

# Implementation Status of the Fukushima Daiichi Nuclear Power Station Unit 1 Primary Containment Vessel Internal Investigation (As of February 10)

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- 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<sup>※1</sup>, measure the thickness of deposits, detect deposit debris, sample debris, and create 3-D maps of the deposits.
- At 11:17 AM on February 8, the submersible ROV-A was inserted the X-2 penetration<sup>※2</sup> and work to install the guide rings<sup>※3</sup> began. At 1: 50 PM on February 9, guide rings were installed in the four areas with jet deflectors<sup>※4</sup> on the south side of the PCV.
- At 3:58 PM on the same day, the submersible ROV travelled back to the area where it was first lowered down to be retrieved. (Announced by February 9)
- At 10 AM today (February 10), hoisting of the submersible ROV commenced and concluded at 4:33 PM. As a result, we were able to complete guide rings installation that should enable future investigations to be carried out smoothly.
- Furthermore, after guide rings installation on February 9, an investigation of the area to the east-northeast of the PCV (215°) was conducted to obtain information that will contribute to future investigations. During this investigation deposits were found near the jet deflectors in the aforementioned area. (Referred to slide 4)

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- Conditions around the pedestal opening were also investigated. When the conditions in the area from around the opening to inside the pedestal opening were investigated, clumps of deposits were found, but it could not be determined if these deposits are core internals or fuel debris. Furthermore, objects that are thought to be rebar were also found around the opening. (Referred to slide 5)
  - We will leverage the information obtained during this investigation for more detailed investigations in the future.
  - This investigation was performed after constructing boundaries<sup>※5</sup> 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 4:40 PM February 10)

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## **【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 1<sup>st</sup> guide ring is installed
- 7:49 PM 2<sup>nd</sup> guide ring is installed
- 9:49 PM 3<sup>rd</sup> 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 4<sup>th</sup> guide ring is installed
- 2:22 PM-3:35 PM Conditions to the east-northeast of the PCV (215°) and the area around the pedestal opening investigated
- 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

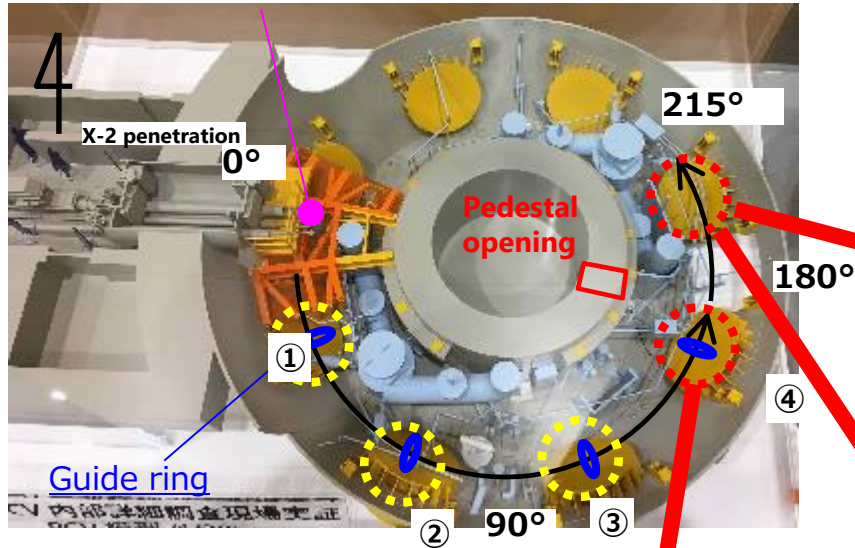
## **【 February 10 】**

- 10 AM Preparations for the internal investigation of the PCV commences (Power is turned on for each piece of equipment)
- 1:47 PM Hoisting of submersible ROV-A commences
- 4:33 PM **PCV internal investigation concludes** (isolation valve installed on the X-2 penetration closed)

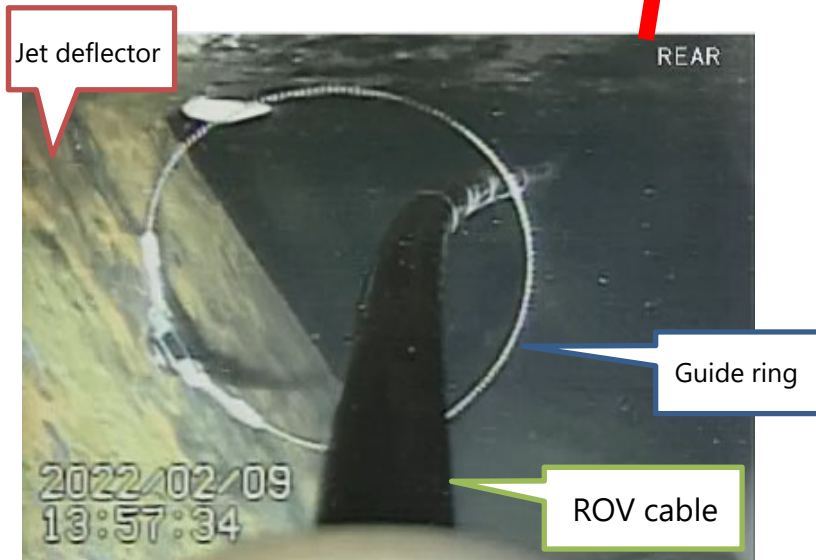
# Guide ring ④ installation and conditions to the east-northeast of the PCV (215°) (Photos taken from investigation on February 9)

