

JAMSTEC's New Research Vessel

- Toward a New Deep-Sea Exploration System-

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Significance of Deep-Sea Exploration in Japan

Seas surrounding Japan are **both vast and deep**.

Japan's EEZ (200 nautical miles) covers 4.47 million km², ranking 6th worldwide in area and 4th in seawater volume.

About half of these waters lies deeper than 4,000 m, and 6% of it extends beyond 6,000 m.

- ✓ The volume of waters deeper than 5,000 m is the largest in the world.
- ✓ The area of waters deeper than 6,000m is the largest in the world.

Table: Top 5 seawater volumes by depth within the world's 200-nautical-mile zones

	0~1,000m		1,000~2,000m		2,000~3,000m		3,000~4,000m		4,000~5,000m		5,000~6,000m		6,000m~	
1		USA		USA		USA		USA		USA		JPN		JPN
2		AUS		AUS		AUS		KIR		KIR		USA		TON
3		IDN		KIR		KIR		AUS		JPN		KIR		RUS
4		JPN		JPN		CHL		JPN		AUS		PHL		PHL
5		NZL		CHL		JPN		CHL		MHL		MHL		NZL

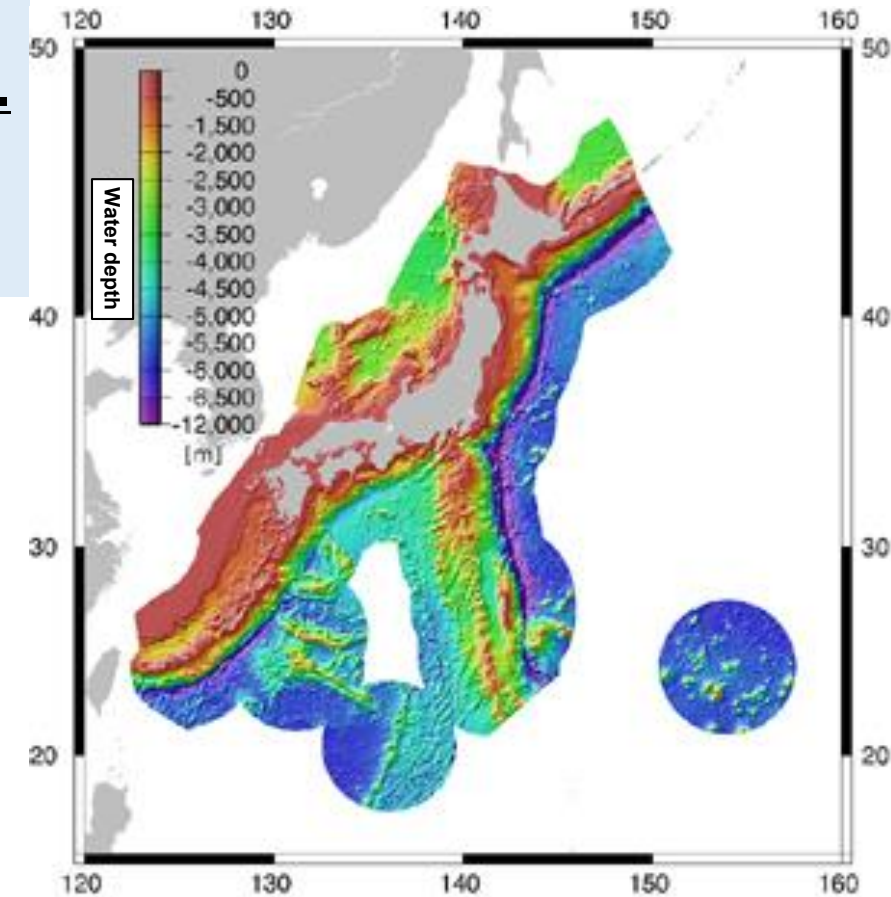
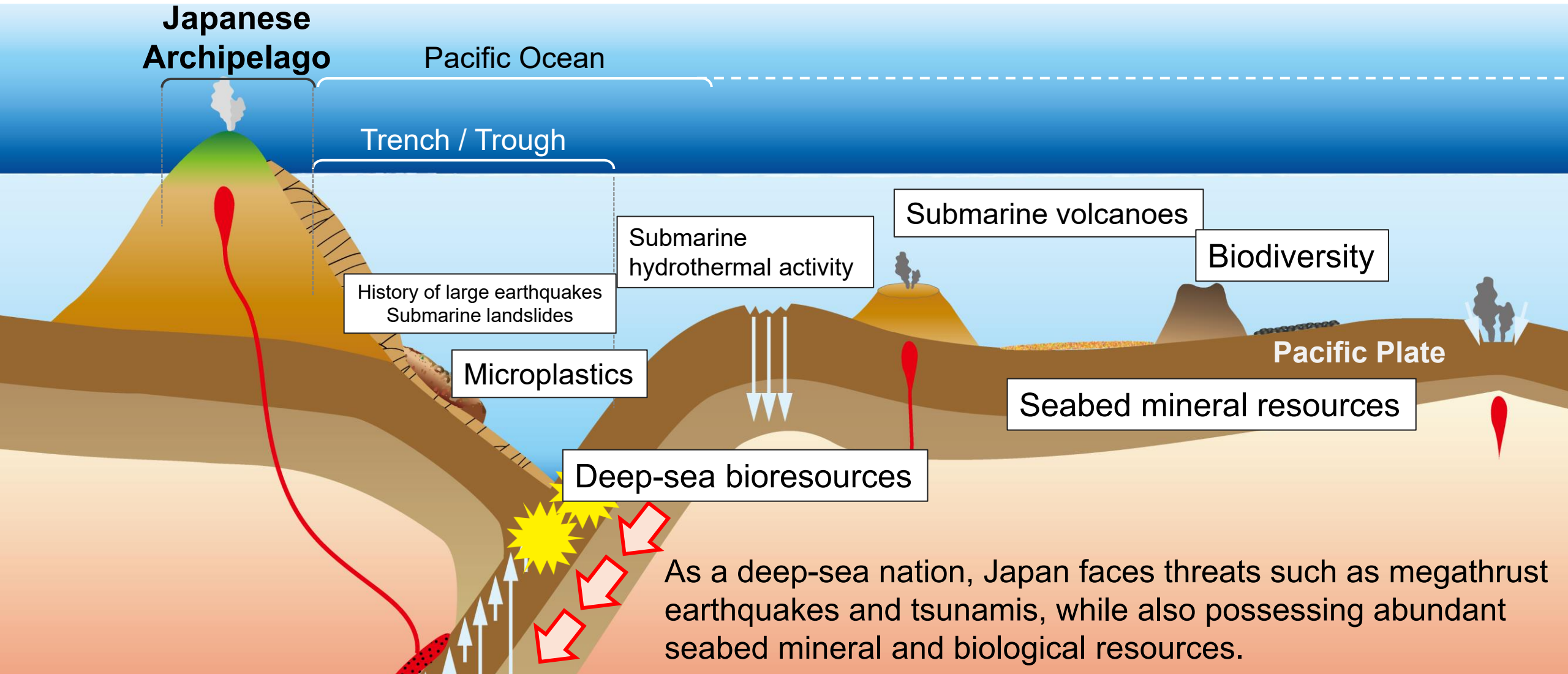


