

Implementation Status of the Fukushima Daiichi Nuclear Power Station Unit 1 Primary Containment Vessel Internal Investigation (As of February 9)

< Reference Material >
February 9, 2022
Tokyo Electric Power Company Holdings,
Inc.
Fukushima Daiichi D&D Engineering
Company

- In order to deliberate equipment and methods for recovering deposits from inside the primary containment vessel (hereinafter referred to as, "PCV"), internal investigations of the PCV shall be conducted to obtain information, such as the amount and origins of such deposits. Going forward, separately developed remotely operated vehicles (hereinafter referred to as, "submersible ROV") will be used to perform a detailed visual investigation of the inside and the outside of the pedestal^{※1}, measure the thickness of deposits, detect deposit debris, sample debris, and create 3-D maps of the deposits.
- Prior to performing these investigations, guide rings^{※2} need to be installed inside the PCV. On January 12, when commencing preparations to insert submersible ROV-A to perform this task, the dose data built-in to the submersible ROV did not display correctly. Thereafter, the cause of the malfunction was ascertained and countermeasures put in place thereby rectifying the problem.
- At 11:17 AM on February 8, the submersible ROV-A was inserted the X-2 penetration^{※3} and work to install the guide rings began. At 1: 50 PM on February 9, guide rings were installed in the four areas with jet deflectors^{※4} on the south side of the PCV (Referred to slide 4).
- What appears to be deposits at the bottom of the PCV, parts of gratings likely severed when building the access route, steel scraps, parts of reactor recirculating system pipes and conduits were identified while installing the guide rings (Referred to slide 5). Detailed investigations will be conducted in future investigations using the information gathered in this investigation.

-
- At 3:58 PM on February 9, the submersible ROV travelled back to the area where it was first lowered down to be retrieved. It will be hoisted up on February 10 (tomorrow).
 - This investigation was performed after constructing boundaries^{※5} to prevent gases from inside the PCV from leaking to the outside, and there were no significant fluctuations in data from monitoring post or dust monitors, or with plant parameters before and after the investigation, so there was no radiological impact on the surrounding environment. We will continue to prioritize safety while carefully conducting these investigations.

※1 Pedestal: Work space below the primary containment vessel

※2 Guide ring: Ring installed to prevent the cables attached to the submersible ROV from getting twisted.

※3 X-2 penetration: Hole used by workers to enter the PCV

※4 Jet deflector: Disk-shaped metal plate installed on the PCV-side of the pipe connecting the PCV to the pressure suppression chamber.

※5 Boundary: PCV containment function

Sequence of events during the internal investigation of the Unit 1 PCV (As of 4 PM February 9)

【February 8】

- 10:00 AM PCV internal investigation preparations begin (Power is turned on for each piece of equipment)
- 10:38 AM It is confirmed that dose data built-in to the submersible ROV-A and the timestamp on submersible ROV-A camera monitors are displaying correctly
- 11:17 AM **PCV internal investigation commences** (Isolation valve on the X-2 penetration is opened)
- 3:27 PM Submersible ROV-A arrives at the surface of the water inside the PCV
- 3:58 PM Operations check of submersible ROV-A begins
- 4:16 PM Operations check of submersible ROV-A concludes (No abnormalities)
- 6:18 PM 1st guide ring is installed
- 7:49 PM 2nd guide ring is installed
- 9:49 PM 3rd guide ring is installed

【February 9】

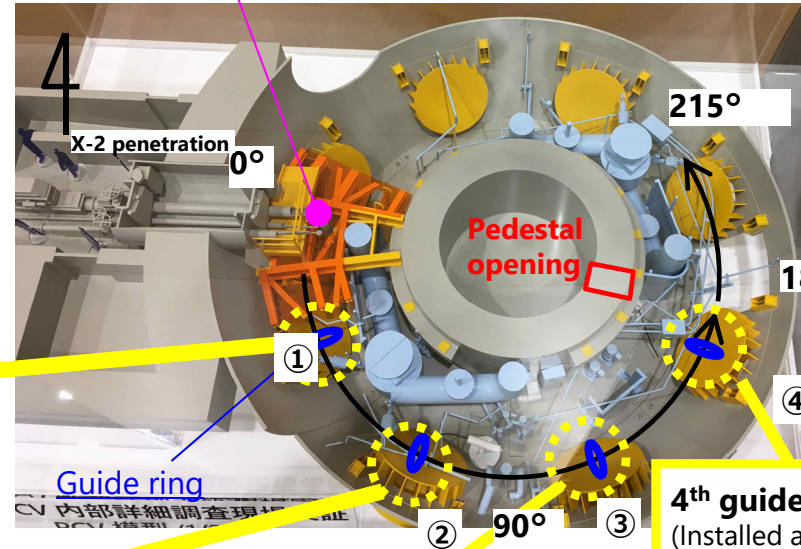
- 10:00 AM PCV internal investigation preparations begin (Power is turned on for each piece of equipment)
- 1:50 PM 4th guide ring is installed
- 3:35 PM Submersible ROV-A starts travelling to the area where it was lowered down
- 3:58 PM Submersible ROV-A arrives at the area where it was lowered down

