



R/V KAIREI Cruise Report
KR17-11 Leg1

Sea trial of ROV "KAIKO"
and study of adaptive underwater optical wireless
communication with photo multiplier tube

Sruga Bay and northern part of Nankai Trough and
Izu-Ogasawara Trench

July.22 - 25, 2017

Japan Agency for Marine-Earth Science and Technology
(JAMSTEC)

Contents

1. Cruise Information	3
2. Researchers	4
3. Contents of the sea trial	4
3.1 General description of KAIKO	5
4. Dive results	6
4.1 Dive# 748	6
4.2 Dive #749	7
4.2.1. Recover dive of bait camera system	7
4.2.2. Outline of Recovery Method	9
4.3 Dive#750	10
5. Acknowledgement	10

Notice on Using

Notice on using: Insert the following notice to users regarding the data and samples obtained.

This cruise report is a preliminary documentation as of the end of the cruise.

This report may not be corrected even if changes on contents (i.e. taxonomic classifications) may be found after its publication. This report may also be changed without notice. Data on this cruise report may be raw or unprocessed. If you are going to use or refer to the data written on this report, please ask the Chief Scientist for latest information.

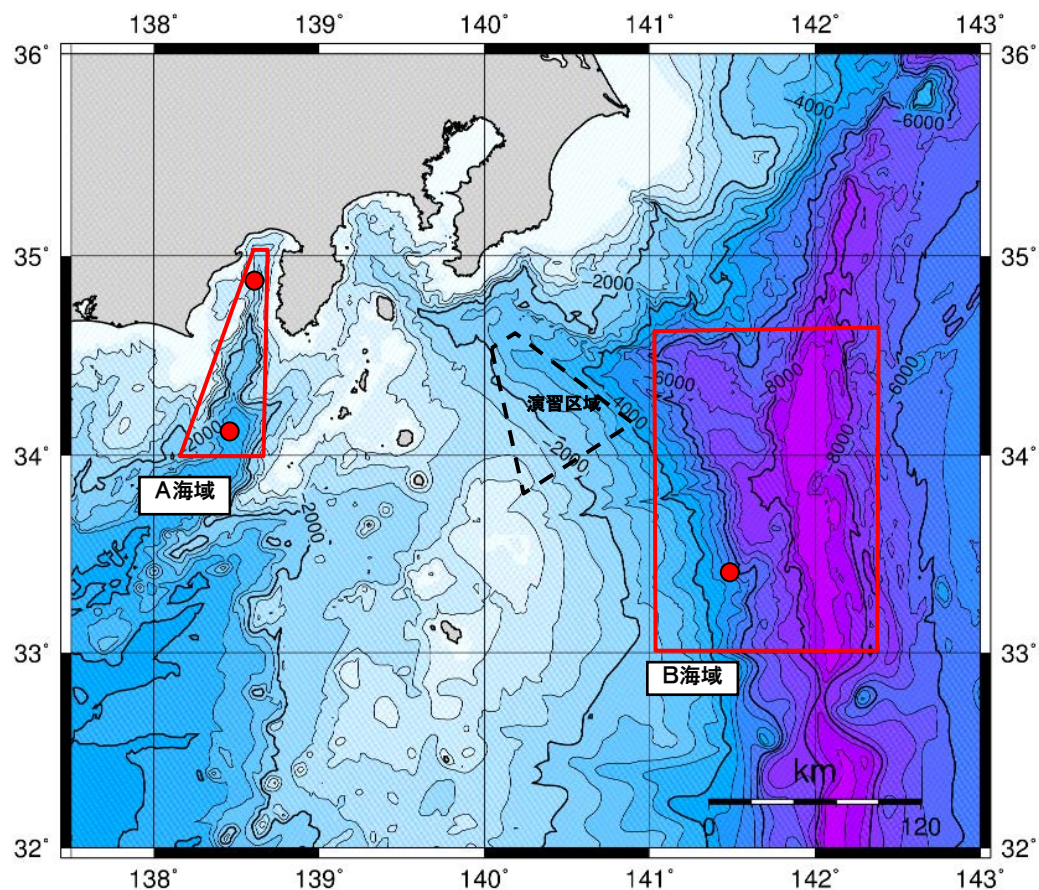
Users of data or results on this cruise report are requested to submit their results to the Data Management Group of JAMSTEC.

