Overview of IRID R&D for fuel debris retrieval technologies at Fukushima-Daiichi

20th Feb. 2020

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Outline of IRID

1. Name

International Research Institute for Nuclear Decommissioning (IRID)

http://www.irid.or.jp/en/

2. Date of Establishment

August 1, 2013

3. Membership (18 organizations)

2 Research Institutes

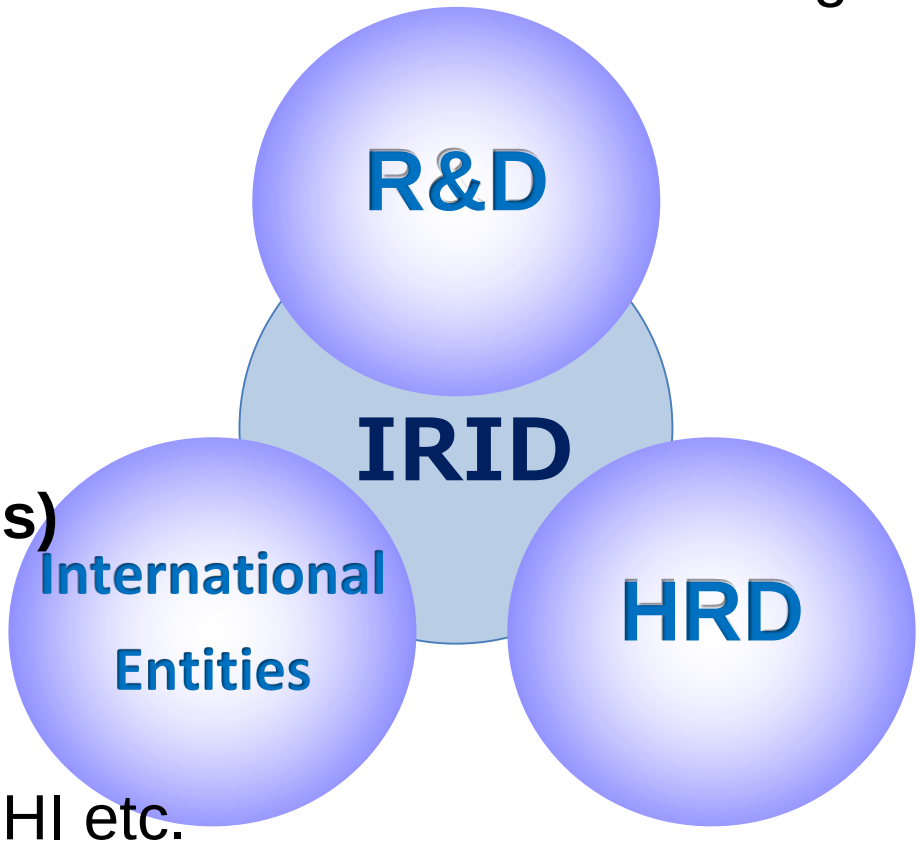
JAEA etc.

4 Manufacturers

ToshibaESS, Hitachi-GE,MHI etc.

12 Electric Utilities, etc.

TEPCO Holdings etc.



