



**28th International Research
Ship Operators meeting
22nd. Oct. '15
California, USA**

**Shinkai6500' 25th
Anniversary
and JAMSTEC AUV/ROV**

MASANOBU YANAGITANI

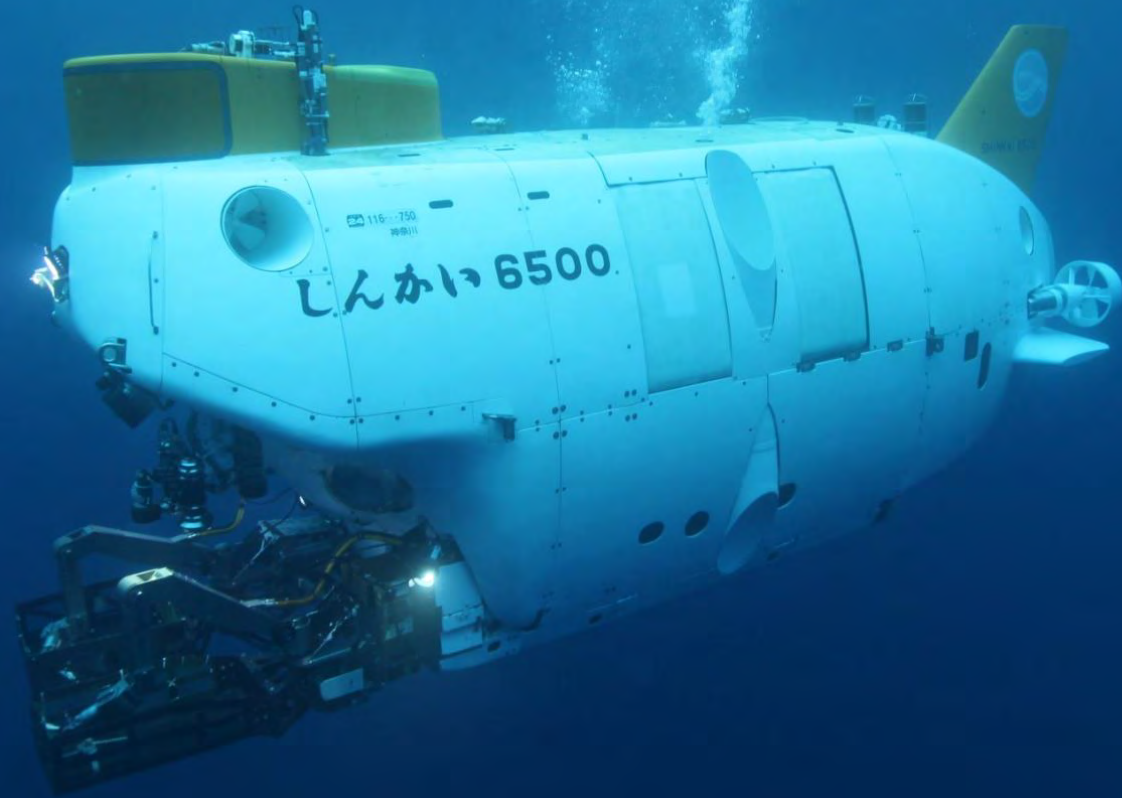
JAMSTEC/MARITEC

Research Fleet Department
Operation and Engineering Group

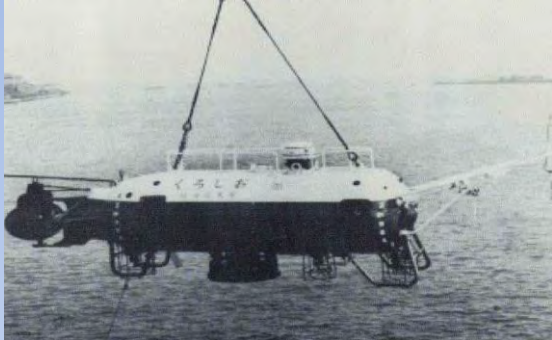


Today's Contents

- Background
- HOV
- ROV
- AUV



Background - 1st. Generation of Japanese DSV-



KUROSHIO

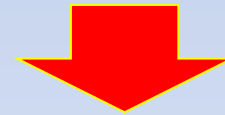


YOMIURI



SHINKAI

Japan is surrounded by the deep trench.



Necessary to develop the deep sea submersible.

Target : 6000m depth



Background - 1st. Generation of Japanese DSV-



SHINKAI 2000

(1981~2002)

<Principal Specifications>

L × B × H : 9.3m × 3.0m × 2.9m

Weight (in air) : approx. 24 tons

Pressure hull dia. : 2.2m

Normal dive duration : 7 hours

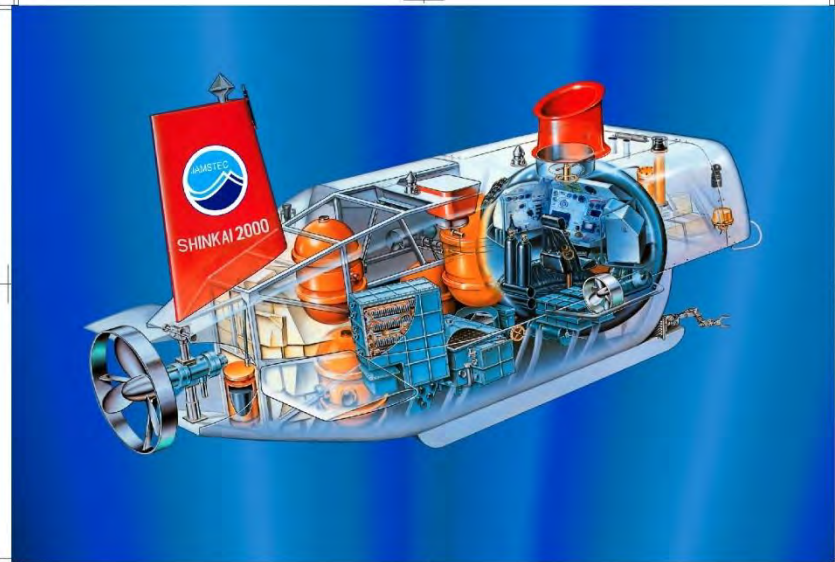
Life support : 80 hours

Payload : 100kg (in air)