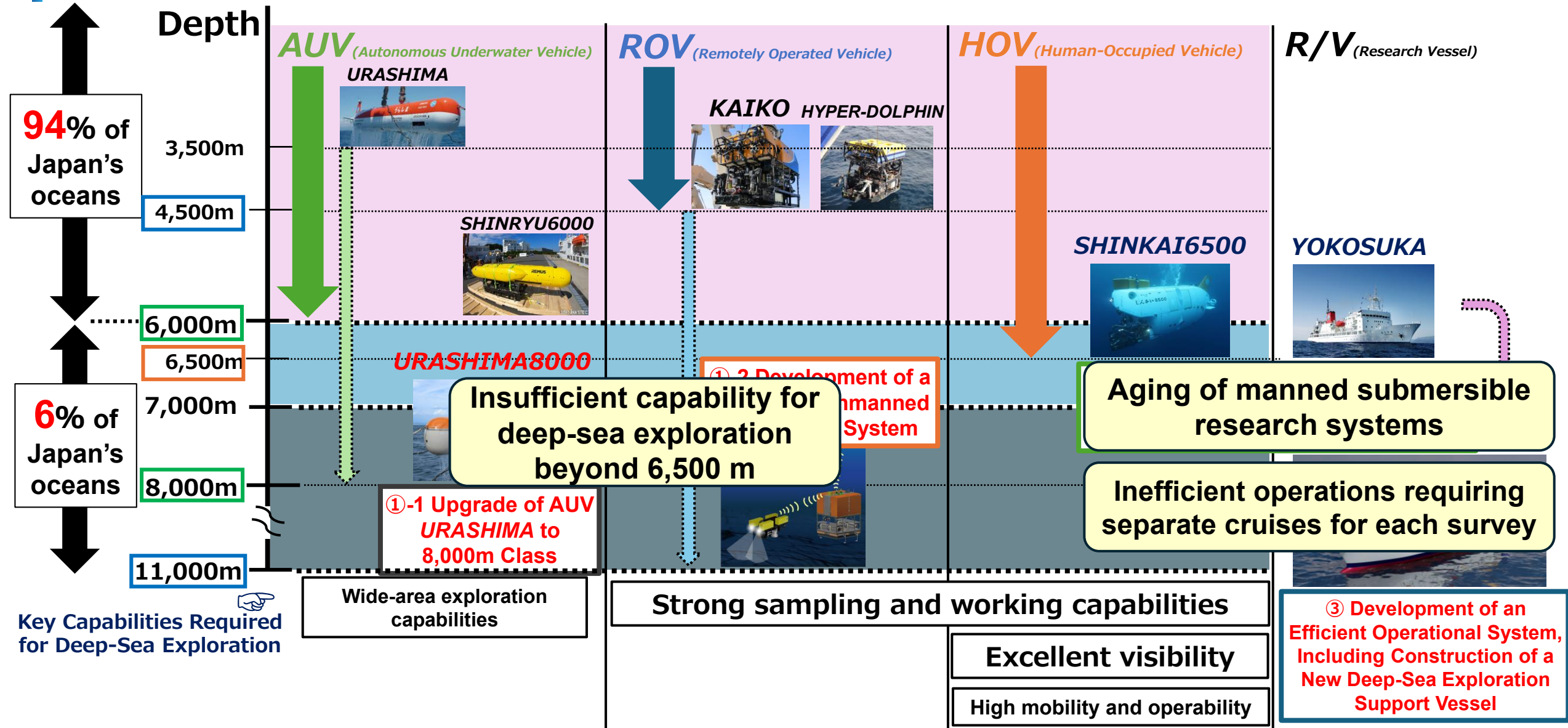
Figure: Japan's EEZ and its water depth

Source: https://www.spf.org/opri/newsletter/123_3.html

The Bounty and Disasters brought by the Ocean



Current status and future plans for Japan's Deep-Sea Exploration System



Upgrade of AUV *URASHIMA* to 8,000m Class

Maximum depth: 8,000 m (initially 3,500 m)
Dimensions: 10.7 m (L) × 1.3 m (W) × 1.5 m (H)
Weight in air: 7.0 tons
Cruising range: >200 km
Cruising speed: 2.5 knots

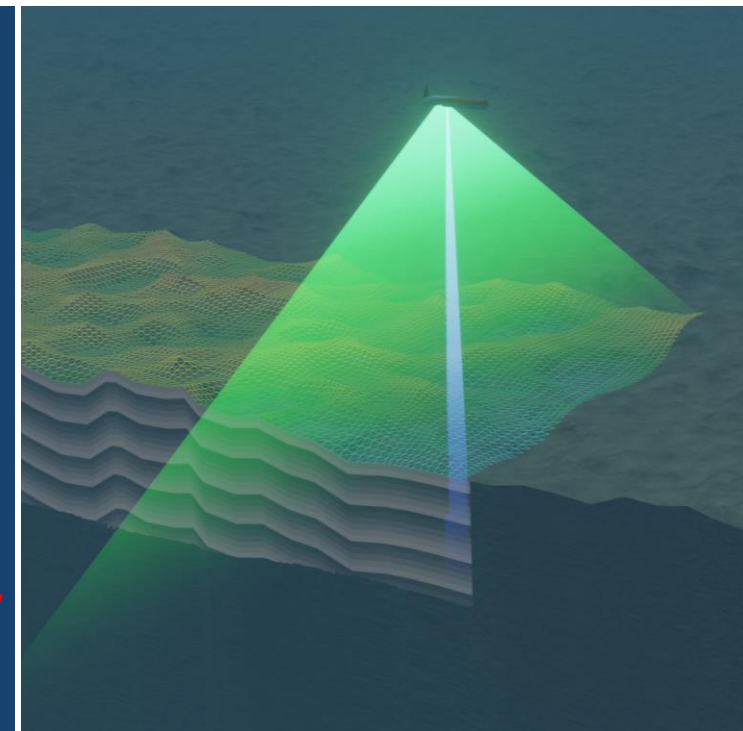
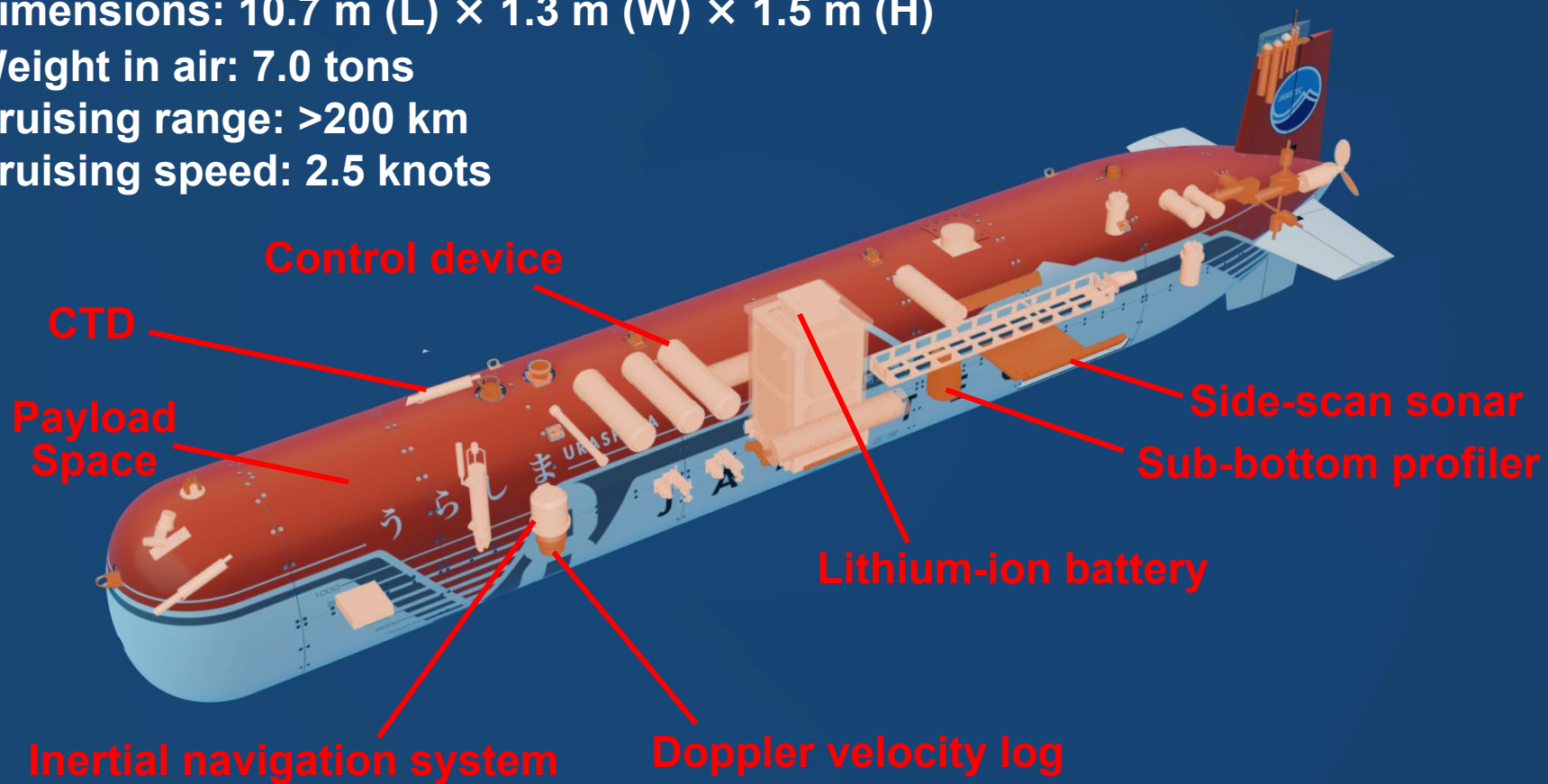
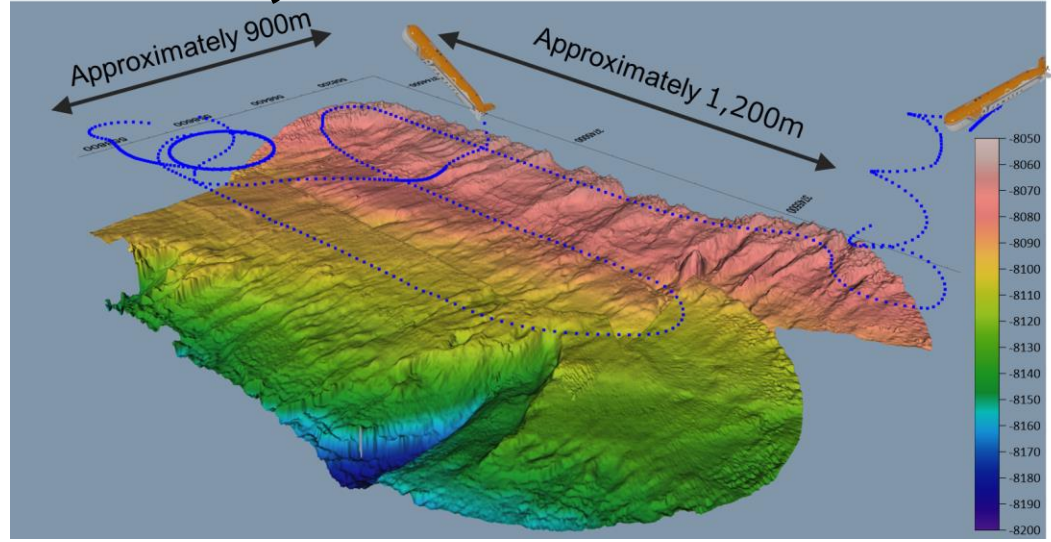
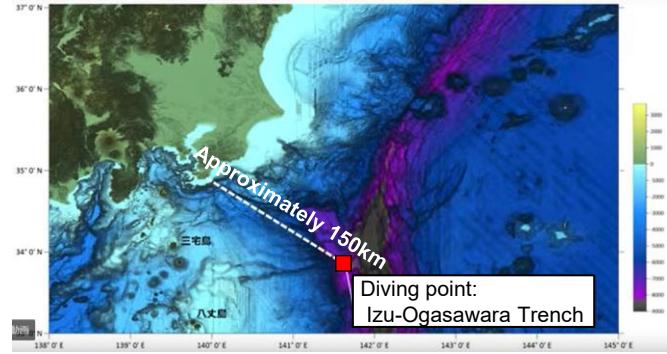