ROV insertion location

※Photos taken on February 9



Conditions to the east-northeast of the PCV (bird's-eye view)



Guide ring ④ installation (Installation completed at 1:50 PM on February 9)

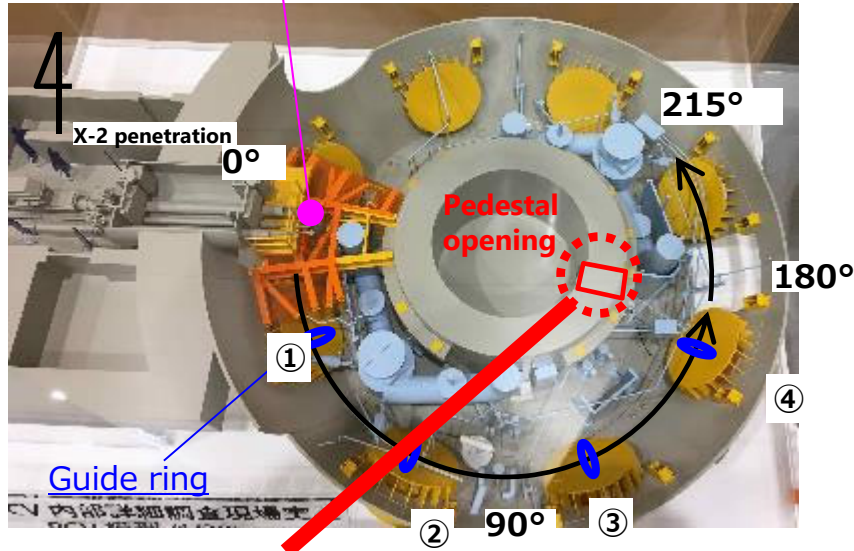


Conditions to the east-northeast of the PCV (close-up)