Hull material : High-Tensile steel

Installed Instruments:

- Movable color TV camera
- Still film camera
- STD sensor
- Manipulator
- Sample basket



DSV “SHINKAI 6500”



1989

<Original Specifications>

L × B × H : 9.5m × 2.7m × 3.2m

Weight (in air) : approx. 26 tons

Pressure hull dia. : 2.0m

Normal dive duration : 8 hours

Life support : 129 hours

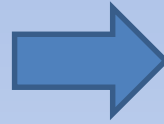
Payload : 200kg (in air)

Hull material : Ti 6Al-4V ELI

Installed Instruments:

- 2 CCD TV cameras
- Digital steel camera
- STDV sensor
- Manipulator and Grabber
- Observation Sonar
- Seawater thermometer
- Sample basket

DSV “SHINKAI 6500”



20 Years



25 Years

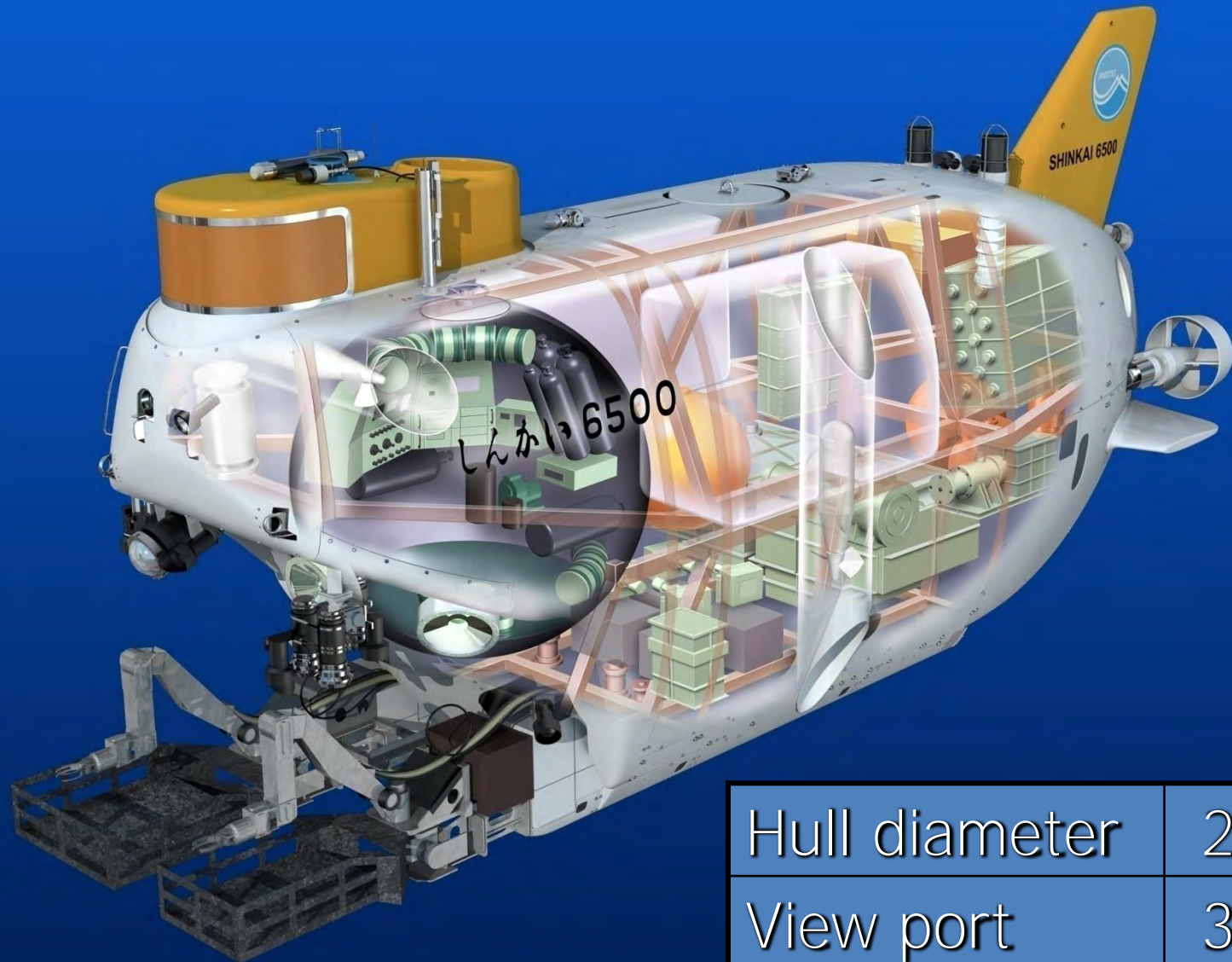
Deep Submergence Vehicle *SHINKAI 6500*



Build in 1989
Operation 1990~

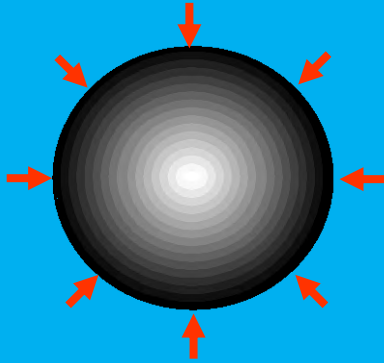
Total Dive 1438 times