Image diagram of high-resolution seafloor mapping with side-scan sonar and shallow sub-seafloor imaging with a sub-bottom profiler

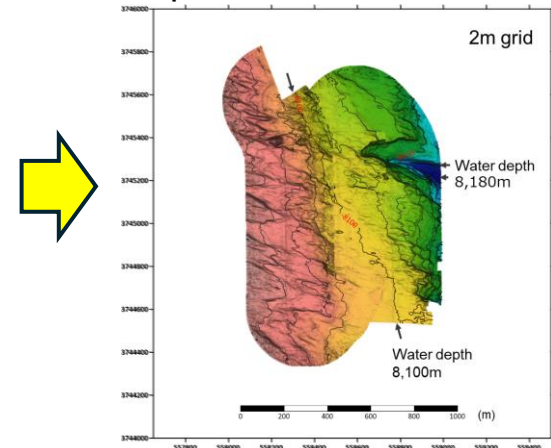
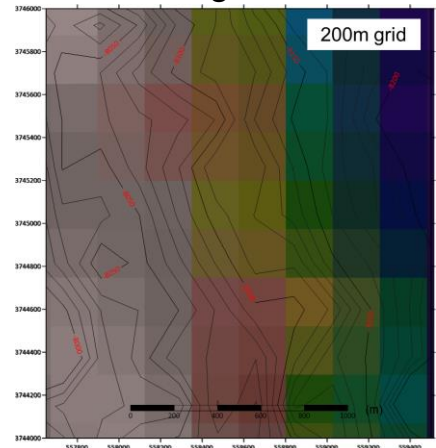
Upgrade of AUV *URASHIMA* to 8,000m Class



indicated value Measured value



Topographic data (Preliminary figures) obtained from the Izu-Ogasawara Trench at a depth of ~8,000 m



Comparison of topographic maps: *URASHIMA*8000 (right) vs. ship survey (left)

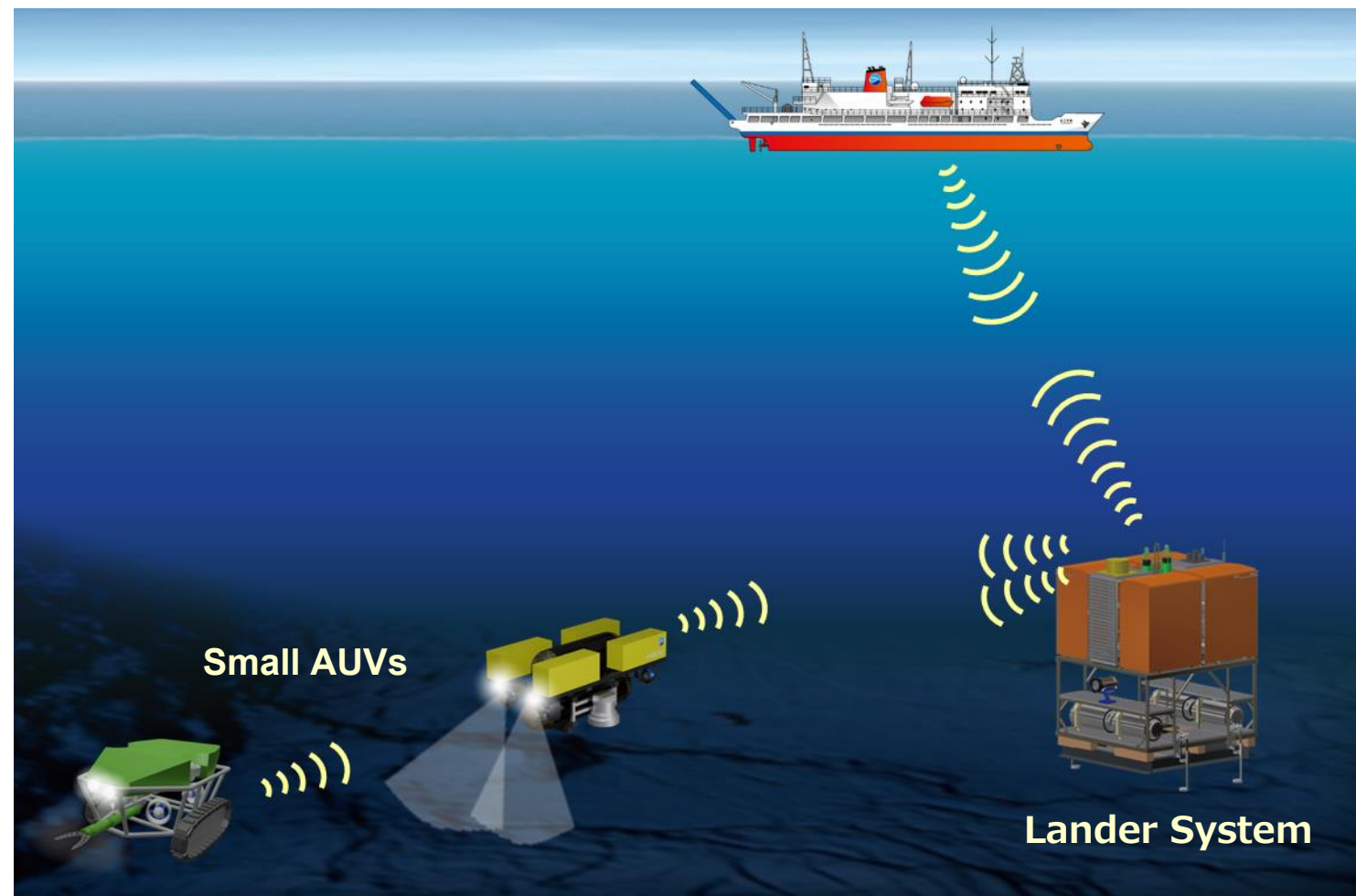
- ※ Photo taken at a depth exceeding 8,000 m
- Achieved at a target depth of 8,015.8 m (July 21, 2025).
- Obtained high-resolution seafloor topography.
- Successfully completed a long-term observation cruise (25 h 34 min) in the Japan Trench (7,100–7,400 m).
- Successfully conducted a steep-slope survey at TAKUYO No3 Seamount (~5,400 m).