# Conditions around the pedestal opening (From investigation on February 9)

ROV insertion location



Referred to slide 6 for arrow views of each photos

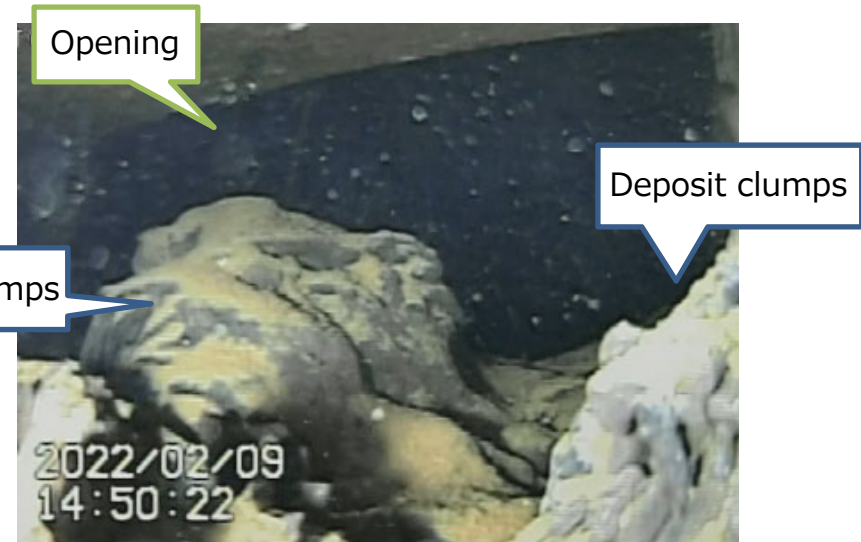
※Photos taken on February 9



A. Near the pedestal opening



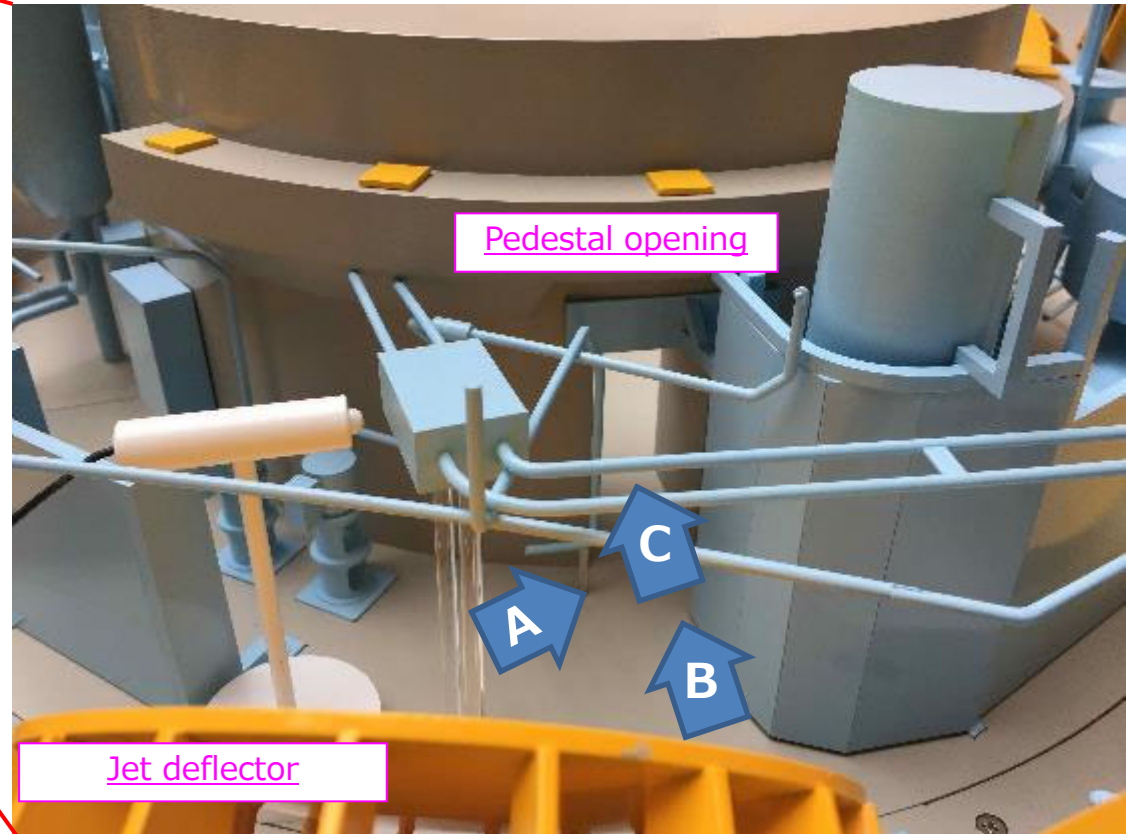
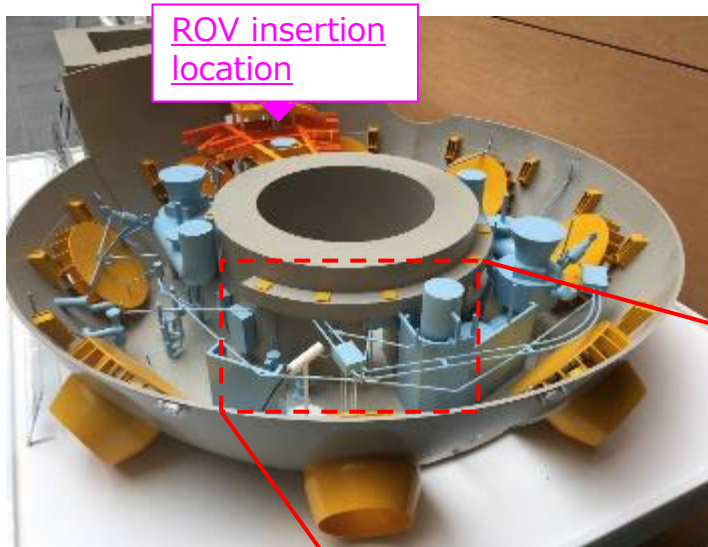
B. Bird's-eye view of the pedestal opening



C. Inside the pedestal opening

Conditions around the pedestal opening (From investigation on February 9)  
(Locations marked with arrow views of each photos on slide 5)

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## Work structure

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### ■ 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: 0.61mSv, Beta: 0mSv (on February 8)

Gamma: 0.19mSv, Beta: 0mSv (on February 9)