Status of guide ring installation

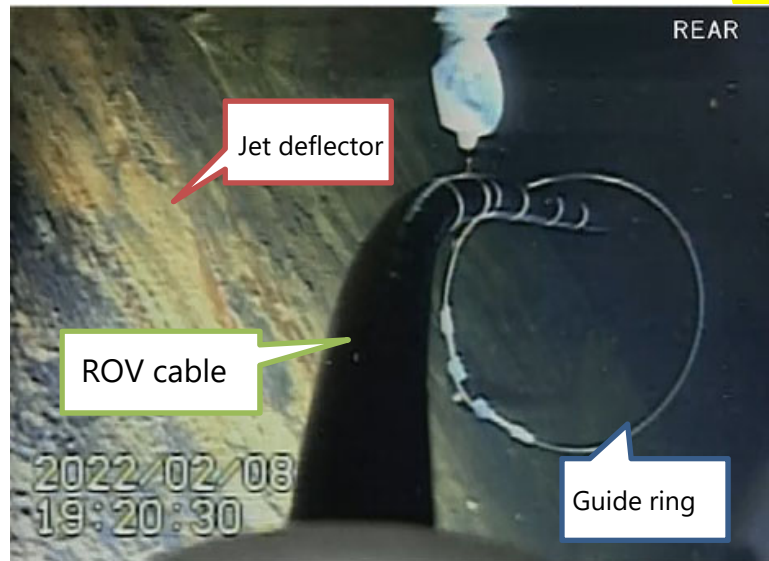


Installed 1st guide ring (installed at 6:18 PM on February 8)

Area where the ROV was inserted ※Photos taken on February 8



4th guide ring
(Installed at 1:50 PM on February 9)



Installed 2nd guide ring (Installed at 7:49 PM on February 8)



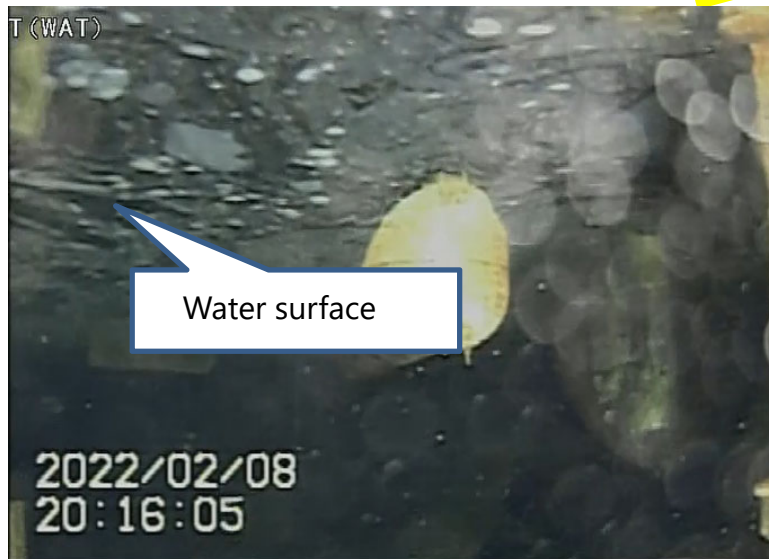
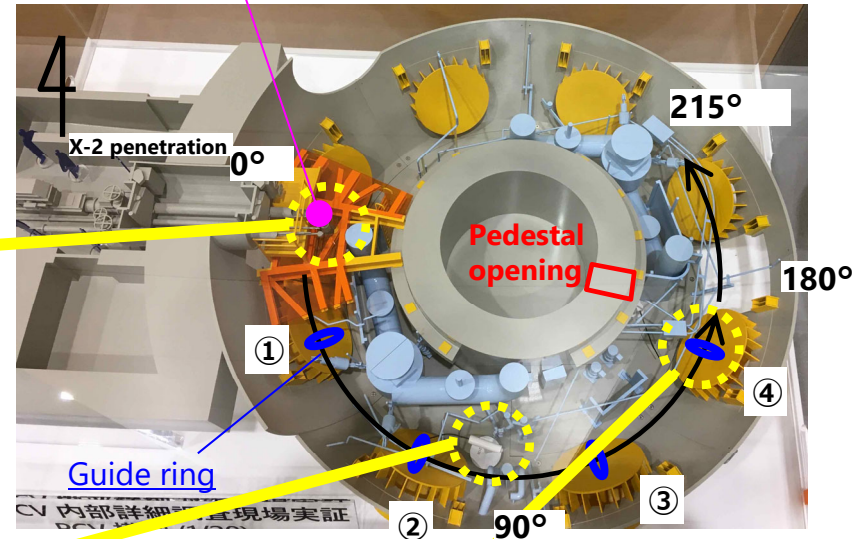
Installed 3rd guide ring (Installed at 9:49 PM on February 8)