Deep Submergence Vehicle *SHINKAI 6500*



Hull diameter	2 m
View port	3 ports
Depth rating	6500 m

Pressure Hull



Material: Titanium alloy
Ti-6Al-4V ELI

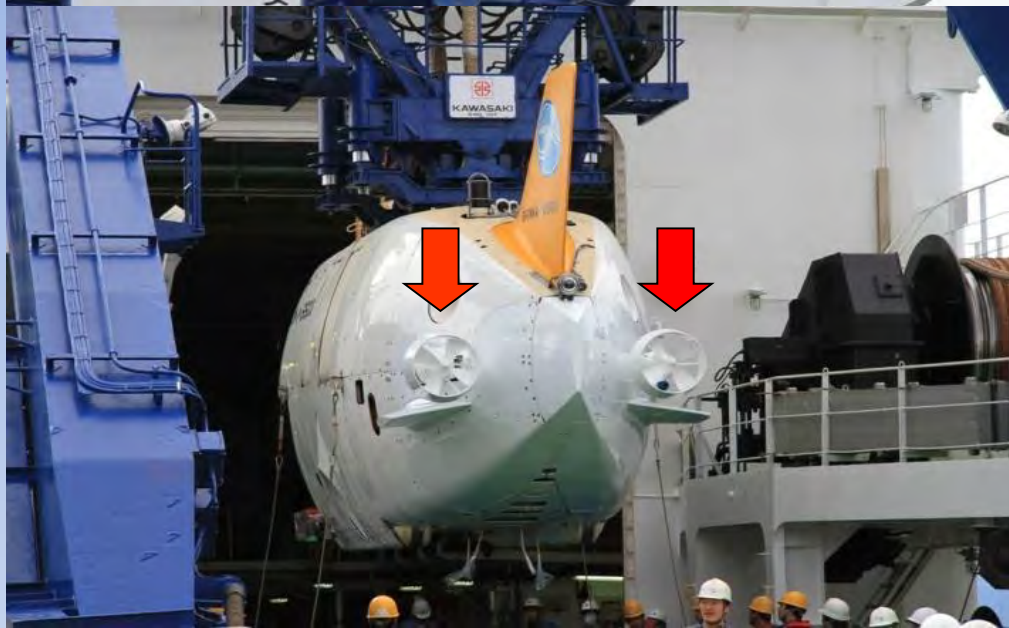
Thickness: 73.5 mm
Inside diameter : 2000 mm

Model 1/ 2.86
Broken 1320 kgf/cm²



Inside the Pressure Hull

◎TOPIC Renewal of the Thruster



2011

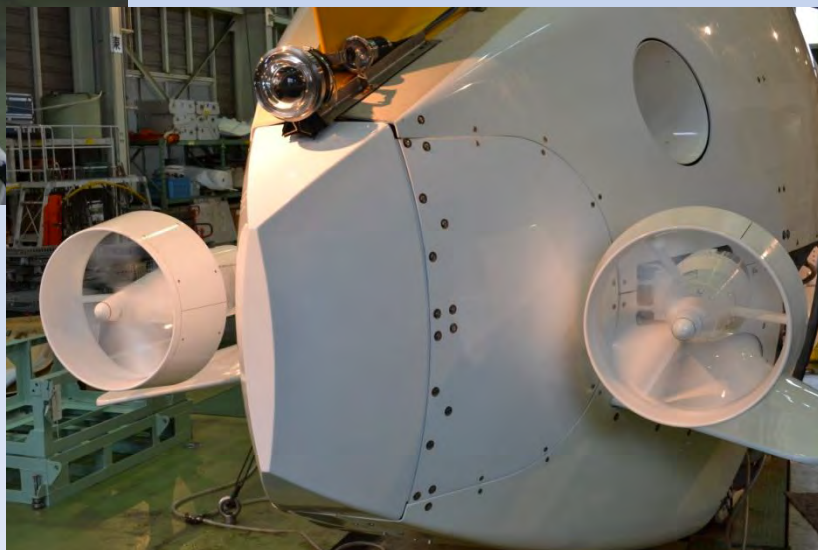


Renewal of the Thruster



Brushless DC motor
Material : Aluminum

- ① Main Thruster × 2 (Starboard/Port × 1)
- ② Vertical Thruster × 2 (Starboard/Port × 1)
- ③ Fore Horizontal Thruster
- ④ Aft Horizontal Thruster



Main Thruster



Support vessel *YOKOSUKA*





Specifications

Support vessel
“YOKOSUKA”

Length :	105.2 m
width :	16.0 m
draft :	4.5 m
Gross tonnage:	4439 tons
Cruising speed:	16 knots
Capacity:	60 persons
cruising range:	9,000 nm