Development of a Full-Depth Unmanned Exploration System

– A Cable-Free Unmanned Exploration System for Deep-Sea Sampling and Operations –

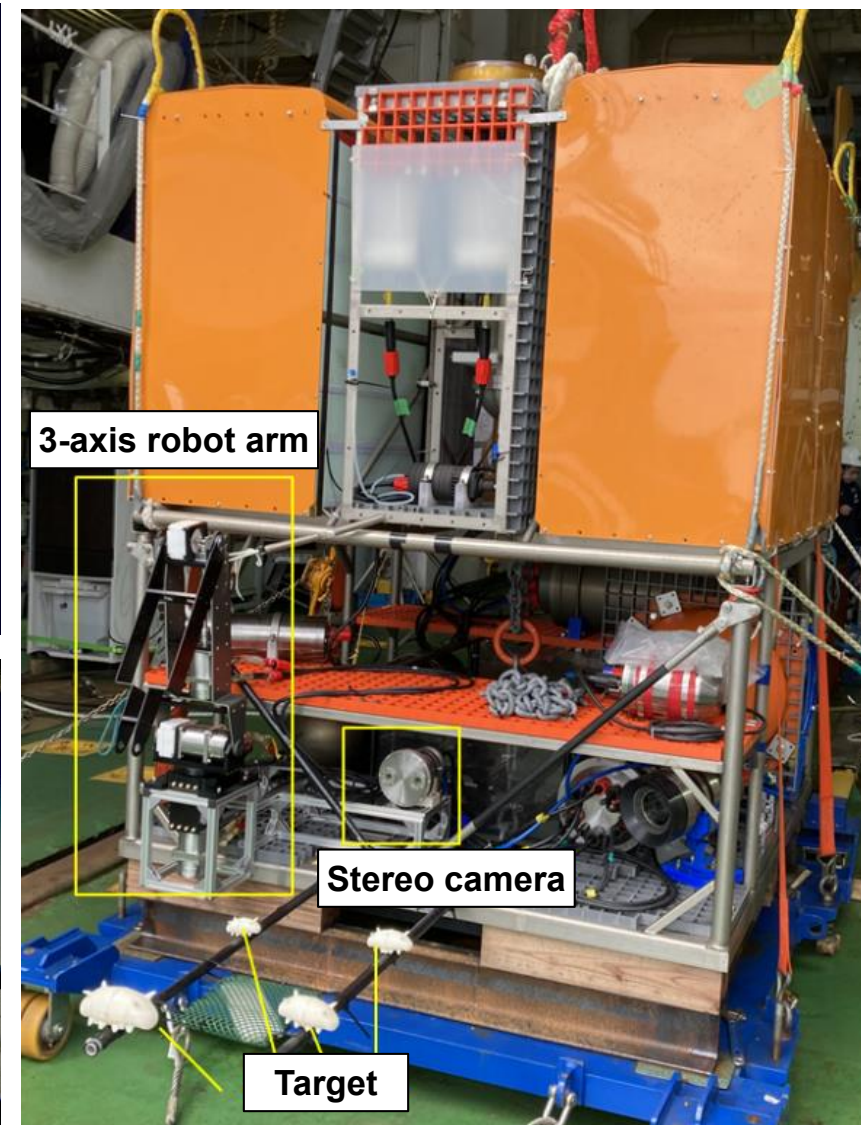
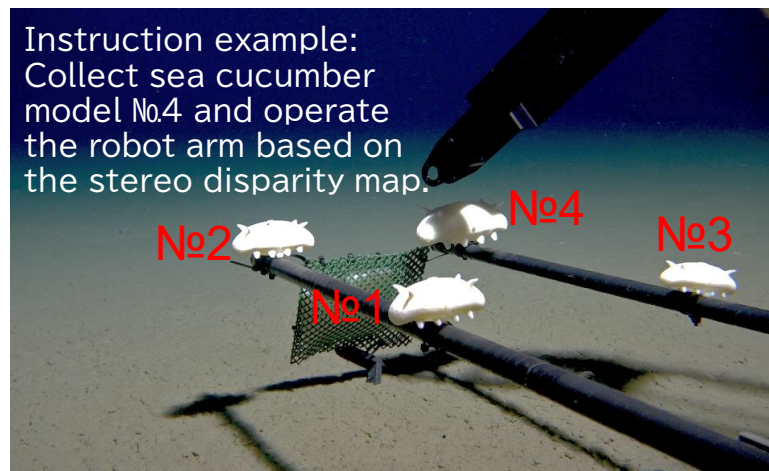
Features

- Remote control via high-speed acoustic communication (with some propagation delay)
- Expanded survey range using small AUVs
- Lightweight sampling capability
- Enhanced autonomy with AI



Simulated demonstration of deep-sea harvesting operations

- An automatic sampling device was installed on the Lander System and tested at a depth of 9,200 m, successfully demonstrating the required sampling operations.
- Going forward, small AUVs equipped with sampling devices will be developed and deployed from the Lander System. They will undergo sea trials simulating actual sampling operations, with their functionality refined through use in research cruises.



The Submersible SHINKAI6500 and Support Vessel YOKOSUKA

YOKOSUKA is the support vessel for SHINKAI6500 and URASHIMA8000. It is a comprehensive oceanographic research vessel that conducts deep-sea surveys, observations, and research.