Status inside the PCV

Area where the ROV was inserted ※ Photos taken on February 8



Area directly below where the submersible ROV was inserted



Floating matter on the surface of the water



Deposits near the 4th jet deflector

Work in progress

※ Photos taken on February 8



Work in the remote operations room



Work in the field headquarters



Work in the area in front the X-2 penetration (1)



Work in the area in front the X-2 penetration (2)

Work structure

■ Staff allocation

Area in front of the outside of the PCV (X-2 penetration): 8 teams each comprised of 8 people

Field headquarters: approx. 36 people mainly supervisors

Remote control room: 4 teams comprised of 4 operators each (1 team leader, 3 member operators) + approx. 10 supervisors

■ Equipment

Area in front of the outside of the PCV (X-2 penetration): R gear (i.e., Anorak, coveralls, full face mask, helmet, cotton gloves, 3 sets of rubber gloves, 3 pairs of socks, shoe covers, R shoes)

Field headquarters: Y gear (i.e., coveralls, full face mask, helmet, cotton gloves, 2 sets of rubber gloves, 2 pairs of socks, Y shoes)

■ Dose

Planned dose : 3mSv/day per person

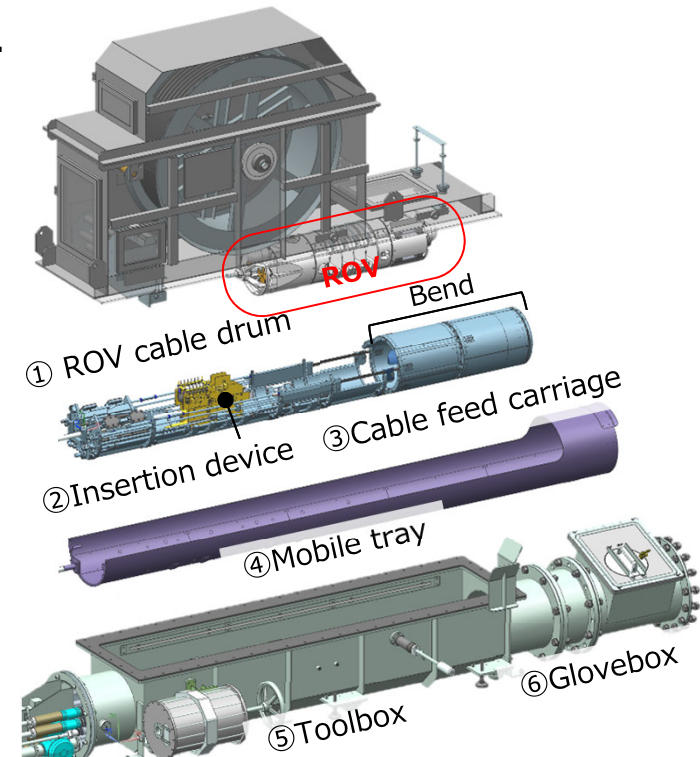
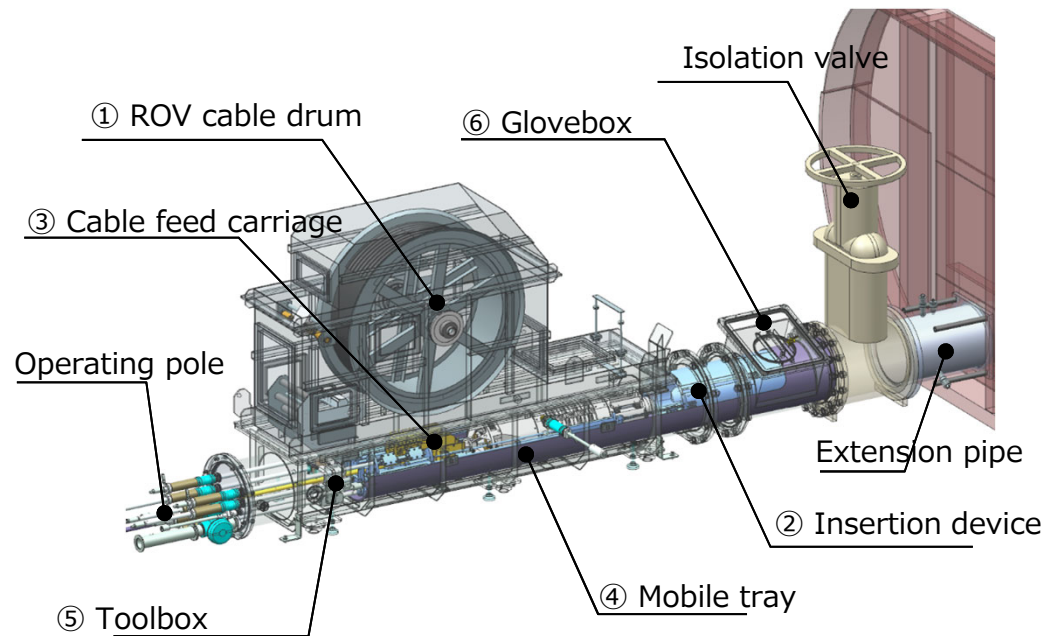
APD set value : 1.5mSv