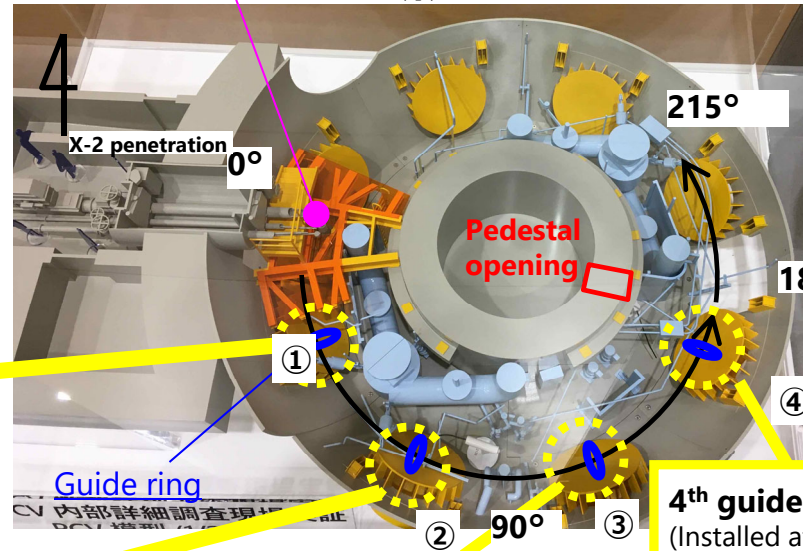


# 【Reference】 Status of guide ring installation

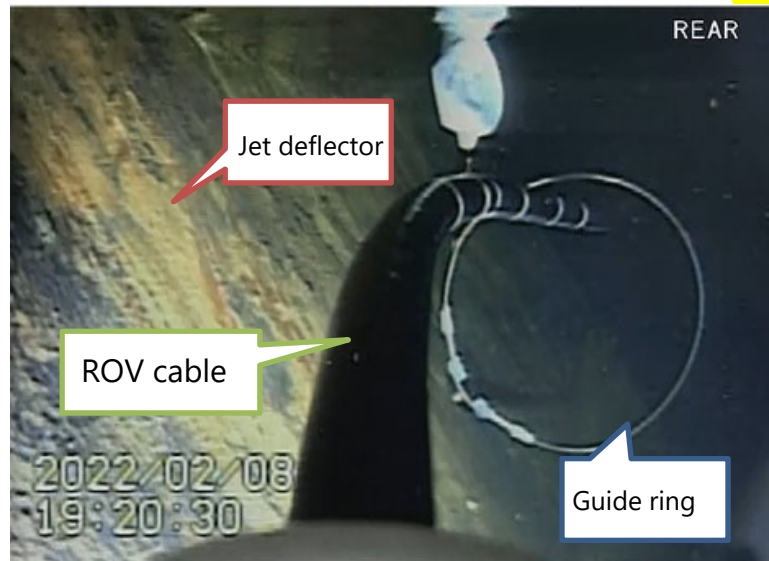


Installed 1<sup>st</sup> guide ring (installed at 6:18 PM on February 8)

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



**4<sup>th</sup> guide ring**  
(Installed at 1:50 PM on February 9)



Installed 2<sup>nd</sup> guide ring (Installed at 7:49 PM on February 8)



Installed 3<sup>rd</sup> guide ring (Installed at 9:49 PM on February 8)

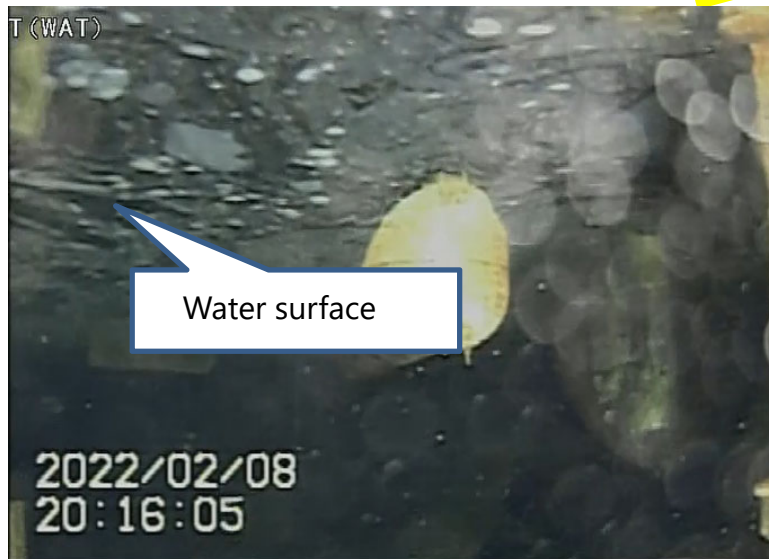
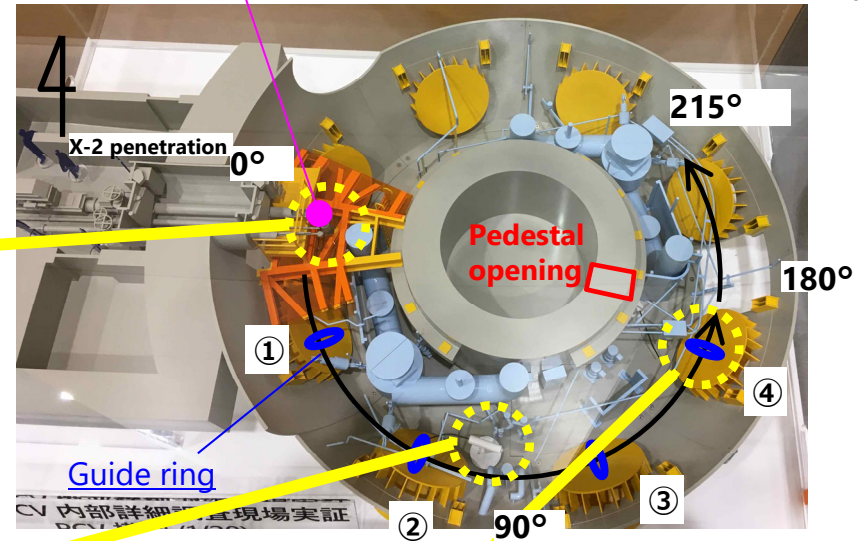


# 【Reference】 Status inside the PCV

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 4<sup>th</sup> jet deflector