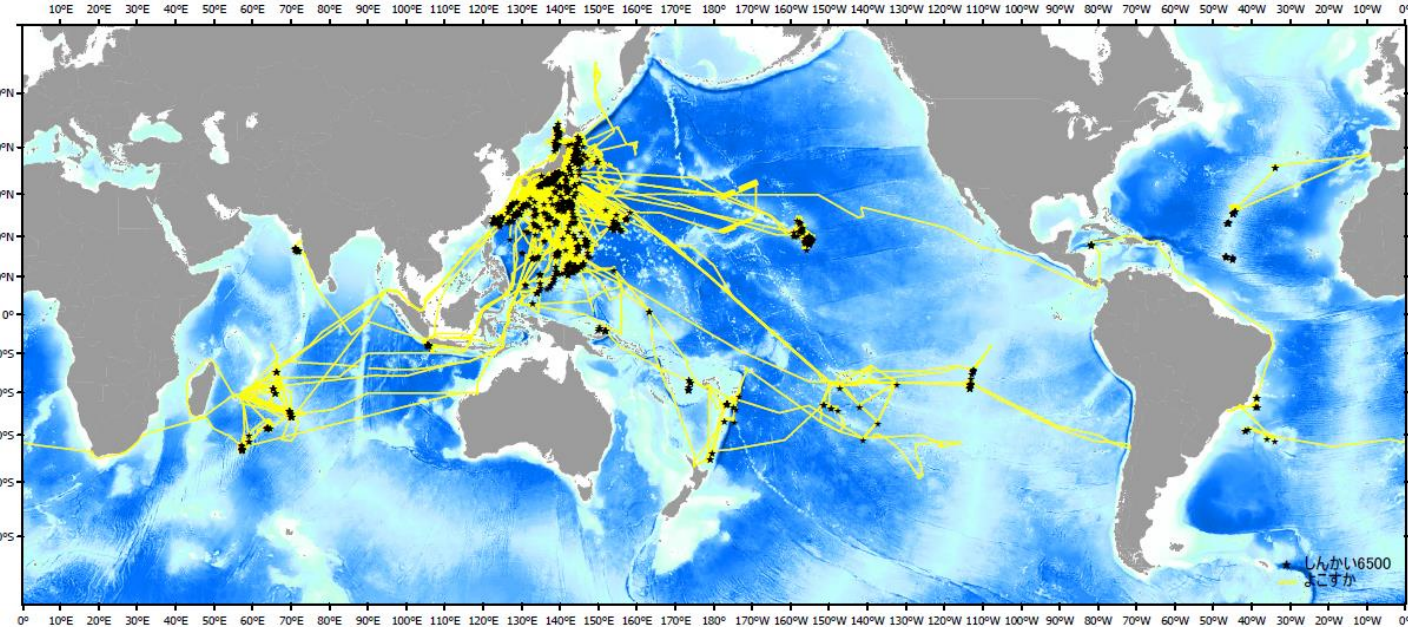
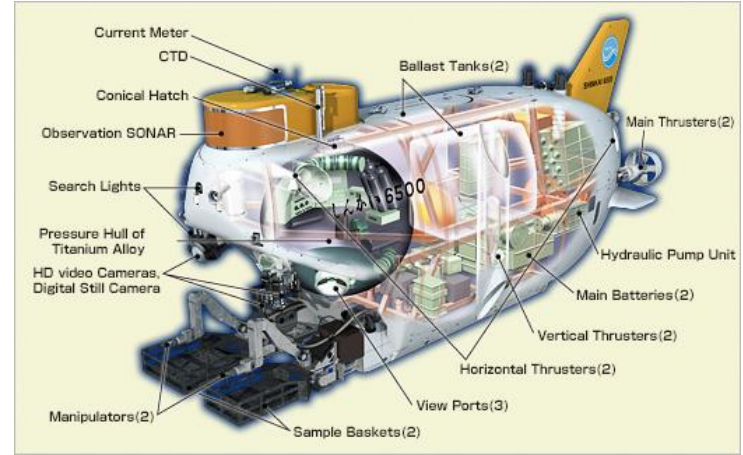
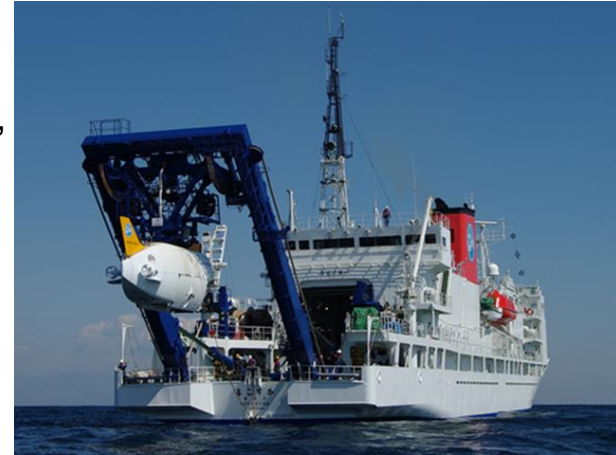
Support Vessel YOKOSUKA

Built year	1990 (Ship age:35 years)
LOA, Beam, Draft	105.2 m, 16.0 m, 4.7 m
Gross tonnage	4,439 GT
Service speed	16 knots
Accommodation	60 (including 15 researchers)

Deep-sea Submergence Research Vehicle SHINKAI6500

Built year	1989 (Ship age:36 years)
Length, Beam, Height	9.7 m, 2.7 m, 4.1 m
Weight in air	26.7 tons
Max operation depth	6,500 m
Maximum speed	2.7 knots
Accommodation	3 (2 pilots and 1 researcher)
Normal dive duration	8 hours

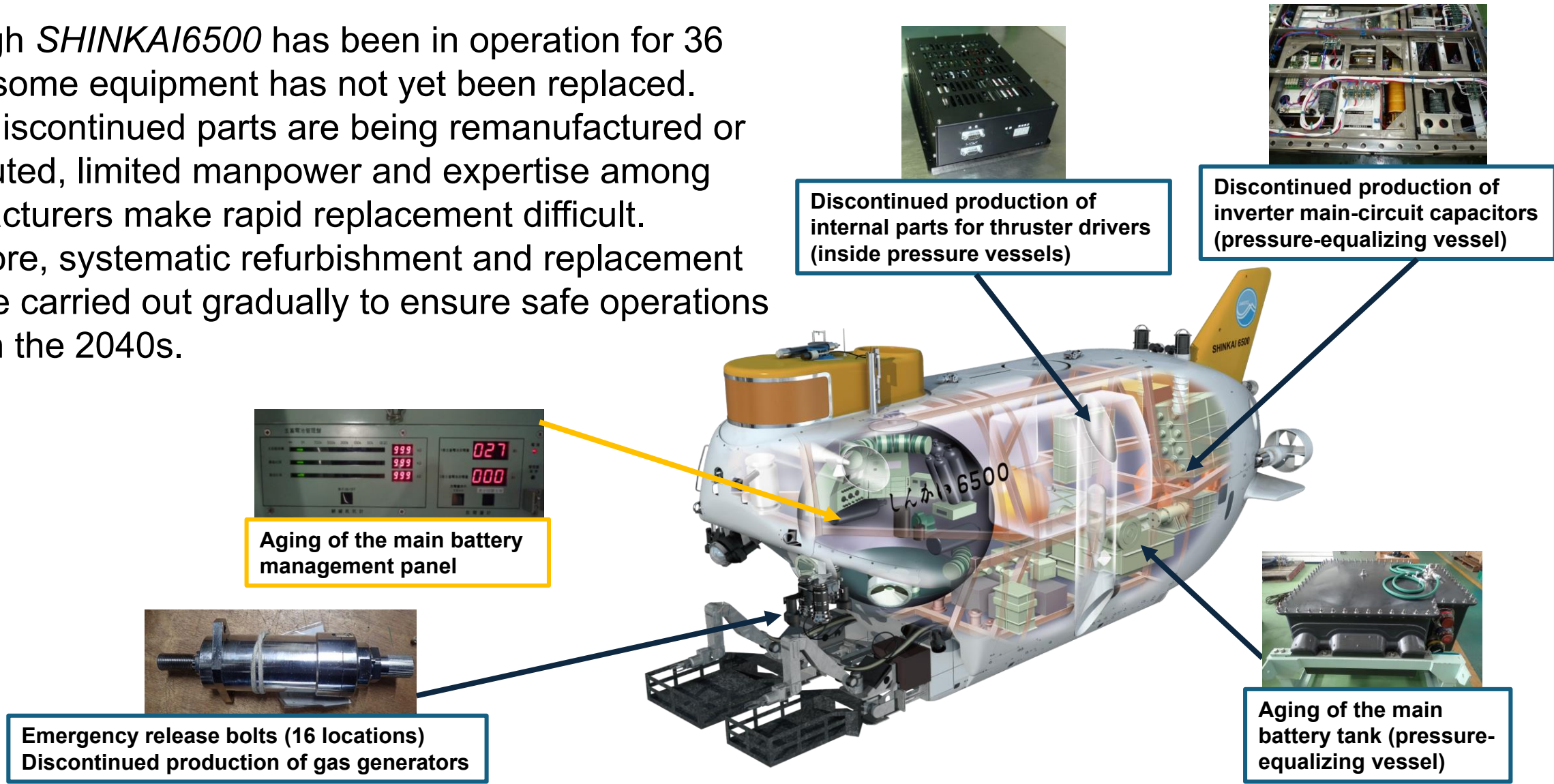
As of 9 September 2025, SHINKAI6500 has completed **1877 dives**.