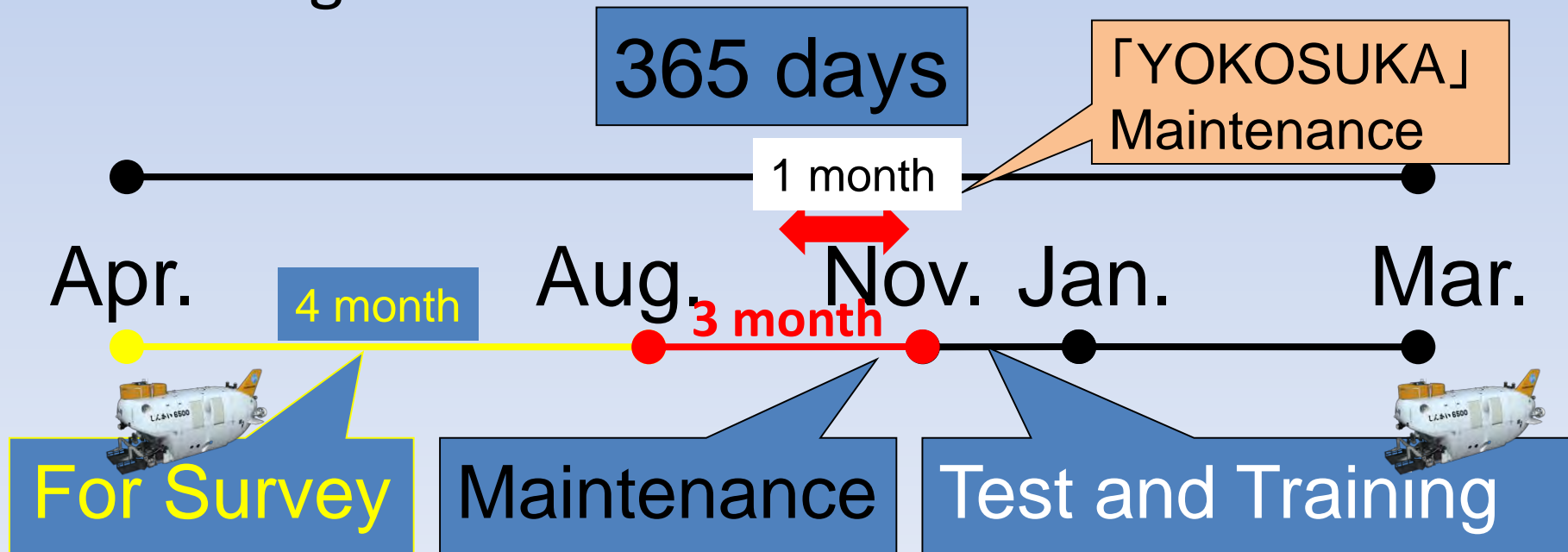
YOKOSUKA **Maintenance** **for 1 month**



KOBE
Shipyard

Annual schedule

- In **2015** FY, examination will carry out for Indian Ocean cruise from Dec. to Mar..
- As usual, cruise ship time is about 180 days of 8 months, and 3 months for maintenance of SHINKAI6500. 1 month is allotted Test and Training.



In 2011

Tohoku-Pacific Ocean Earthquake

「SHINKAI6500」 Diving point

Site 1

39° 07'N 143° 53'E

(Depth : 5,350m)

Site 2

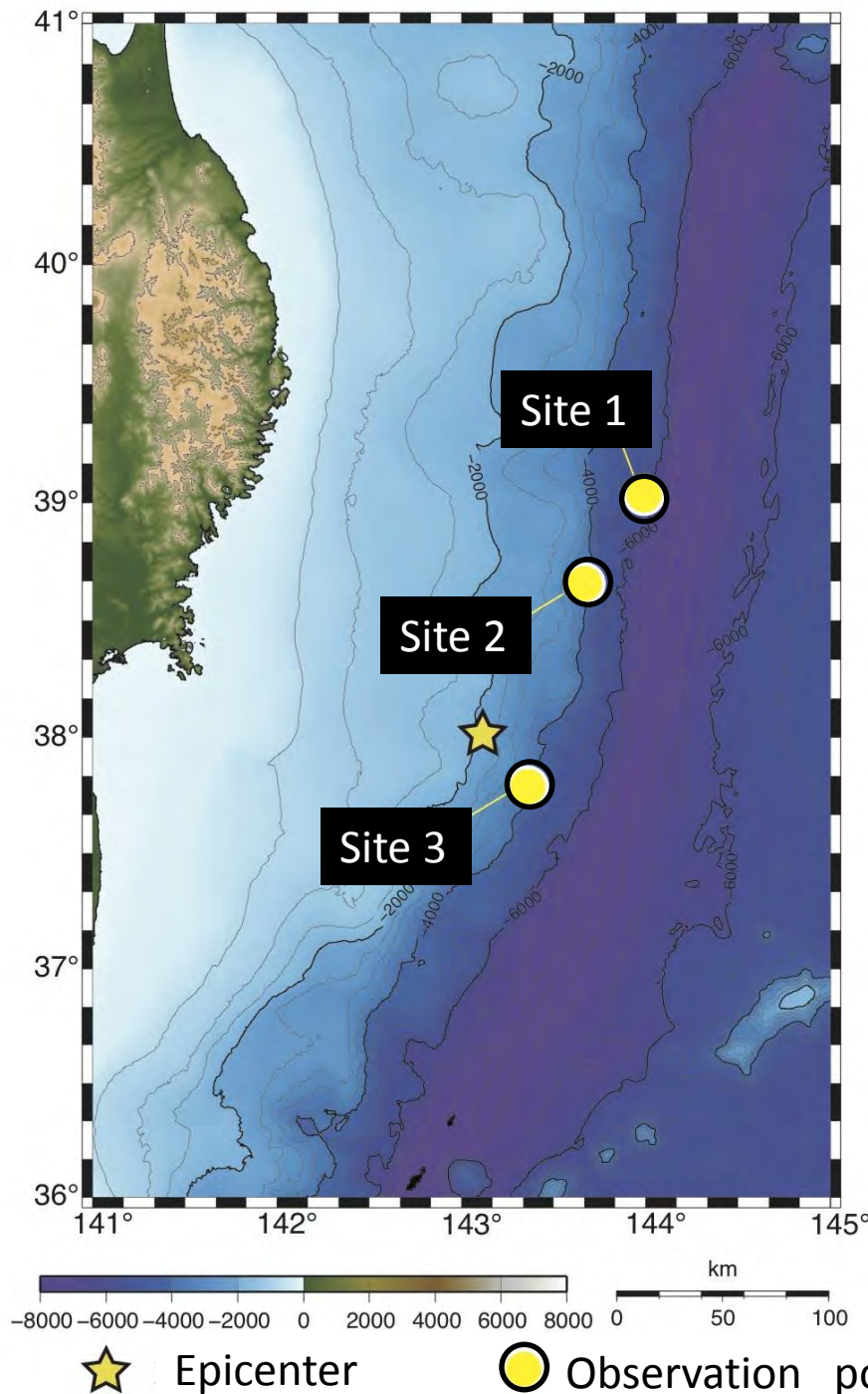
38° 39'N 143° 36'E

(Depth : 3,200m)