1. Cruise Information

- 1) Cruise ID : KR17-11 Leg1
- 2) Name of vessel : R/V Kairei
- 3) Cruise Title : Sea trial of ROV "KAIKO" and study of adaptive underwater optical wireless communication with photo multiplier tube
- 4) Representative of Science Party: Hidehiko Nakajoh, MARITEC, JAMSTEC
- 5) Chief scientist : Hidehiko Nakajoh, MARITEC, JAMSTEC
- 6) Cruise period : 2017/7/22 ~ 2017/7/25
- 7) Ports of call : Yokosuka(JAMSTEC) ~ Shimizu
- 8) Experiment Area (see Fig.1) :

Area A : Suruga Bay and northern part of Nankai Trough (depth 1,200m~3,000m)

Area B : Izu-Ogasawara Trench (depth 2,000m~5,700m)



2. Researchers

Leg.1 members

Hidehiko Nakajoh [JAMSTEC]

Yoshihiro Fujiwara [JAMSTEC]

Yasuyuki Matsumoto [JAMSTEC]

3. Contents of the sea trial

In KR17-11 Leg1 cruise, we carried out the sea trial of ROV “KAIKO Mk-IV” and operation check tests after the maintenance work in FY2017. The bait camera system was recovered as training of ROV manipulators.

Contents of the sea trial:

(1) Operation check tests of KAIKO system at the depth of 1,400 m, 1,700m and 5,800 m

(2) Experiments on comprehensive operation tests of KAIKO system

- Vehicle cruising test
- Manipulator work test

○ Dive information

Dive#	Date	Time	Latitude	Longitude	Depth(m)
748	23 July. 2017	11:59	30-24.70’N	141-37.90’E	5,800
749	24 July. 2017	12:10	34-50.27’N	138-36.32’E	1,433
750	25 July. 2018	10:19	34-47.00’N	138-37.00’E	1,722

* The bait camera system was recovered at Dive# 749.

3.1 General description of KAIKO

The work class remotely operated vehicle KAIKO can dive down to depths of 7,000 meters. The ROV consists of two parts, Launcher and Vehicle. KAIKO's Vehicle has been upgraded occasionally, and the current forth one was named KAIKO Mk-IV in 2013.

The new KAIKO system started operation as one of facilities available for research exploration carried out for projects selected from among the proposals submitted from applicants in and out of JAMSTEC in 2016.



【 Specifications 】

7,000 m Work Class Remotely Operated Vehicle KAIKO

	Launcher	Vehicle (KAIKO Mk-IV)
Length	5.2 m	3.0 m
Breadth	2.6 m	2.0 m
Height	3.2 m	2.6 m
Weight in the air	5.8 tons	5.5 tons
Maximum diving depth	11,000 m	7,000 m
Payload weight	-	300 kg in air, 200 kg in water
Thrusters	-	4 Horizontal, 3 Vertical
Research and observational equipment	CTD, side scan sonar, sub-bottom profiler	Two high definition video cameras, two PTZ-color cameras, digital still camera, video camera with a wide-angle fisheye lens, lights, CTD, and DO sensor
Navigational equipment	Obstacle avoidance sonar, monochrome video camera for monitoring the Launcher/Vehicle connection, video camera for monitoring the secondary cable, altimeter using the primary wave from the sub-bottom profiler, compass, and depth meter also used for the CTD sensor	Obstacle avoidance sonar, altimeter, inertial navigation system, Doppler Velocity Log, depth meter, monochrome rear view video camera, video camera for monitoring the Launcher/Vehicle connection, and ROV-Homer
manipulators	-	Two 7-function master-slave: schilling ATLAS 7P (Lift capacity :250kg)
Cables	Optical/power composite cables (12,000 meter-long primary cable with a diameter of 45 millimeters and 250 meter-long secondary cable with a diameter of 29.5 millimeters)	

4 Dive results

4.1 Dive# 748

We carried out the sea trial of ROV “KAIKO Mk-IV” and operation check tests after the maintenance work in FY2017 on 23 July 2017 at 5,800 m depth of Izu-Ogasawara Trench. In the dive# 748, the operation check was first conducted at a depth of 500 m. After that, KAIKO's vehicle went down to the ocean floor and operation check test was carried out. It was confirmed that the all function of the devices was satisfactory.

Dive log	Description
8 : 37	Vehicle and launcher was joined.
8 : 43	KAIKO was launched.
8 : 49	High voltage power supply started
8 : 56	Operation check at 150m
8 : 58	Start descending.
9 : 16	Pre-operation confirmation test start.
9 : 22	Pre-operation confirmation test end.
11 : 30	Stop descending at 5672m depth.
11 : 38	Vehicle released from launcher at 5566m depth.
11 : 59	Reached the bottom at 5800m depth (33-24.7455N, 141-37.994E) Operation check tests was carried out
13 : 05	Detachment at 5799m depth (33-24.6951N, 141-37.9170E)
13 : 17	Vehicle reconnected to launcher at 5569m depth.
13 : 19	Primary cable winding started.
15 : 48	High voltage power supply stopped.
15 : 51	KAIKO was raised at the sea surface.
16 : 02	KAIKO was recovered at the end of the dive #748.