Actual dose (maximum value for an individual) : Gamma rays of 0.61mSv/person (on February 8)

【Reference】 Investigation device details

Toolbox and other equipment

Inserts/extracts the ROV into/from the PCV.
Creates a PCV boundary along with the ROV cable drum.



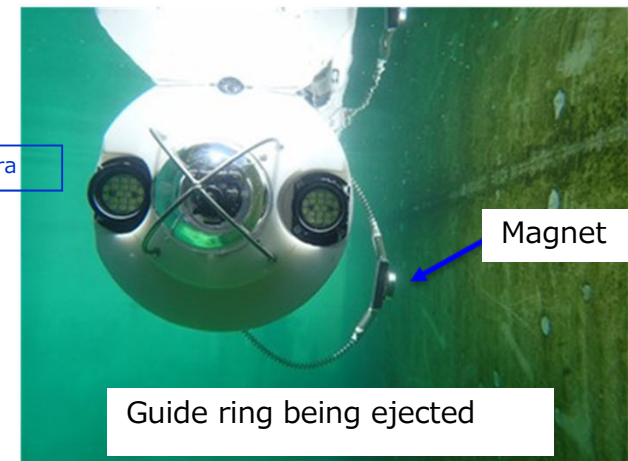
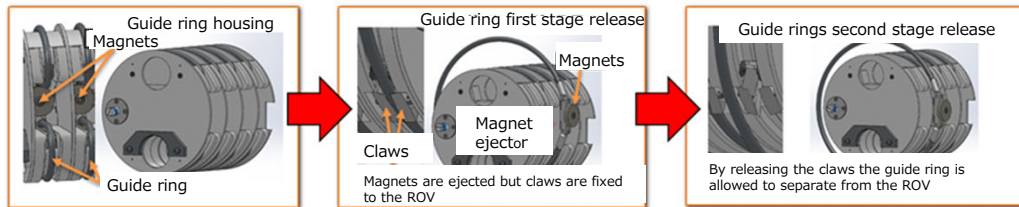
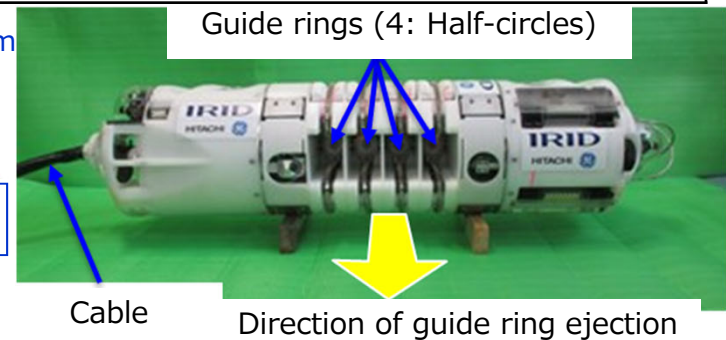
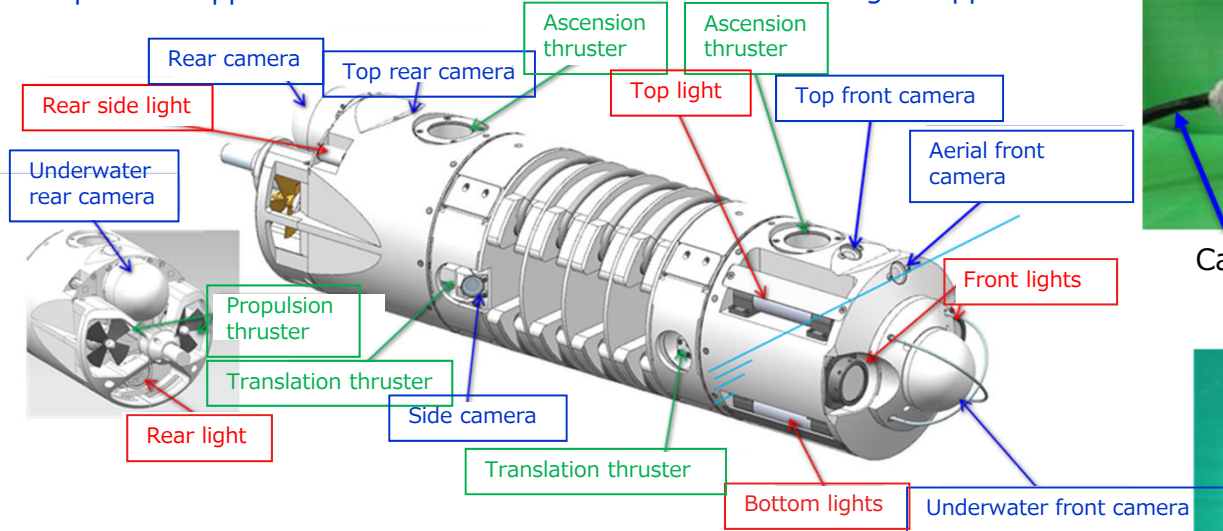
Name of component		Role
①	ROV Cable drum	Part of the ROV that feeds and retracts the ROV cable.
②	Insertion device	Inserts the ROV into the PCV via guide rings and bends to stand the ROV vertically once inside.
③	Cable feed carriage	Works in tandem with the cable drum to assist with the cable.
④	Mobile tray	Device for carrying the insertion device up to the guide pipe.
⑤	Toolbox	Houses the ROV cable drum and constitutes a boundary.
⑥	Glovebox	Used to set the cable fee carriage and to cut the cable in the event of an emergency.

【Reference】 Investigation device details

ROV-A guide ring installation device

Investigation device	Instruments	Details
ROV-A Guide ring installation	ROV protection (Fiber-optic γ -ray dosimeter※) ※ : Same as that used for the external investigation of the pedestal	Guide rings (internal diameter: 300mm (design value)) are attached to the jet deflectors to prevent structures from interfering with the cable
	Quantity: 1 for the north and 1 for the south; Cruising time: Approx. 80 hours/unit Since this is the first ROV to be inserted, low-friction and relatively hard polyethylene cables ($\phi 24\text{mm}$) will be employed	