Site 3

37° 45'N 143° 17'E

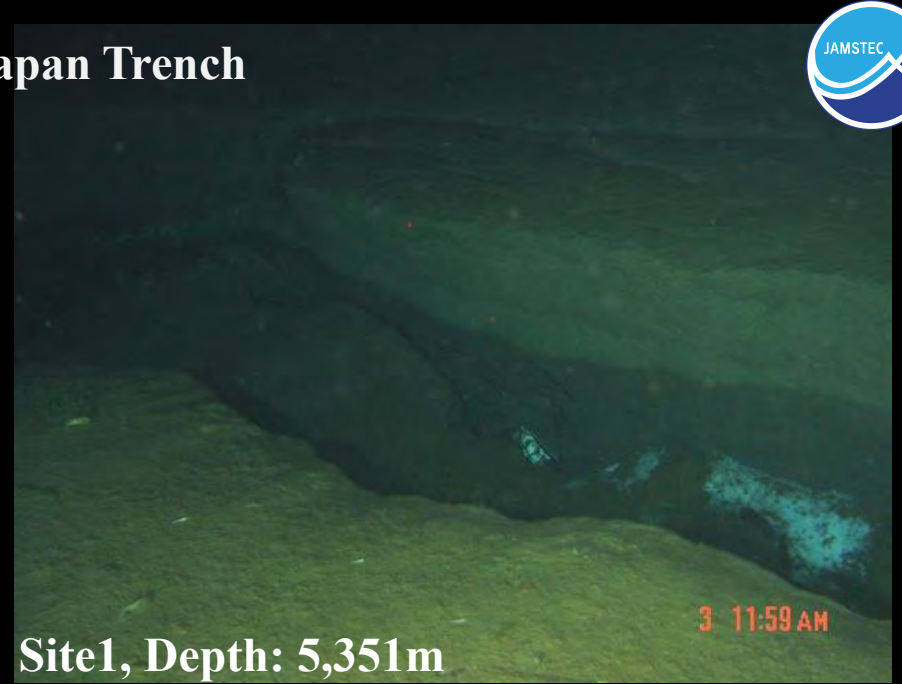
(Depth : 3,500m)