# 【Reference】 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)

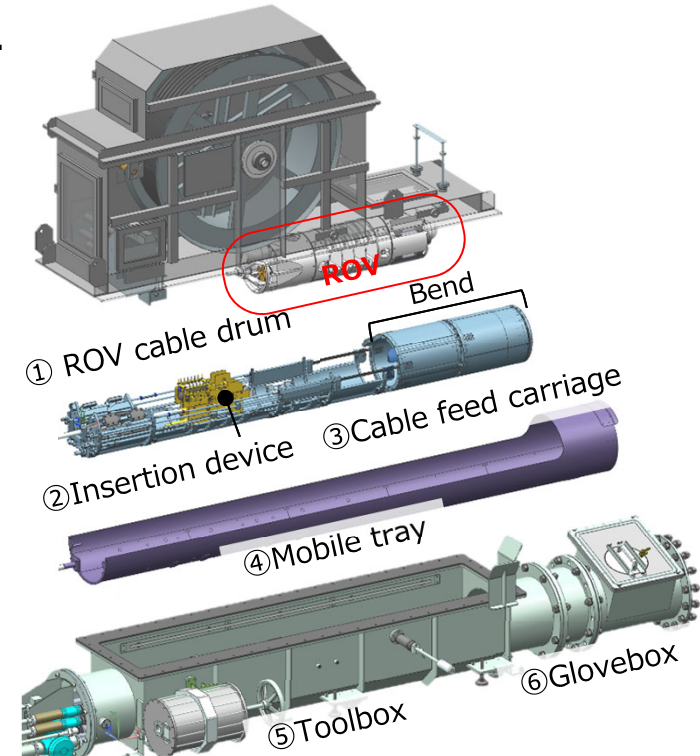
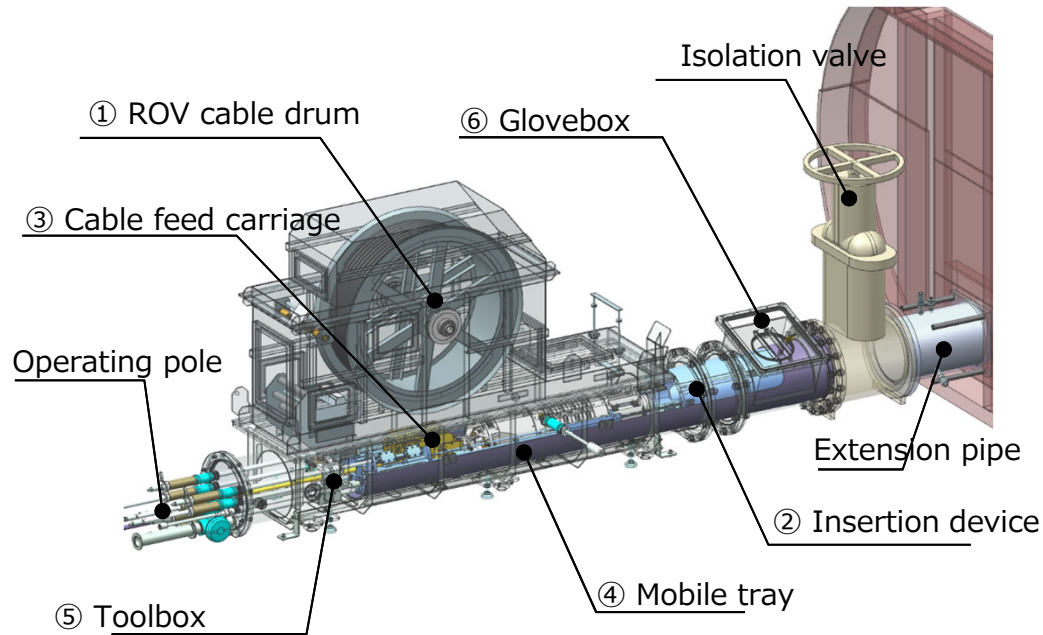