YOKOSUKA's track (yellow line) and SHINKAI6500's dive points (★) as of December 2024

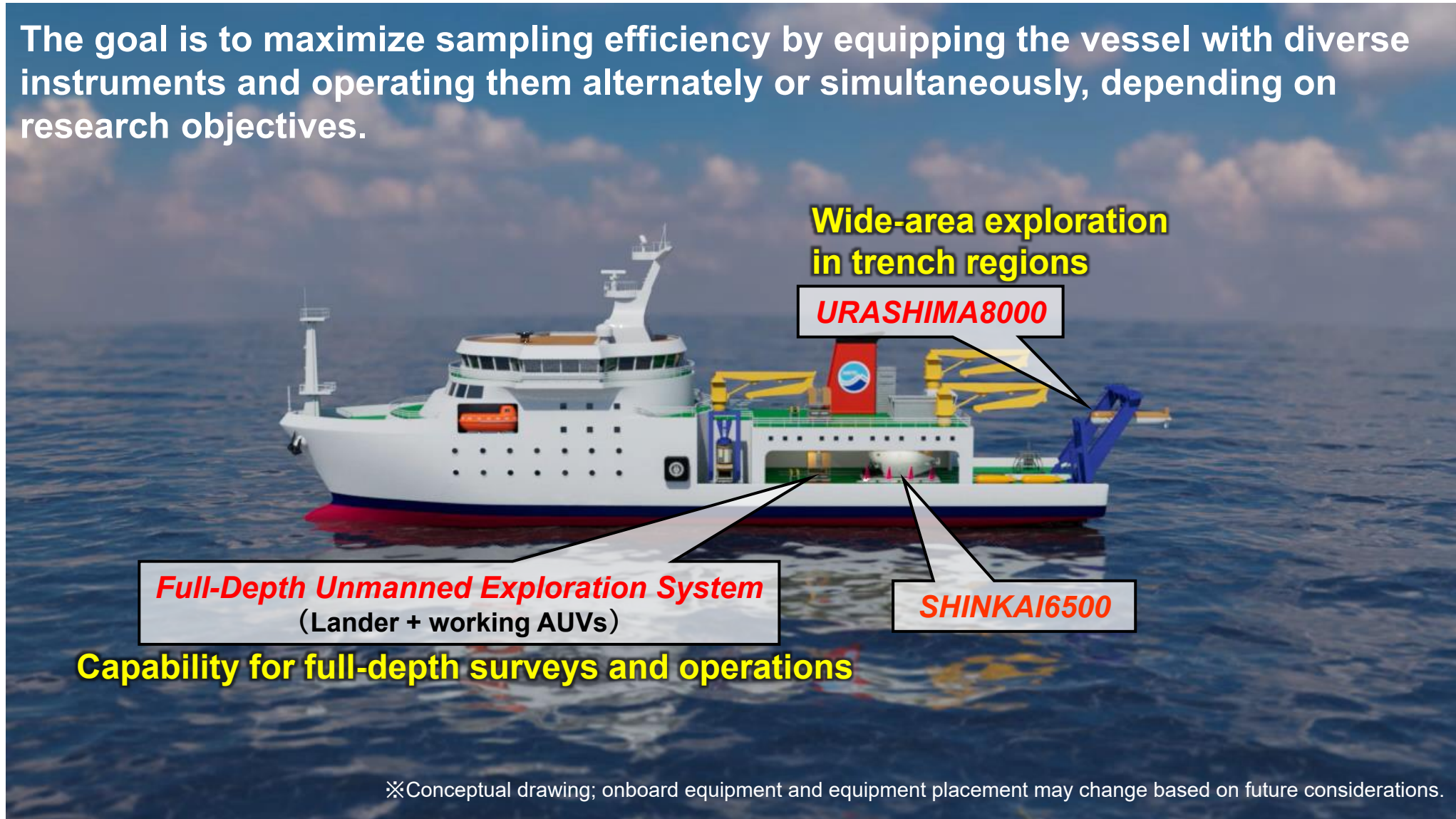
Current status and Countermeasures for aging of SHINKAI6500

- Although SHINKAI6500 has been in operation for 36 years, some equipment has not yet been replaced.
- While discontinued parts are being remanufactured or substituted, limited manpower and expertise among manufacturers make rapid replacement difficult.
- Therefore, systematic refurbishment and replacement must be carried out gradually to ensure safe operations through the 2040s.



Concept for a New Deep-Sea Exploration Support Vessel

The goal is to maximize sampling efficiency by equipping the vessel with diverse instruments and operating them alternately or simultaneously, depending on research objectives.



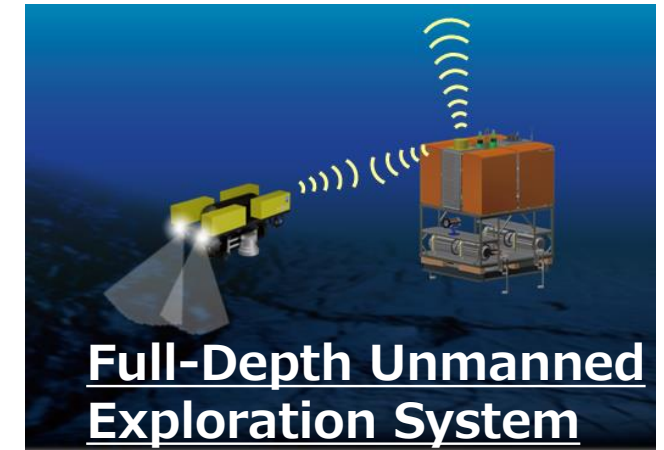
Examples of expected onboard equipment (partial list)



SHINKAI6500



URASHIMA8000

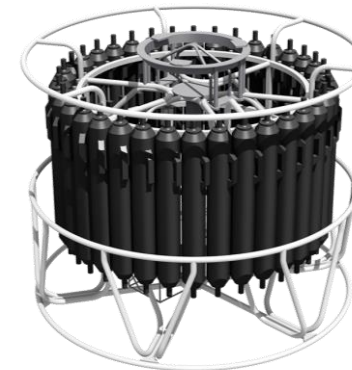
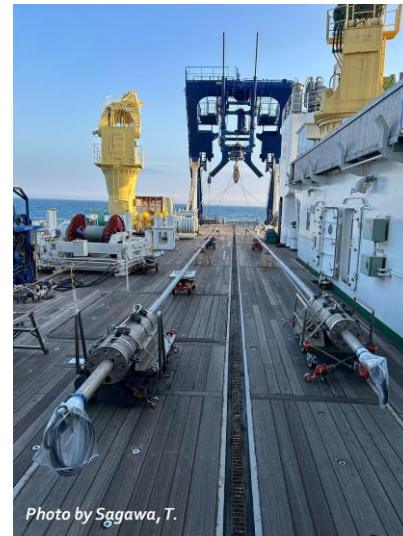


Full-Depth Unmanned Exploration System



General-purpose ROV

※assuming commercially available product



Other Survey and Observation Equipment
CTD water samplers, conventional mud samplers for sampling seafloor strata

Functions and Specifications Required for the new Vessel

(current assumptions)

- Support for HOV *SHINKAI6500* and AUV *URASHIMA8000*
- Deployment and operation of General-purpose ROV
- Operational support for cruising AUVs and hovering AUVs
- Efficient operation of multiple exploration vehicles (*SHINKAI6500*, *URASHIMA8000*, other AUVs and ROV) with reduced labor requirements
- Installation and operation of various observation winches required for research
- Comfortable living environment for researchers and crew
- Onboard research facilities for sample processing and analyses
- High-speed, high-capacity satellite communication systems
- Environmentally conscious design with energy-saving measures

Plans include reducing manpower in the launch and recovery system and enabling remote operation of unmanned probes from shore.