2011.8.1~13@Japan Trench



Site1, Depth: 5,351m

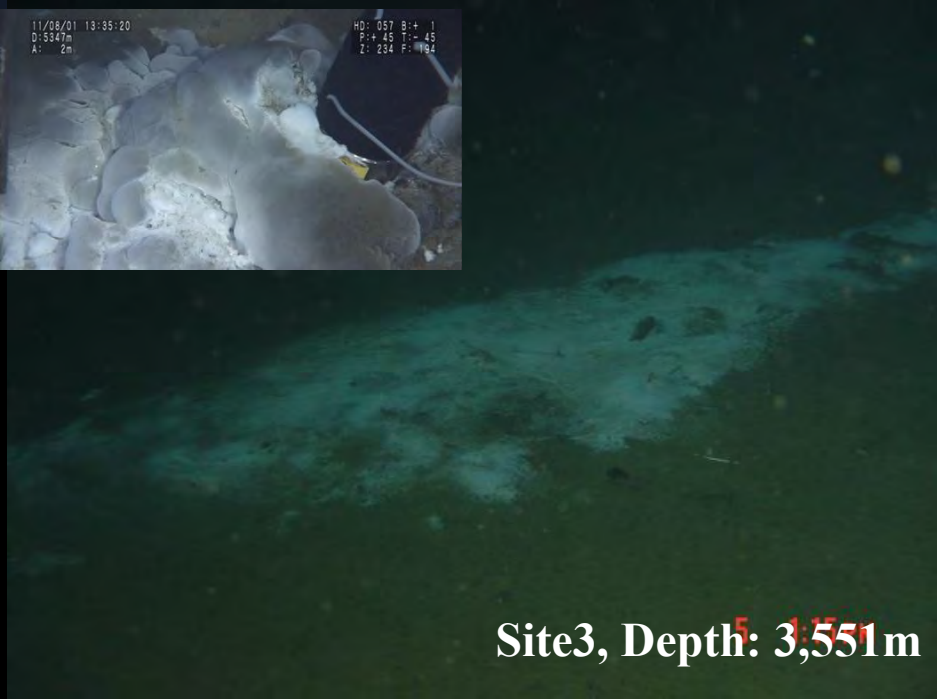


Site1, Depth: 5,351m

3 11:59 AM



11/08/01 13:35:20
D: 5849m
A: 2m
HD: 057 B: + 1
P: + 45 T: - 45
Z: 284 F: 194

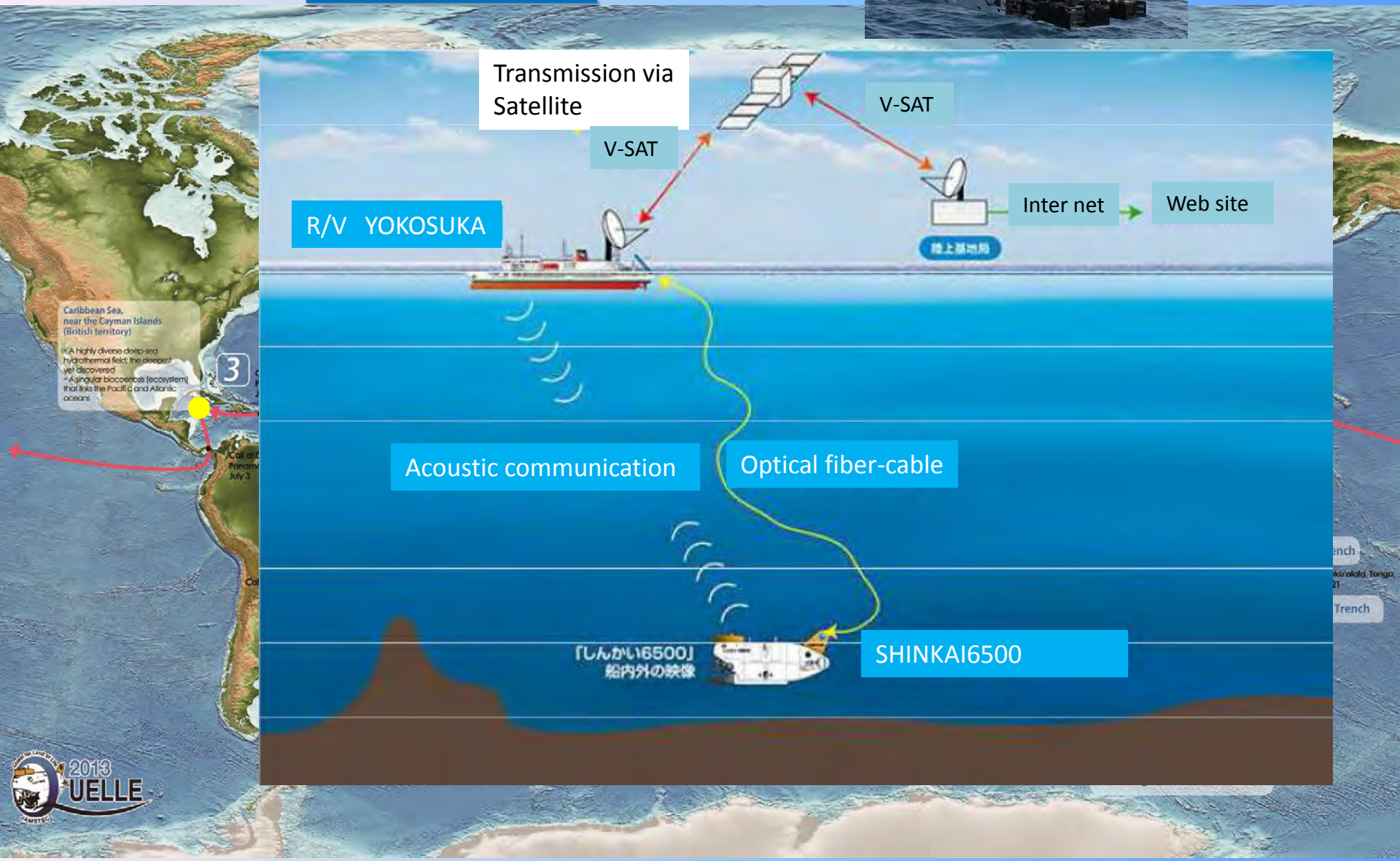


Site3, Depth: 3,551m

Quest for the Limit of Life

An around- the-world voyage by the Shinkai 6500

Quelle2013



Transmission via Satellite

V-SAT

V-SAT

R/V YOKOSUKA

Inter net

Web site

陸上基地局

Caribbean Sea, near the Cayman Islands (British territory)

- A highly diverse deep-sea hydrothermal field, the deepest yet discovered
- A singular biocoenosis (ecosystem) that links the Pacific and Atlantic oceans

3

Call of Panama July 3

Acoustic communication

Optical fiber-cable

「しんかい6500」
船内外の映像

SHINKAI6500





しんかい6500

北

JAMSTEC ROV

Hyper Dolphin

KAIKO7000 II

KAIKO MarkIV

the outside



Dimension [m]

3 x 2 x 2.3

3 x 2 x 2.1

3 x 2 x 2.6

Weight [kg]

3.8

3.9

6.0

Working Depth[m]

3,000

7,000

7,000

Payload [kg]

100

50

300

Thrust Power[kgf]

272

180

600

Manipurater
Working[kg]

68

40

250

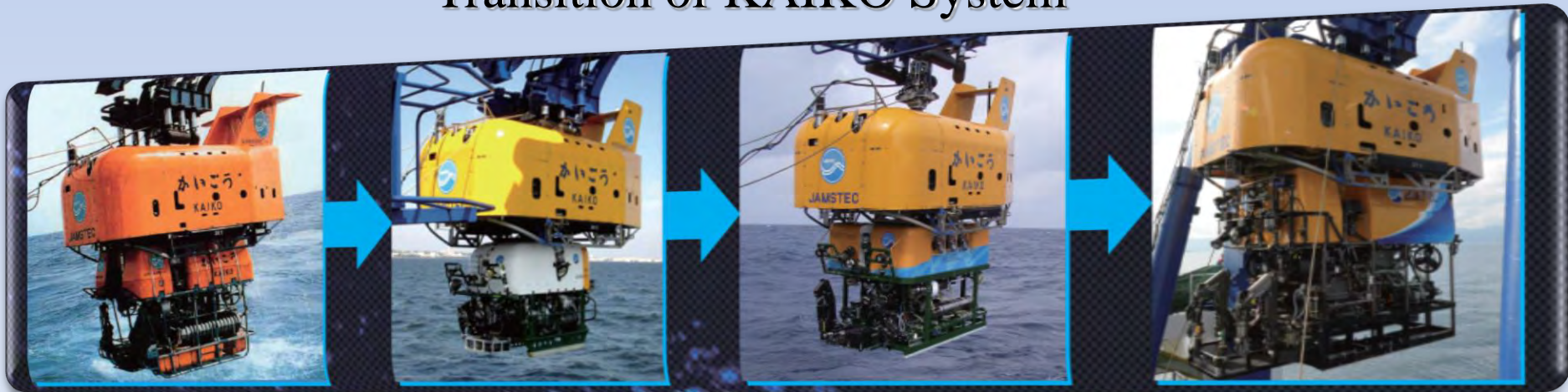
KAIKO Mk-IV



Launcher

Vehicle

Transition of KAIKO System



KAIKO

1995

2003
vehicle lost

KAIKO 7K

2004

KAIKO 7K II

2006

KAIKO Mk-IV

2013

ROV KAIKO System

Control Unit
R/V KAIREI



Primary Cable (12,500m)



