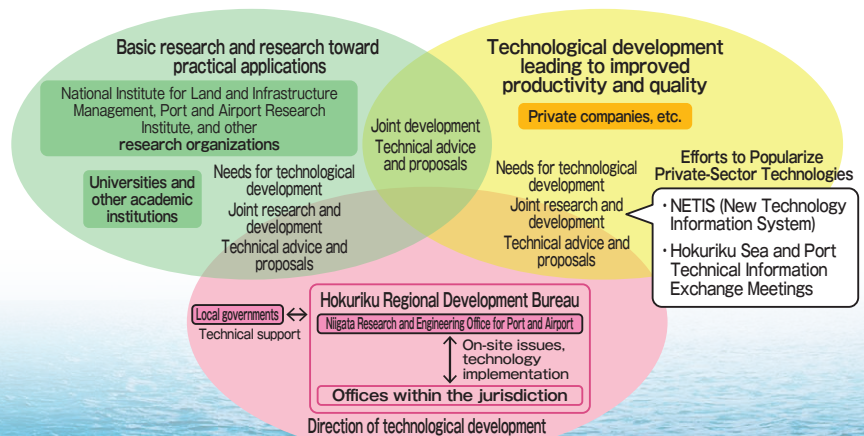
○ Port Structures, Construction, etc.

- New Structural Type of Breakwater (Back-Parapet-Type Spot Leaf Breakwater)
- Suction Foundation Structures
- Replaceable Piers
- Automatic Mooring Equipment

○ Environment

- Effective Utilization of Recycled Resources (Molten Slag)

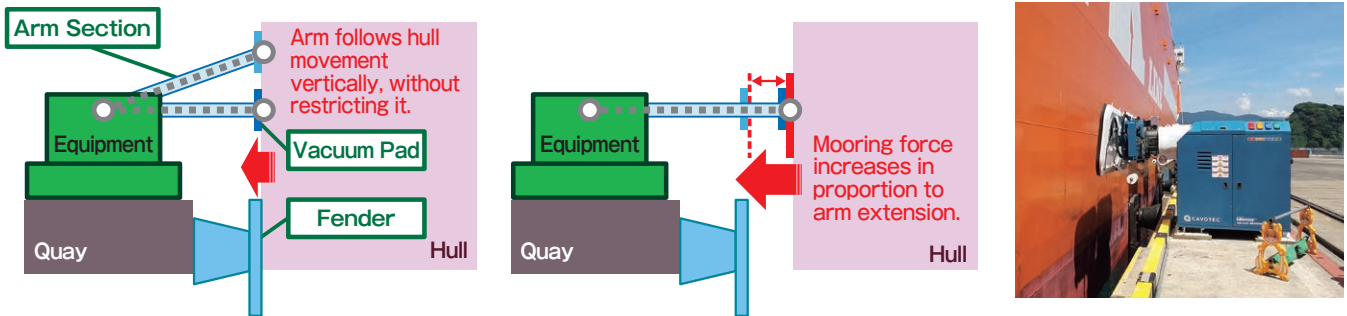
Organizational Framework for Technological Development



Improving the Efficiency of Vessel Mooring Operations

○Automatic Mooring System

In the Mariyama South Area of Tsuruga Port, we are pushing forward with an initiative to upgrade port operations toward the formation of a Next-Generation High-Standard Unit Load Terminal, through the utilization of new technologies. More specifically, as part of our efforts, we are considering the introduction of automatic mooring equipment, which promises to improve the efficiency and safety of vessel mooring operations.

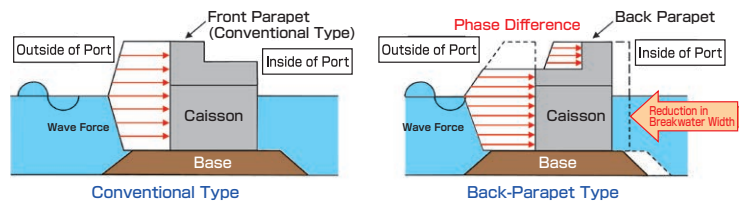


New Structural Form of Breakwater

Back-Parapet-Type Spot Leaf Breakwater

The phase difference between the wave force acting on the front face of the breakwater and that acting on the parapet section results in a reduction of the wave force simultaneously applied to the entire breakwater.

This allows for reduced breakwater width compared to conventional structures, which in turn reduces costs.

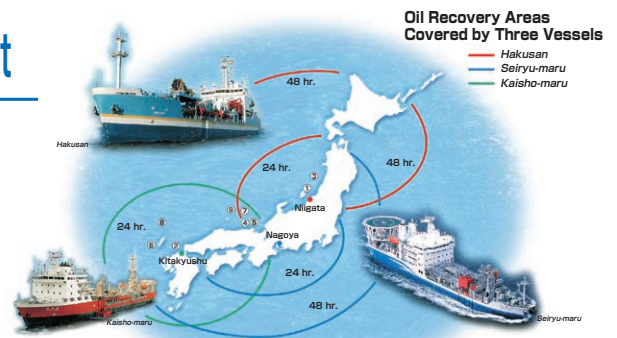


④ Maintenance of Vessels and Other Equipment

Maintenance of the Large-Scale Dredging and Oil Recovery Vessel *Hakusan*

Following the *Nakhodka* oil spill incident in January 1997, which caused extensive damage along the Sea of Japan coastline, construction began on the large dredging and oil recovery vessel *Hakusan*. It was completed in August 2002.

The *Hakusan* performs dredging, which involves excavating sediment within ports to maintain waterways; oil recovery, which involves collecting large quantities of oil spilled into the sea due to accidents or other causes; and support operations following the occurrence of large-scale disasters. The Niigata Research and Engineering Office for Port and Airport handles the construction, maintenance, and repairs of the *Hakusan*.