4.2 Dive #749

On 24 July 2017 at 1,500 m depth at Suruga Bay, we carried out the sea trial of ROV “KAIKO Mk-IV” and operation check tests after the maintenance work in FY2017.

After the vehicle reached the sea bottom, the bait camera system was explored and recovered at depth 1,401m as training of the ROV manipulators.

Dive log	Description
10 : 33	Vehicle and launcher was joined.
10 : 39	KAIKO was launched.
10 : 44	High voltage power supply started.
10 : 50	Operation check at 150m depth
10 : 54	Start descending.
11 : 49	Stop descending.
11 : 56	Vehicle released from launcher at 1332m depth.
12 : 10	Reached the bottom at 1433m depth (34-50.1754N, 138-36.3423E) Bait camera system was started searching.
14 : 34	The top buoy of bait camera system was found at 1383m depth. (34-50.2283N, 138-36.3753E)
15 : 24	The recovery operation of the bait camera system has started at 1401m depth. (34-50.2178N, 138-36.3738E)
16 : 17	The bait camera system was recovered. Detachment at 1418m depth (34-50.2007N, 138-36.3899E)
17 : 05	Vehicle reconnected to launcher at 1256m depth.
17 : 08	Primary cable winding started.
18 : 04	High voltage power supply stopped.
18 : 06	KAIKO was raised at the sea surface.
18 : 18	KAIKO was recovered at the end of the dive #749.

4.2.1. Recover dive of bait camera system

The bait camera system is a small self-floating observation device developed for deep sea biological observation. This system consists of an HD handy camera built into a glass float sphere, LED lights, bait that used to entice fish, and releaser with ballast.

The progress of recovery bait camera system was as follows:

- 1) Deployment date and sea bottom position of “Bait camera system”
 - Deployment Date: 20 April. 2017

- Sea bottom position : 34° 50.270' N、138° 36.321 'E Depth 1,371m

Situation:

The bait camera system was released from the surface descends independently thanks to its weight. After that, it's position confirmation by acoustic positioning method was carried out.

2) lost date and position of "Bait camera system"

- lost date: 21 April. 2017
- Sea bottom position : 34° 50.310' N、138° 36.315 'E Depth 1,399m

Situation:

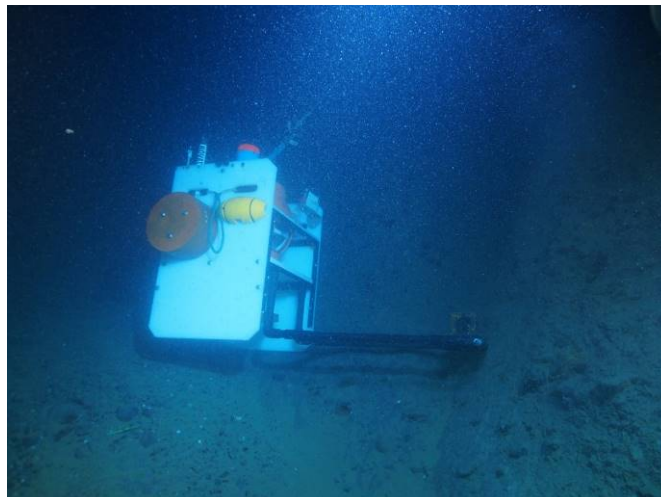
Although the acoustic separation command was normally accepted, there was no change in the camera position.

2. Recovery Date

- Recovery Date: 24 July. 2017
- Sea bottom position : 34° 50.218' N、138° 36.374 'E Depth 1,401m