Also used for educational activities, such as live online lectures from onboard.

Possibilities under consideration include the use of shore power and installation of carbon dioxide capture equipment. Specific methods are still being studied.

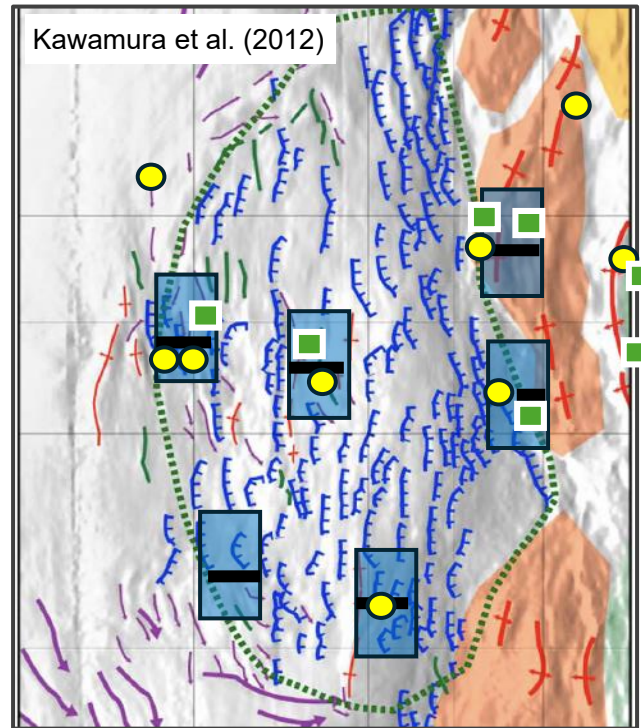
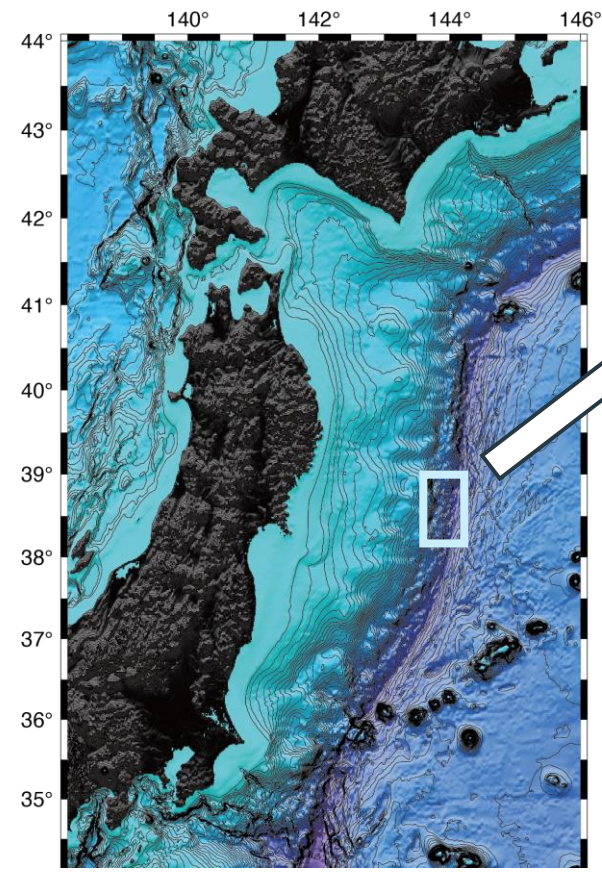
Main Specifications (current assumptions)

	New research vessel (New Deep-Sea Exploration Support Vessel)	Reference: <i>YOKOSUKA</i>
Gross tonnage	About 5,000 t	4,439 t
LOA, Beam, Draft	About 100 m(maximum 110 m), 20 m, 6 m	105.2 m, 16.0 m, 4.7 m
Speed	Cruising speed:12 knots Maximum speed:15 knots or more	Cruising speed:12 knots Maximum speed:16 knots
Range	Over 9,000 nautical miles @ 12 knots	9,500 nautical miles
DPS (Dynamic Positioning System)	Equip	NIL
Propulsion System / Propulsion Device	Electric / Azimuth Thrusters × 2 or Controllable pitch propeller × 2	Diesel / Controllable pitch propeller × 2
Capacity	About 70 people Crew 20-24 people, Researchers 45-50 people Deep-sea exploration vehicle operators and observation technicians are included in the researchers.	60 people Crew 27-29 Deep-sea exploration vehicle operators 18-16 Researchers 15 (technicians are included)

Example of an Efficient Deep-Sea Survey

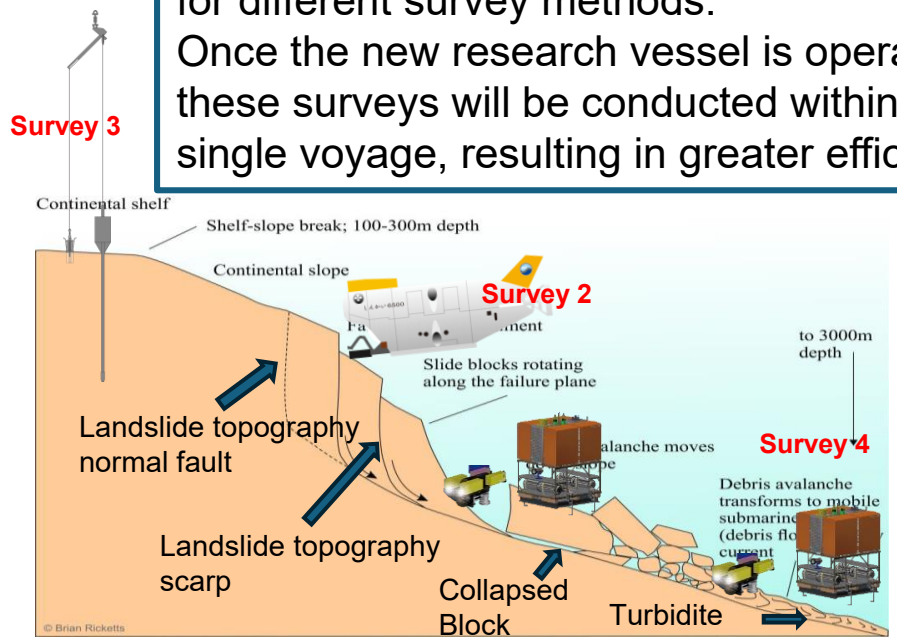
- Understanding submarine landslides in the Japan Trench

Major earthquakes and tsunamis have repeatedly struck in the Japan Trench. A survey using multiple vehicles is planned to clarify the history and mechanisms of these events.