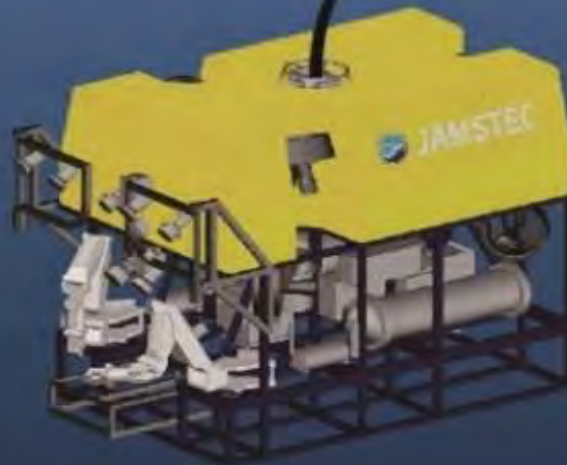
2014 Stopping Use
the Primary Cable

→ 5,700m



Launcher

Secondary Cable (300m)



Vehicle

Science service
Start 2015~

Unmanned Underwater Vehicles



Weight

Length

Depth

Altitude

Endurance

Yumeiruka



2.7 t

5 m

3000 m

50 m

16 hr

Jinbei



1.7 t

4 m

3000 m

30 m

10 hr

Otohime



0.85 t

2.5 m

3000 m

2-10 m

8 hr

Urashima



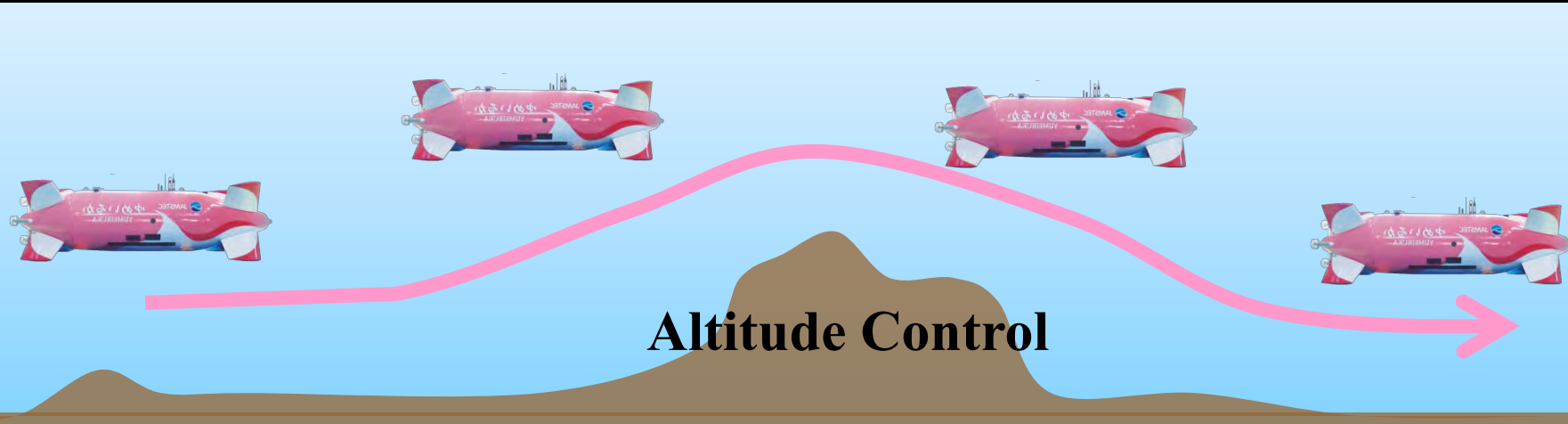
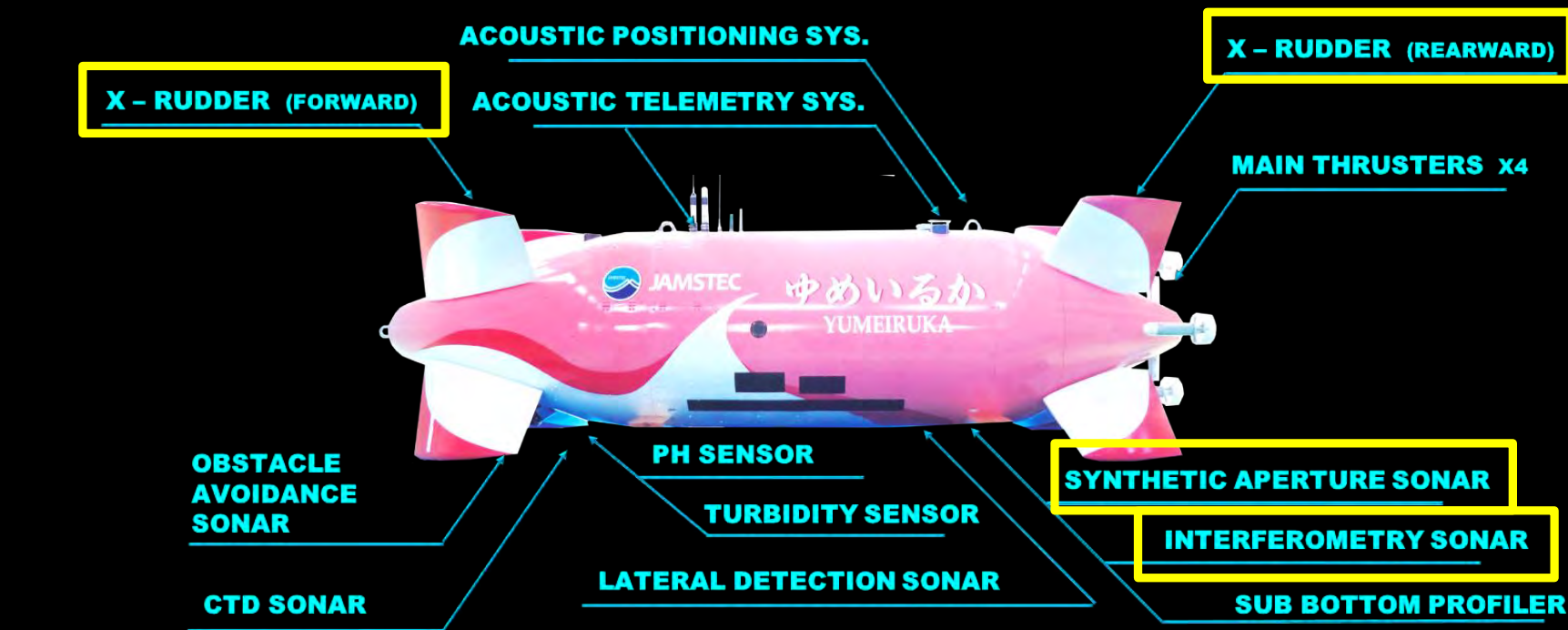
7 t