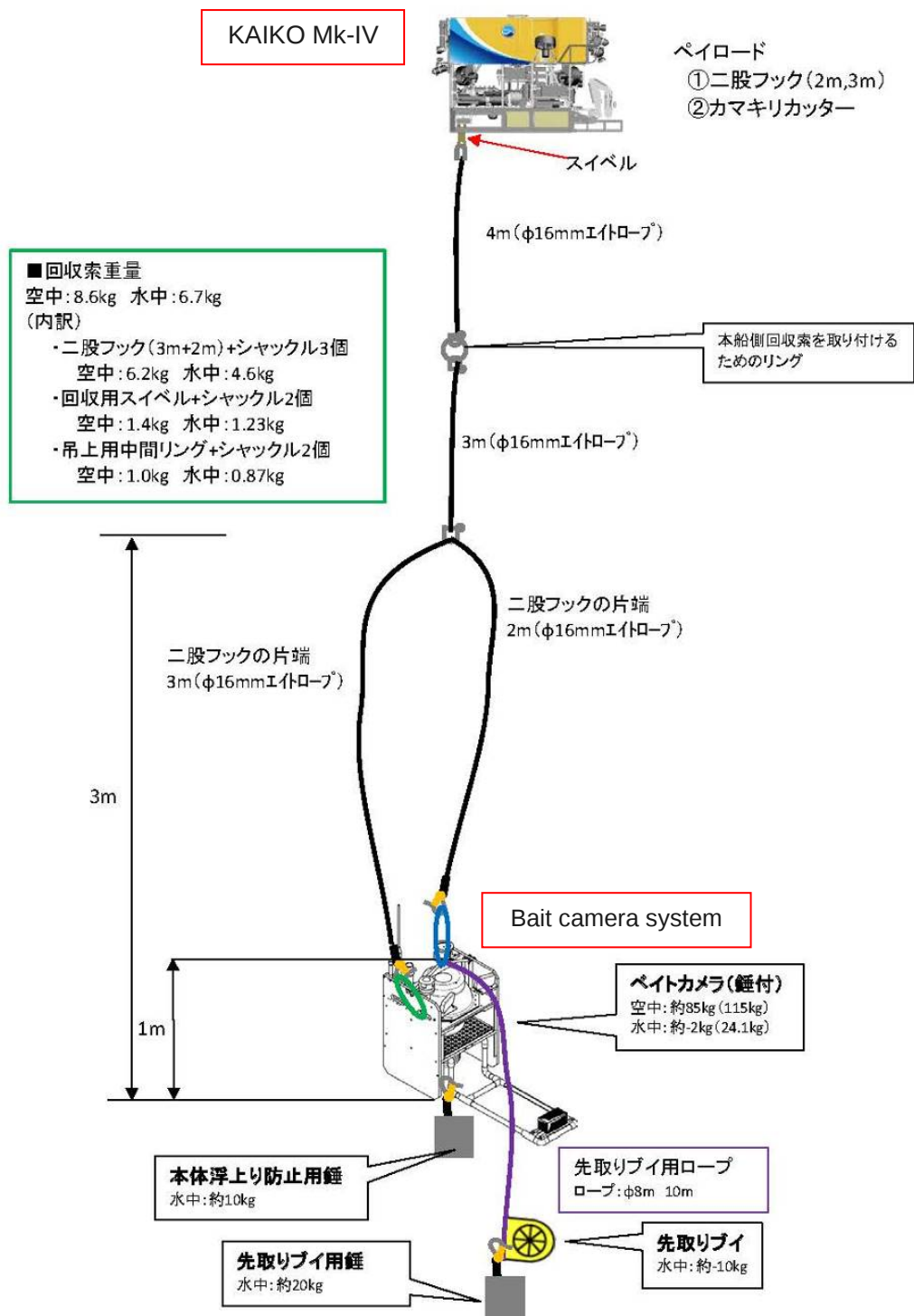
Situation:

We found a bait camera with "KAIKO Mk-IV", attached a retrieval rope, picked up it on a "Kairei" ship and collected it.



Bit camera discovered at the depth of 1401 m by KAIKO Mk-IV. Since it is after attaching the floating prevention weight to the top buoy, it is inclined to the left side.

4.2.2. Outline of Recovery Method



4.3 Dive#750

We carried out the sea trial of ROV “KAIKO Mk-IV” and operation check tests after the maintenance work in FY2017 on 25 July 2017 at 1,700 m depth at northern part of Nankai Trough. We carried out the experiments on comprehensive operation tests of KAIKO system, such as vehicle cruising test and Manipulator work test at the seabed.

Dive log	Description
8 : 31	Vehicle and launcher was joined.
8 : 37	KAIKO was launched.
8 : 41	High voltage power supply started
8 : 48	Operation check at 150m depth was carried out.
8 : 52	Start descending.
9 : 56	Stop descending.
10 : 04	Vehicle released from launcher.
10 : 19	Reached the bottom at 1721m depth (34-46.9399N, 138-37.0167E)
12 : 31	Detachment at 1722m depth (34-46.9321N, 138-36.9947E)
12 : 43	Vehicle reconnected to launcher
12 : 46	Primary cable winding started.
13 : 54	High voltage power supply stopped.
13 : 55	KAIKO was raised at the sea surface.
14 : 04	KAIKO was recovered at the end of the dive #750.

5. Acknowledgement

Here we express our sincere appreciation for the excellent support and assistance by Captain and ship crew, and the operation manager of KAIKO team throughout the cruise.