Work in the area in front the X-2 penetration (2) 10



# 【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.



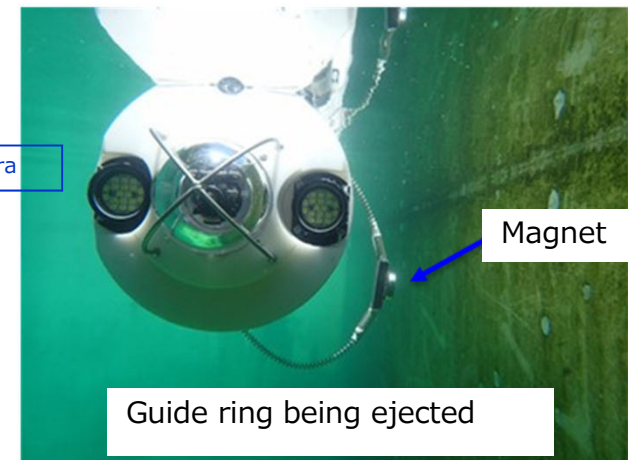
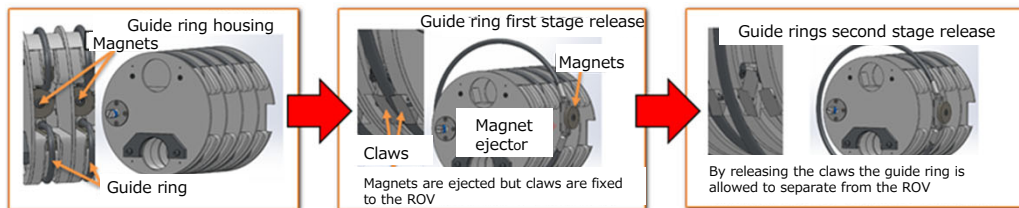
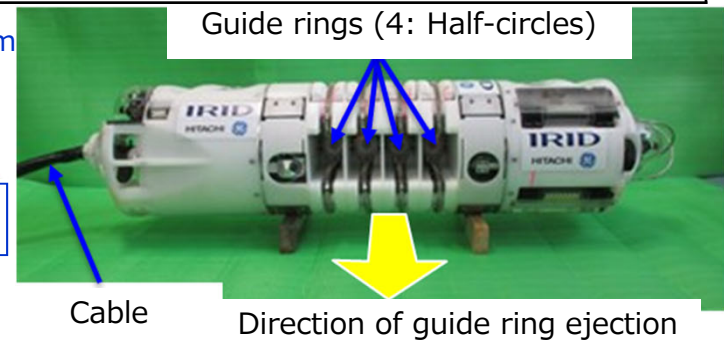
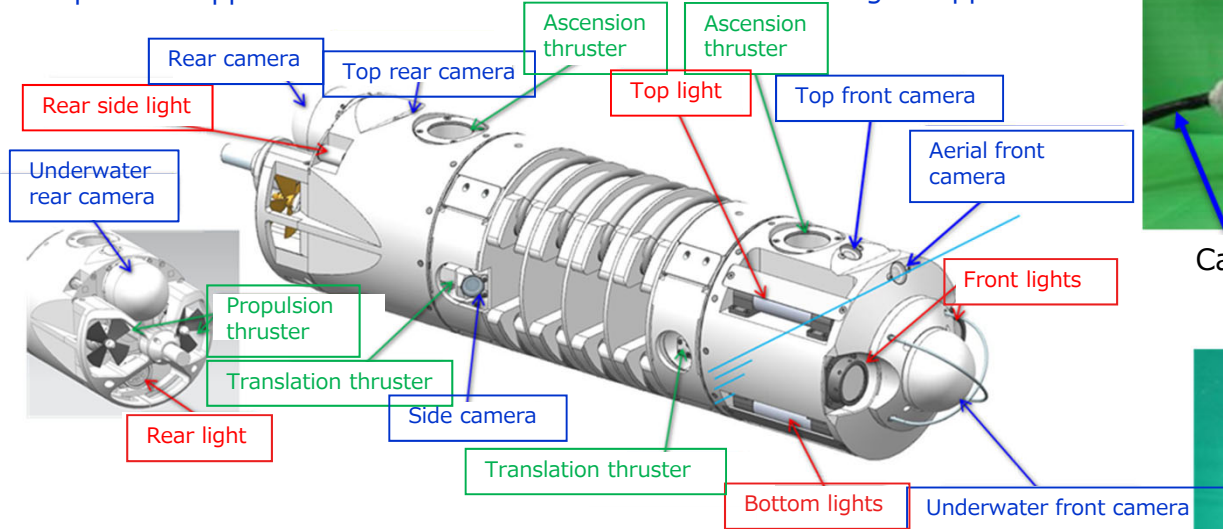
Name of component		Role
①	ROV Cable drum	Part of the ROV that feeds and retracts the ROV cable.
②	Insertion device	Inserts the ROV into the PCV via guide rings and bends to stand the ROV vertically once inside.
③	Cable feed carriage	Works in tandem with the cable drum to assist with the cable.
④	Mobile 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
<b>ROV-A</b> Guide ring installation	ROV protection (Fiber-optic $\gamma$ -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 ( $\phi$ 24mm) will be employed	