10 m

3500 m

50m

24h



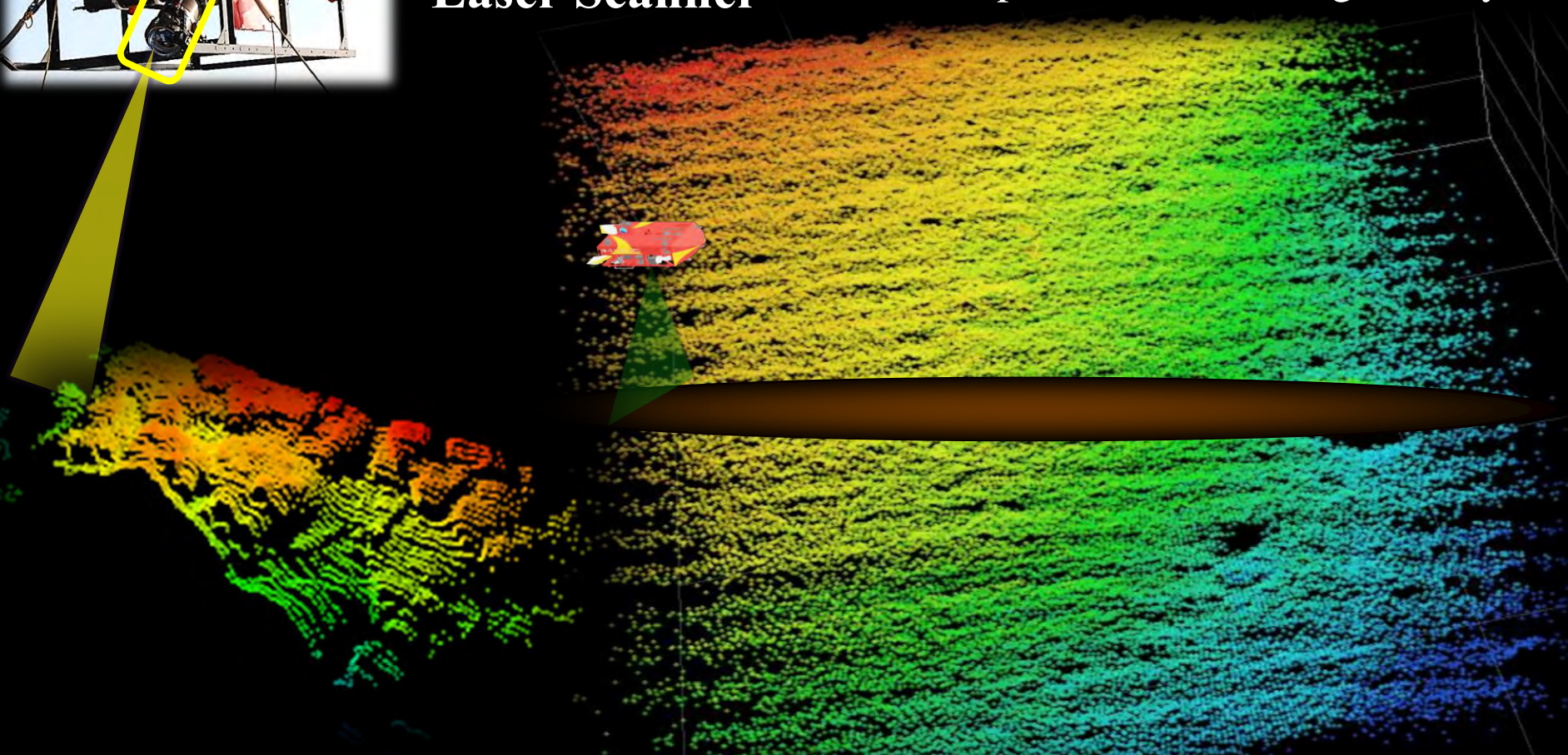


Under water 3D

Laser Scanner

Altitude : 7-10m

Depth : 120m at Sagami Bay



NEXT STEP



© JAMSTEC

SHINKAI6500

- Upgrade to the “in side of the Pressure Hull”



YUMEIRUKA JINBEI OTOHIME

- Dive to 3,000m depth (OTOHIME)
- Parameter adjustment for high vehicle maneuverability and better performance of sonars.
- Programmed the navigate to the research (YUMEIUKA)



KAIKO Mk-IV

- Up grade to the “Full Depth ROV”



**Thank you very much
for your kind attention !**

ありがとうございました



**International Research
Ship Operators**