The *Hakusan* can begin oil recovery operations within 24 hours in the Sea of Japan, and within two days in waters around Hokkaido. In addition, we have established a capability to handle oil spills nationwide, together with the *Seiryu-maru* at Nagoya Port and the *Kaisho-maru* at Kitakyushu Port.

The Large-Scale Dredging and Oil Recovery Vessel *Hakusan*

- Deployed to Niigata Port in August 2002
- Total Length 93.9m, Width 17m, Depth 7.5m, Gross Tonnage 4,185 tons, Cruising Speed 13.1 knots
- Performs maintenance dredging of the Niigata West Port waterway using the Trailing Suction Hopper Dredger (TSHD) Method.
- Performs oil recovery operations in the event of a large-scale oil spill
- Transports emergency relief goods, provides water and fuel supplies, and offers bathing and laundry support in the event of a major disaster



Disaster Response Functionality



Oil Recovery Functions



Emergency Relief Goods Transport Functions



Water Supply Functions

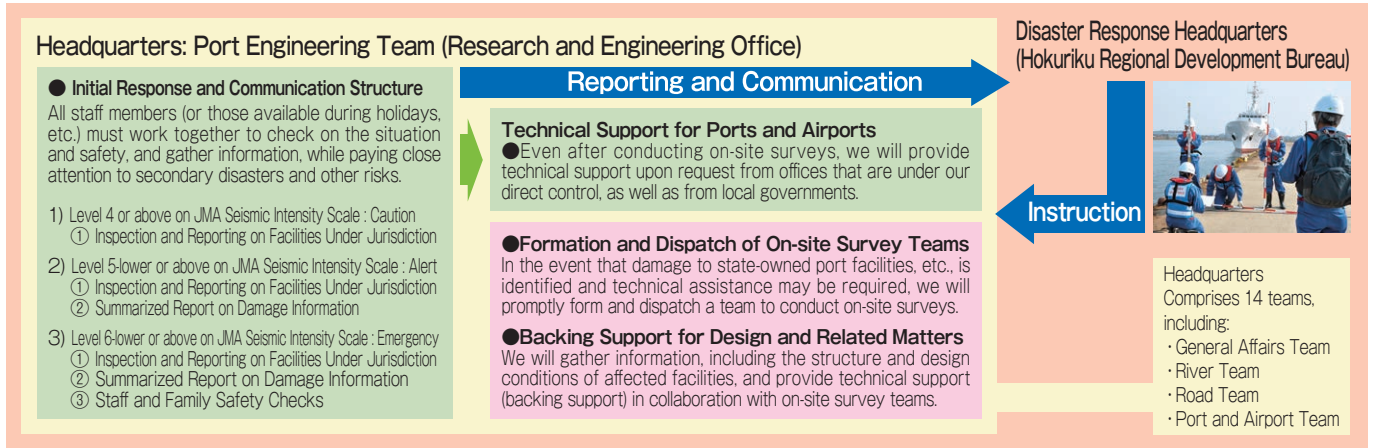


Refueling Functions

⑤ Disaster Response

Crisis Management Measures in the Event of a Disaster

In order to ensure prompt initial response and appropriate measures in the event of disasters such as earthquakes, tsunamis, and oil spills, we work to identify issues based on the Operational Guidelines of the Port Engineering Team and the Business Continuity Plan (BCP) of the Research and Engineering Office, as well as through the implementation of disaster prevention drills and other activities, thereby improving our capabilities in information gathering, information sharing, support systems, and related areas. Additionally, as part of disaster support efforts for regions including those outside our jurisdiction, we dispatch appointed personnel to the Technical Emergency Control Force (TEC-FORCE) and provide assistance, upon request.

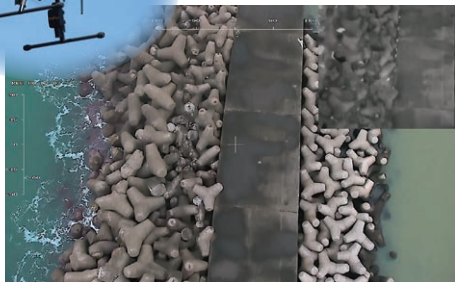


Unmanned Aerial Vehicle (UAV) Operations

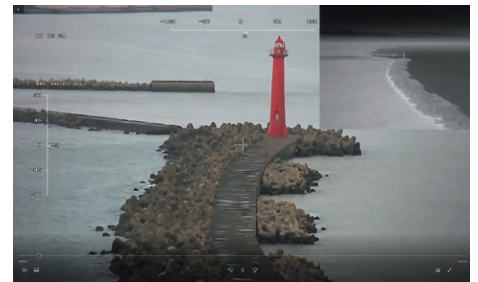
■ The Niigata Research and Engineering Office for Port and Airport owns one unmanned aerial vehicle (UAV) equipped with GPS control. It is intended for use in disaster surveys, construction process control, facility management, and other purposes.



Survey of Damage Immediately after the Noto Peninsula Earthquake



Images Captured by UAV



⑥ Regional Collaboration and Revitalization Activities

Hydraulic Laboratory Tours

We offer tours of our hydraulic laboratory to help a wide range of local residents understand the importance of ports, the roles of our office, the structure of the laboratory, and more.



Support for Project-Based Learning

We provide support for project-based learning by focusing on topics such as surveys, design, and technological development related to ports, airports, and coastlines within the Hokuriku region.



Niigata Research and Engineering Office for Port and Airport; Hokuriku Regional Development Bureau; Ministry of Land, Infrastructure, Transport and Tourism

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