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

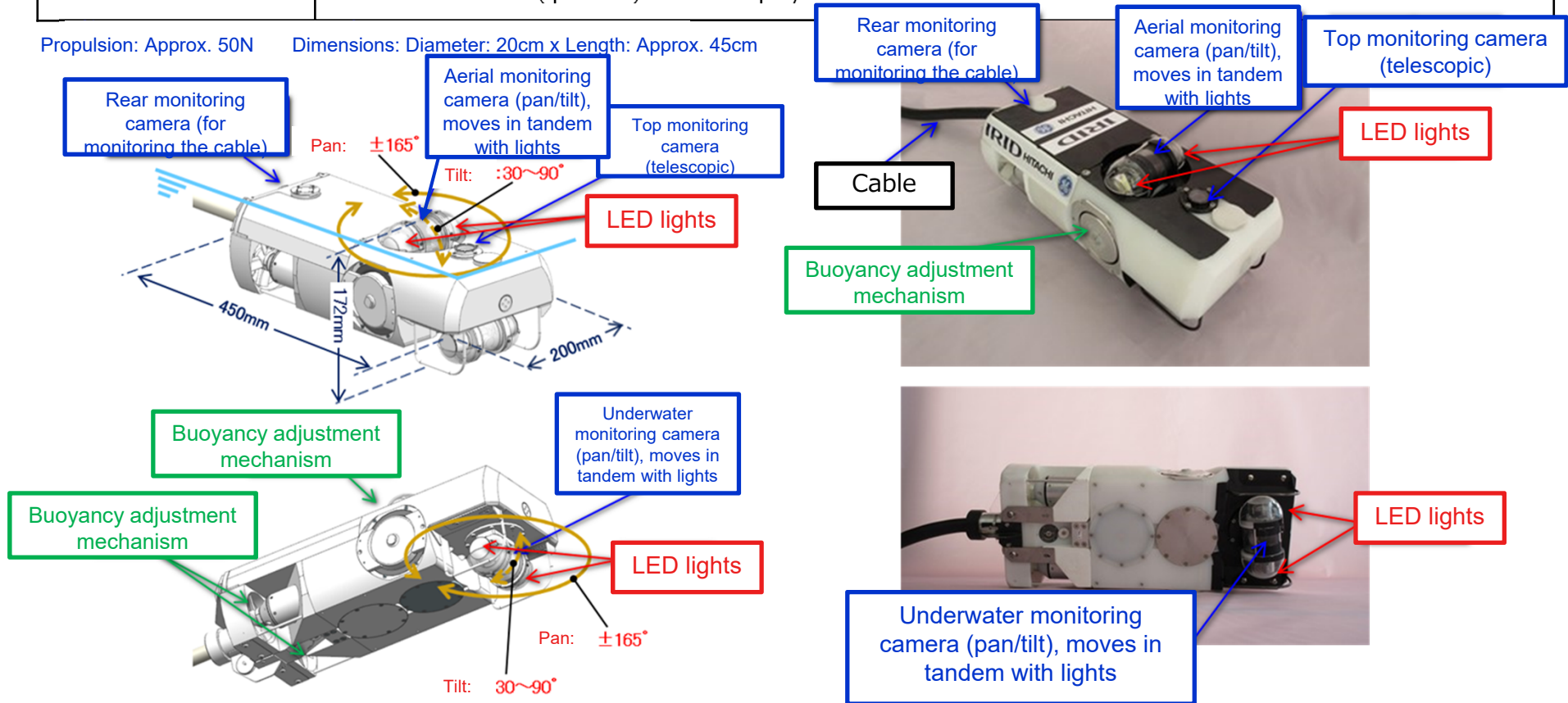




# 【Reference】 Investigation device details

## ROV-A2 For detailed visual investigation

Investigation device	Instruments	Details
<b>ROV-A2</b> Detailed visual investigation	ROV protection (Fiber-optic $\gamma$ -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 ( $\phi$ 23mm) will be employed	