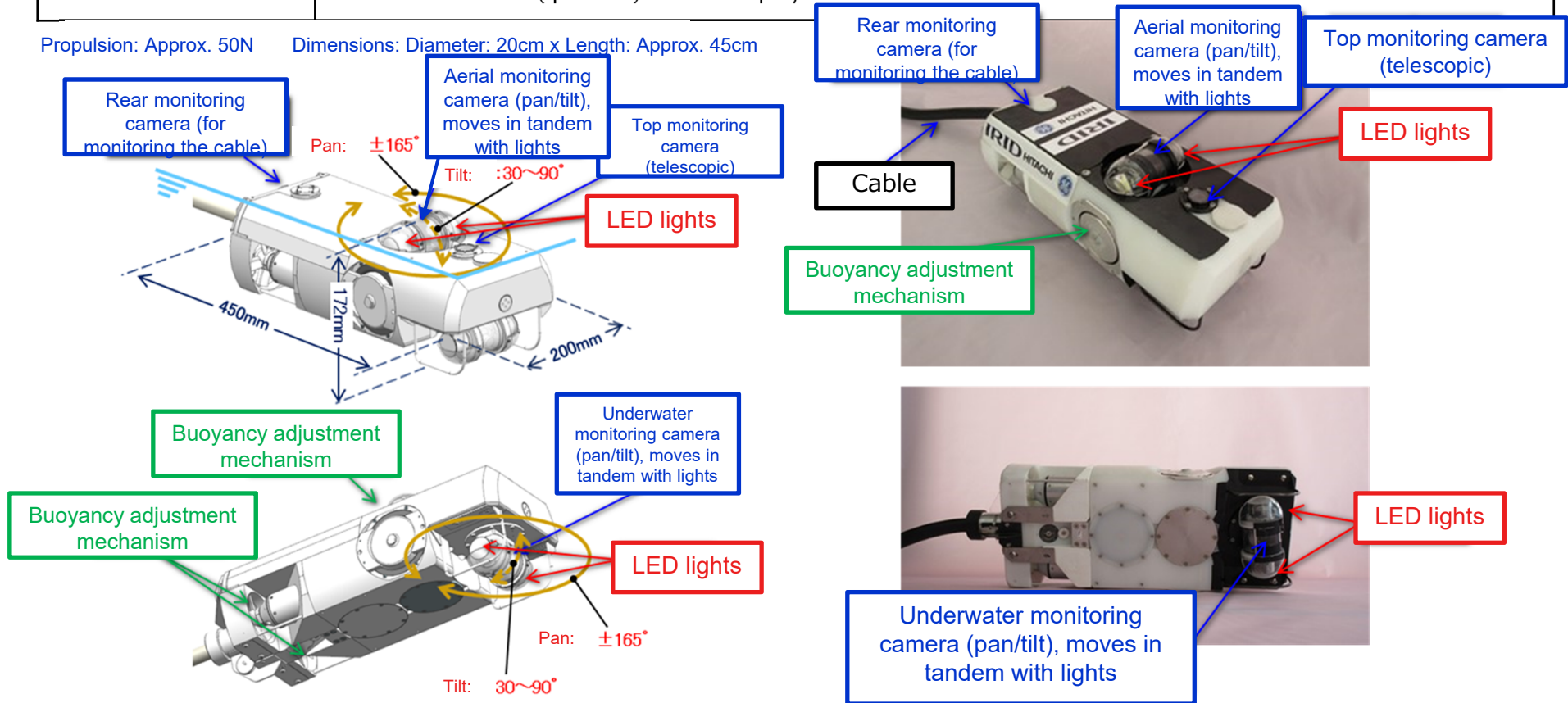
Propulsion: Approx. 25N Dimensions: Diameter: 25cm x Length: Approx. 110cm



【Reference】 Investigation device details

ROV-A2 For detailed visual investigation

Investigation device	Instruments	Details
ROV-A2 Detailed visual investigation	ROV protection (Fiber-optic γ -ray dosimeter※, Improved mini B10 detector) ※ : Same as that used for the external investigation of the pedestal	Uses cameras to perform a visual investigation of the extensive basement area and of the status of the detached CRD housing inside the pedestal (※) (※If it can be accessed)
	Quantity: 2 units; Cruising time: Approx. 80 hours/unit Since the units need to be agile for the investigation flexible PVC cables (ϕ 23mm) will be employed	