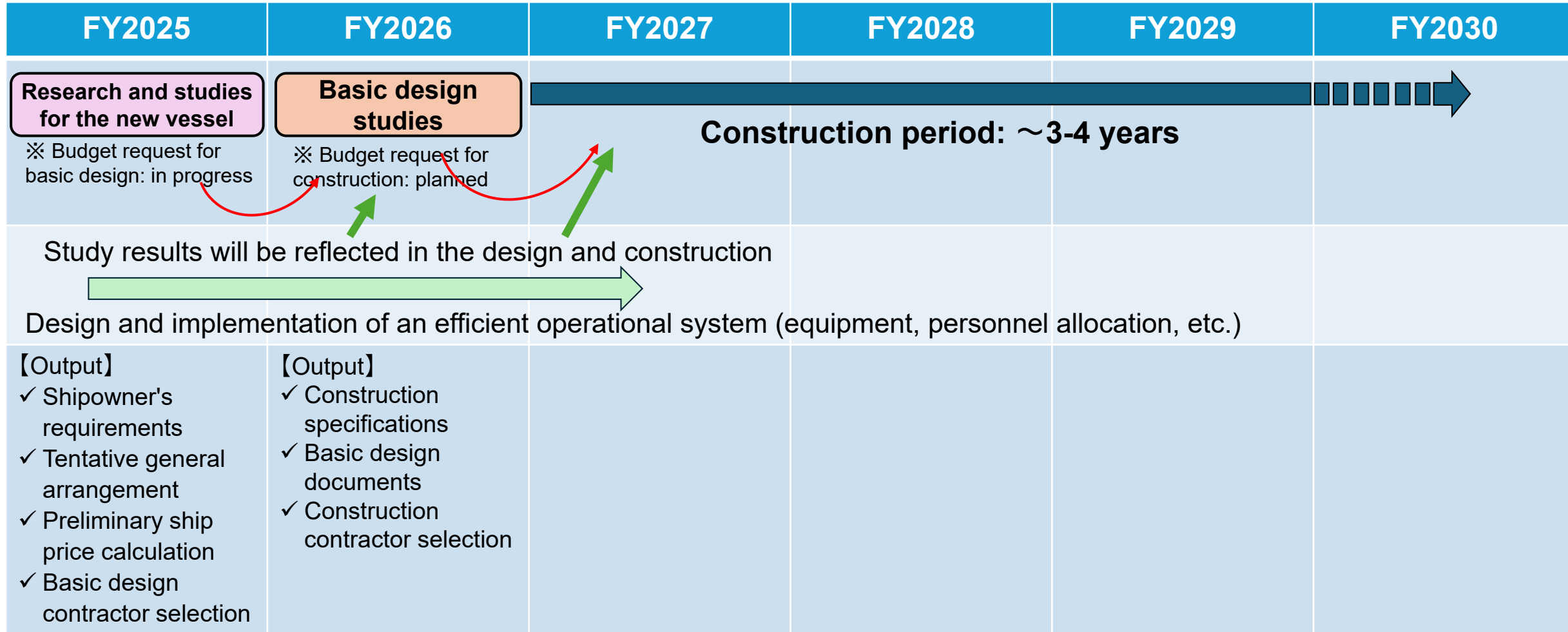
- Survey 1 Detailed topographical survey of a wide area by **URASHIMA8000**
- Survey 2 Transverse line observation and surface mud sampling by **SHINKAI 6500**
- Survey 3 Long-term axial sample collection by **Piston Corer**
- Survey 4 Observation, sample collection, and on-site measurements by **Full-Depth Unmanned Exploration System**

In the past, separate voyages were required for different survey methods. Once the new research vessel is operational, these surveys will be conducted within a single voyage, resulting in greater efficiency.



<https://www.geological-digressions.com/submarine-landslides-danger-lurks-in-the-ocean-deep/>

Preliminary Schedule for Construction of the New Research Vessel

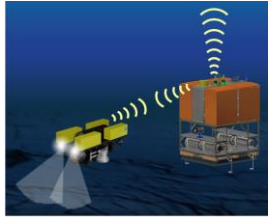


Plan for Building a New Deep-Sea Exploration System

①-1 Upgrade of AUV *URASHIMA* to 8,000m Class



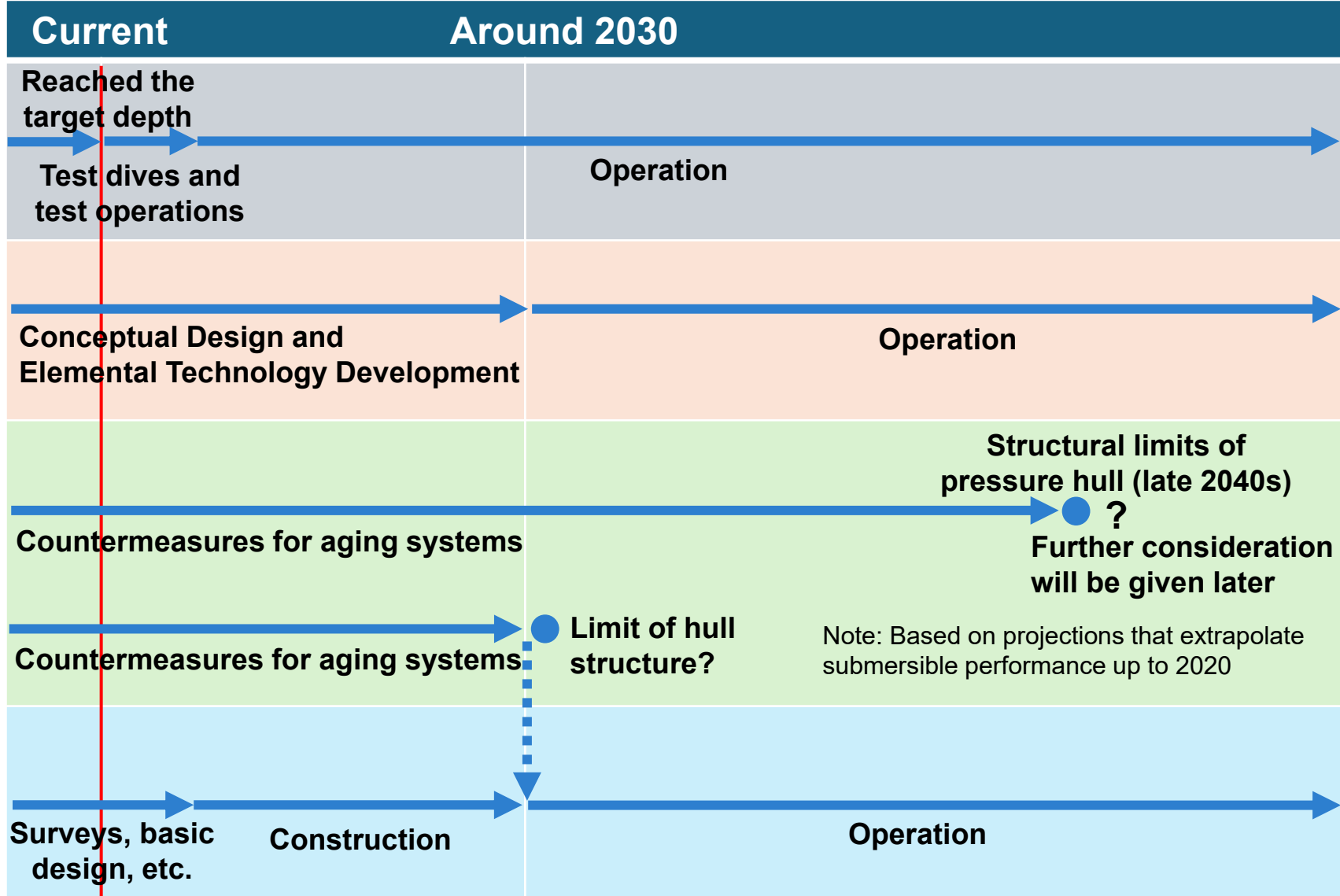
①-2 Development of a Full-Depth Unmanned Exploration System



② Countermeasures for Aging and Functional Upgrades of *SHINKAI6500* and Her Support Vessel *YOKOSUKA*



③ Development of an Efficient Operational System, Including Construction of a New Deep-Sea Exploration Support Vessel



Toward a New Deep-Sea Exploration System