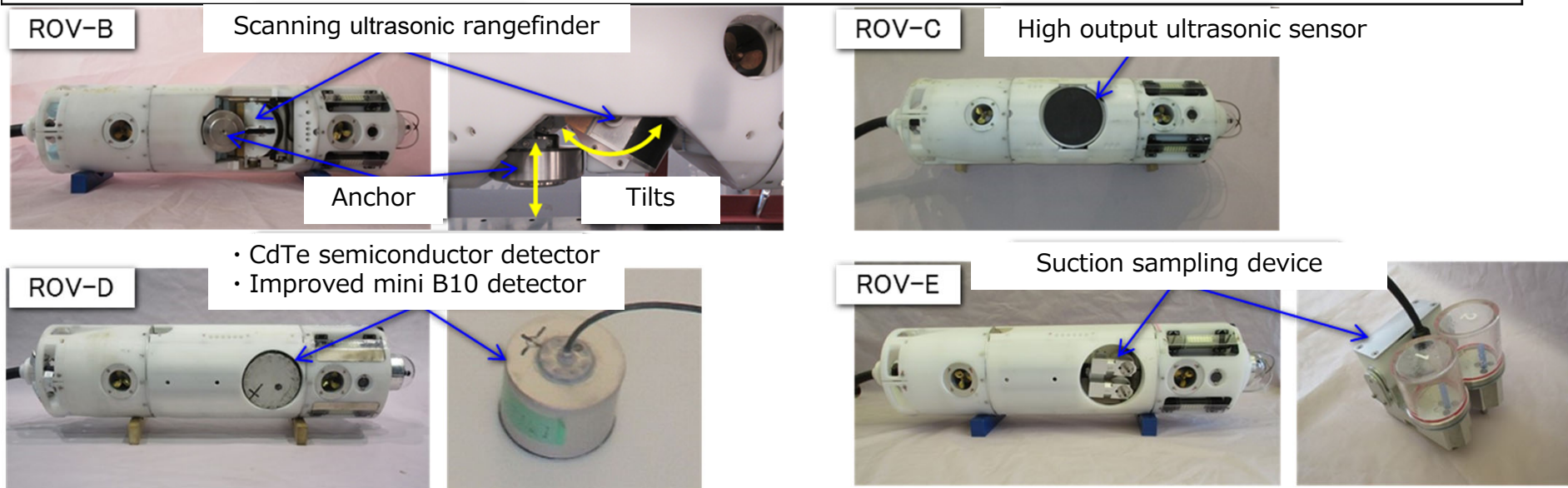


# 【Reference】 Investigation device details

## ROV-B~E for different investigations

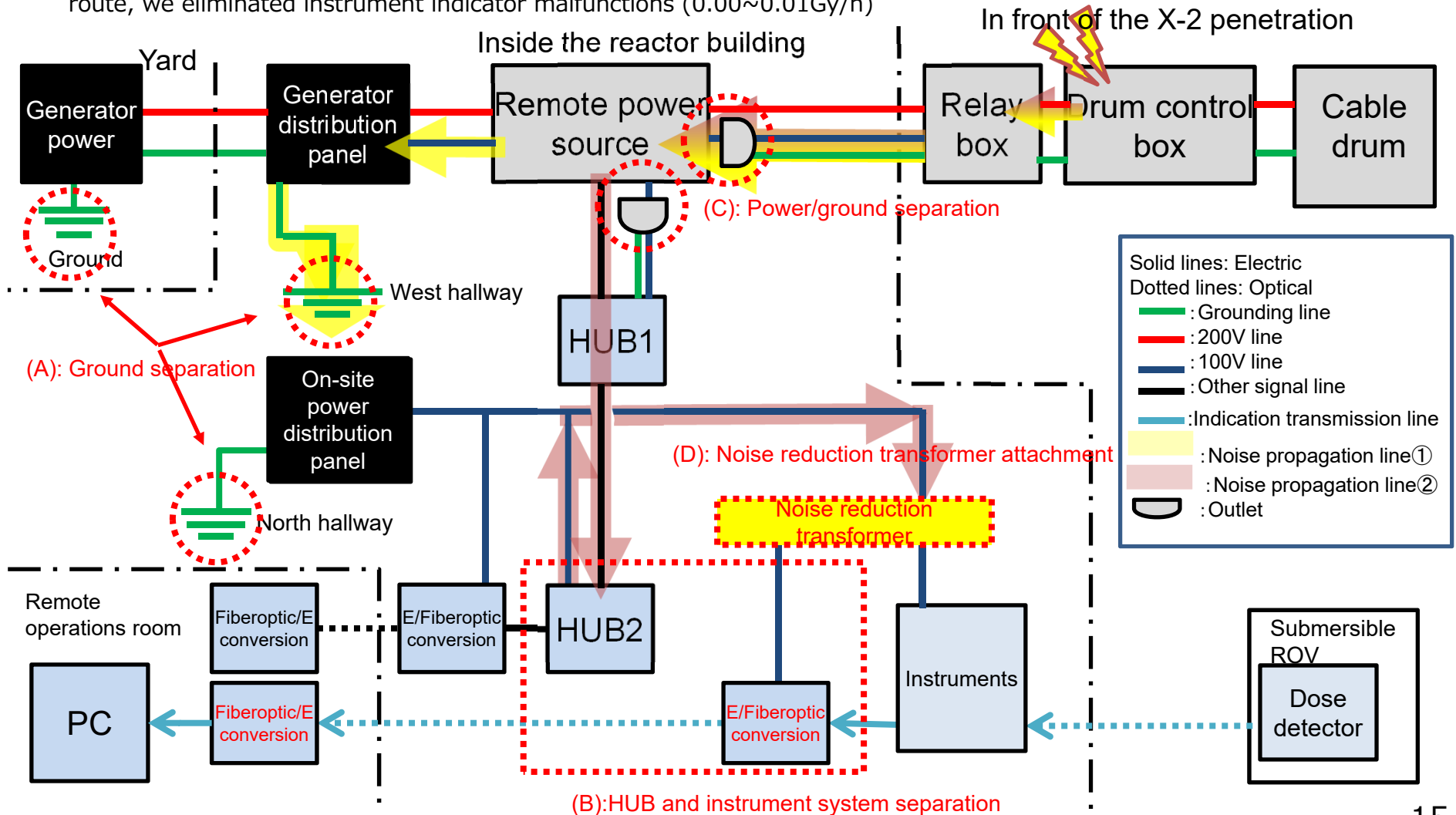
Investigation device	Instruments	Details
<b>ROV-B</b> 3-D mapping of deposits	<ul style="list-style-type: none"> <li>• Scanning ultrasonic rangefinder</li> <li>• Water temperature gauge</li> </ul>	Scanning ultrasonic rangefinder used to examine the height distribution of deposits.
<b>ROV-C</b> Deposit thickness measurements	<ul style="list-style-type: none"> <li>• High output ultrasonic sensor</li> <li>• Water temperature gauge</li> </ul>	High output ultrasonic sensor used to measure the height of deposits and examine objects underneath them in order to estimate debris height and distribution.
<b>ROV-D</b> Deposit debris detection	<ul style="list-style-type: none"> <li>• CdTe semiconductor detector</li> <li>• Improved mini B10 detector</li> </ul>	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.
<b>ROV-E</b> Deposit sampling	<ul style="list-style-type: none"> <li>• Suction sampling device</li> </ul>	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.