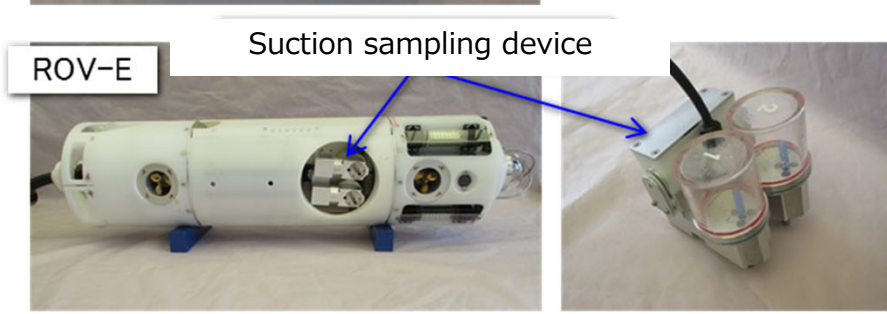
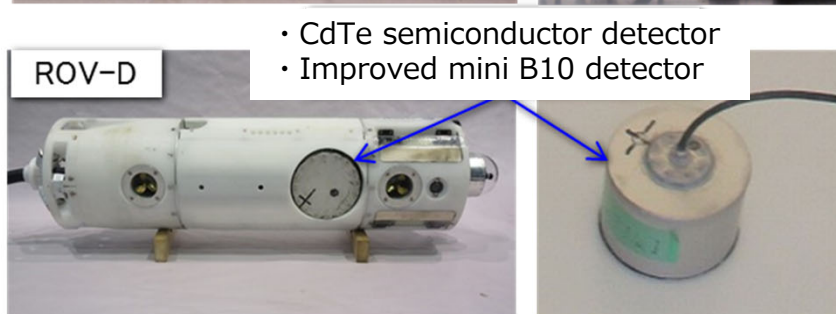
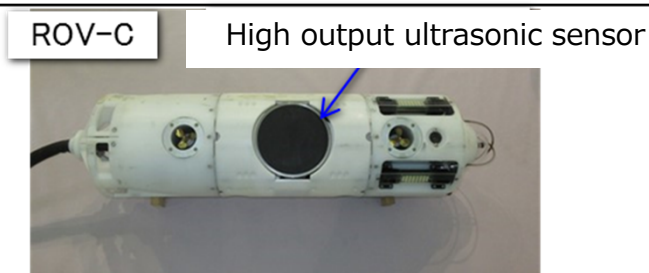
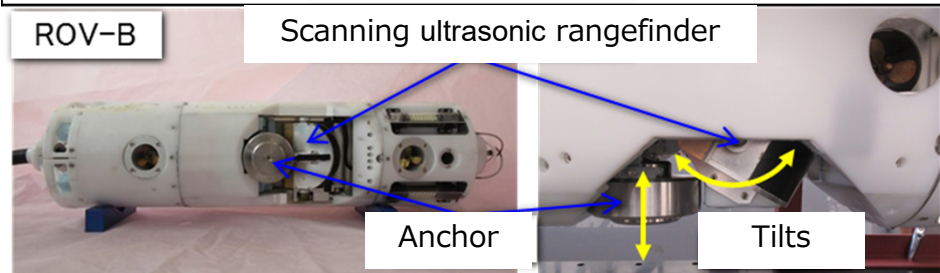


【Reference】 Investigation device details

ROV-B~E for different investigations

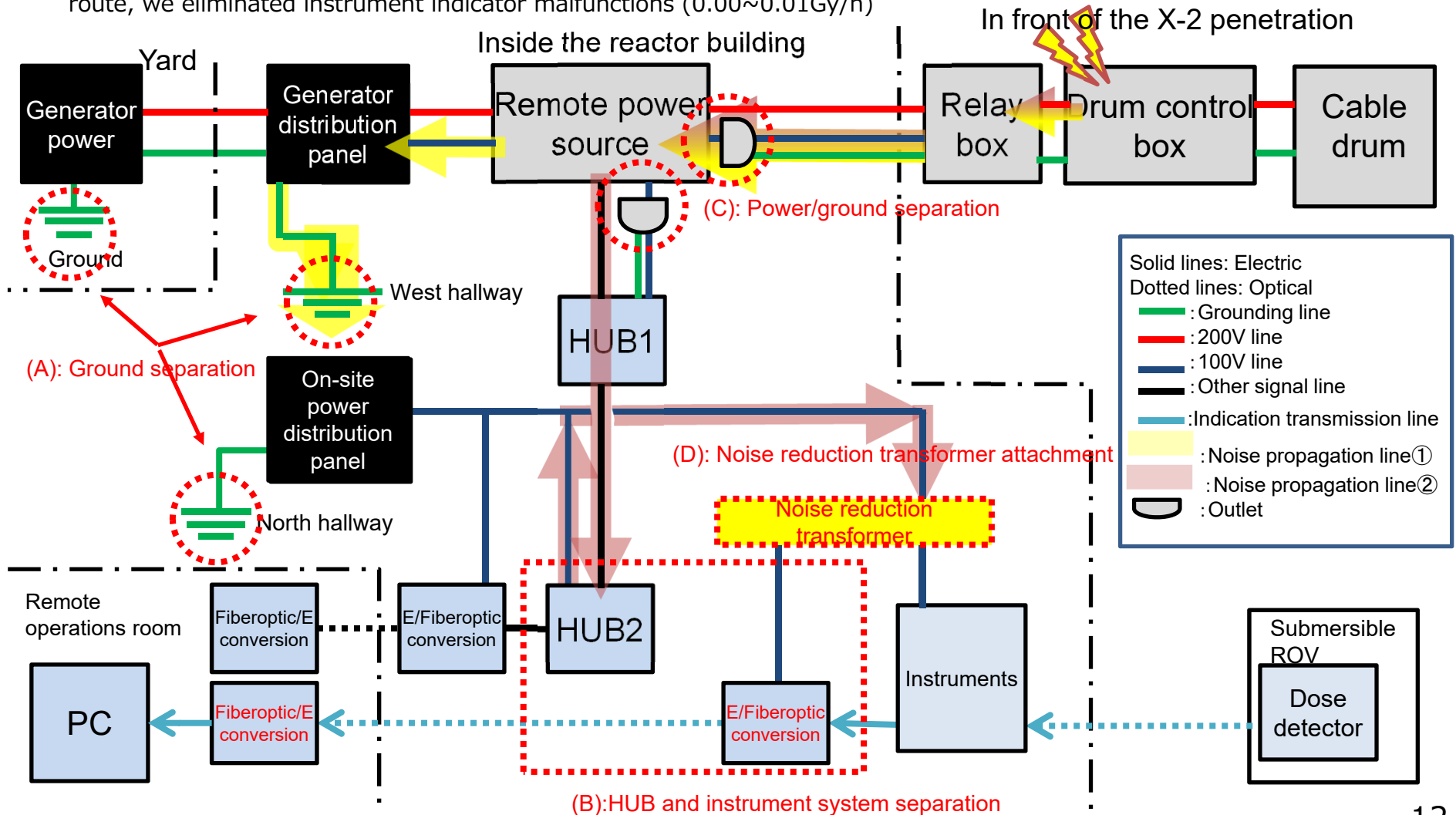
Investigation device	Instruments	Details
ROV-B 3-D mapping of deposits	<ul style="list-style-type: none"> • Scanning ultrasonic rangefinder • Water temperature gauge 	Scanning ultrasonic rangefinder used to examine the height distribution of deposits.
ROV-C Deposit thickness measurements	<ul style="list-style-type: none"> • High output ultrasonic sensor • Water temperature gauge 	High output ultrasonic sensor used to measure the height of deposits and examine objects underneath them in order to estimate debris height and distribution.
ROV-D Deposit debris detection	<ul style="list-style-type: none"> • CdTe semiconductor detector • Improved mini B10 detector 	Debris detection sensors will be dropped on the surface of the deposits to analyze nuclides and measure neutron flux in order to examine if debris exists inside the deposits.
ROV-E Deposit sampling	<ul style="list-style-type: none"> • Suction sampling device 	The deposit sampling device will be dropped on the surface of the deposits to take samples from the surface of the deposits.

Quantity: 2 each; Cruising time: Approx. 80 hours/unit Since the units need to be agile for the investigations flexible PVC cables (ROV-B : φ33mm, ROV-C : φ30mm, ROV-D : φ30mm, ROV-E : φ30mm) will be employed



【Reference】 Causes and countermeasures for the nonconformities found during preparations on January 12 (1/2)

- From the results of additional investigations we have hypothesized that noise originating from the drum control box propagated as follows and affected the instruments. (①: Noise propagating from the south grounding line, ②: Noise propagating from the HUB)
- By implementing the countermeasures (A)~(D) shown in the diagram below and cutting off each noise propagation route, we eliminated instrument indicator malfunctions (0.00~0.01Gy/h)



【Reference】 Causes and countermeasures for the nonconformities found during preparations on January 12 (2/2)

- Cause

Tension from the outside was put on **one of the camera communication cables** thereby causing signal interruption and affecting the timestamp display.

- Countermeasure

The malfunctioning cable was replaced with a longer cable to avoid the cable from being put under tension from the outside. During reproducibility tests thereafter, no abnormalities were found with the timestamp display.