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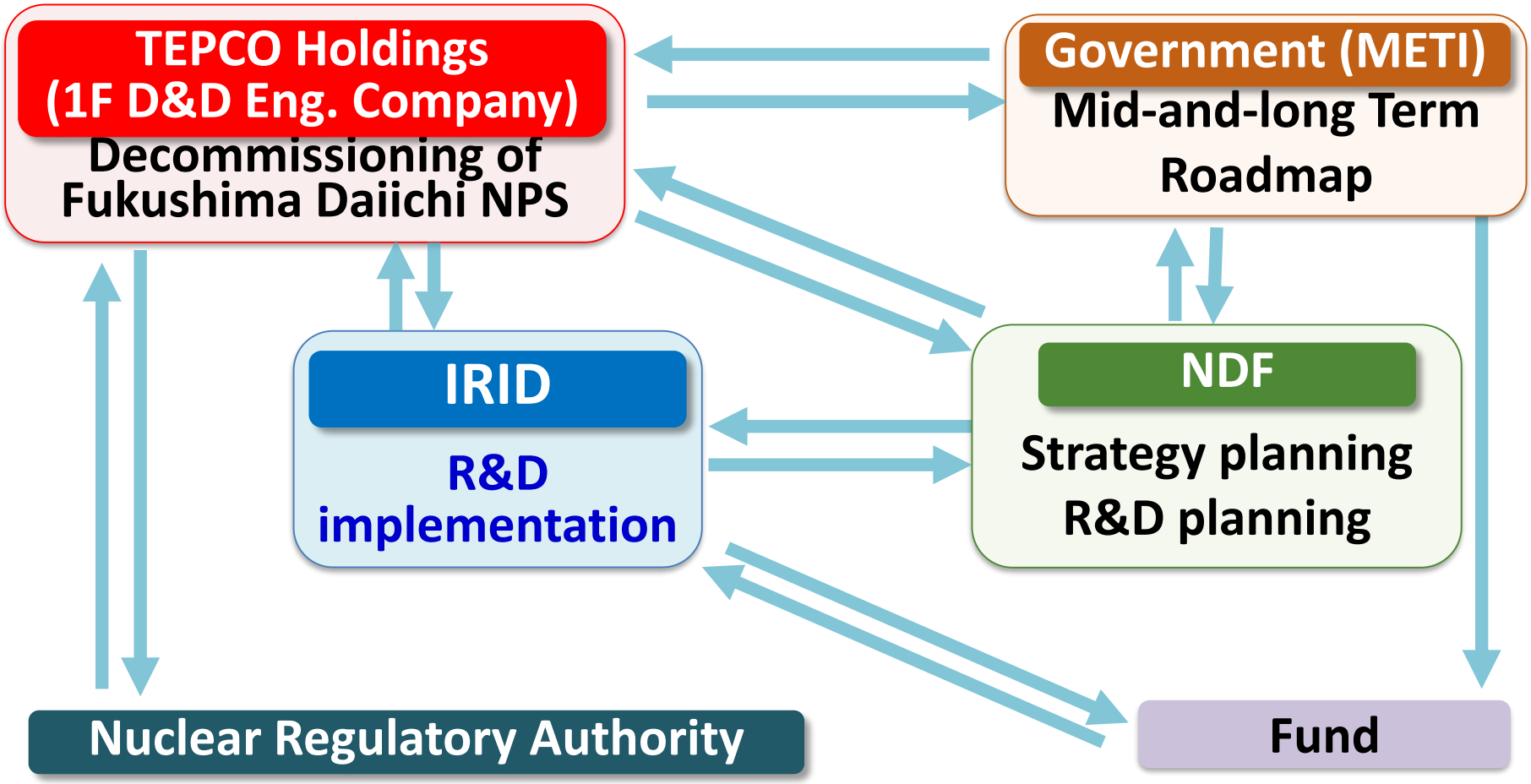
Role of IRID

R&D for decommissioning of the Fukushima Daiichi NPS, with a view to strengthening the foundation of nuclear decommissioning technologies.



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1 .R&D for Fuel Removal from Spent Fuel Pool

Evaluation on Long-term Integrity of the Fuel Assemblies Removed from Spent Fuel Pool — Completed in March 2016

2 . R&D for Fuel Debris Retrieval

Technology for Decontamination and Dose Reduction

Remote-operated Decontamination Technology in R/B

Completed in March 2016

Fuel Debris Retrieval Technology

<Ensuring Stability>

Corrosion Control Technology in RPV/PCV — Completed in March 2017

Seismic Resistance Assessment for RPV/PCV — Completed in March 2018

Criticality Control Technology for Fuel Debris Retrieval — Completed in March 2019

Fundamental Technologies For Retrieving Fuel Debris and Internal Structures — Completed in March 2019

<Fuel Debris Retrieval>

Fundamental Technologies for **Small Neutron Detector** — Completed in September, 2018

Technology for Environmental Improvement

Repair/Water Stoppage Technology For PCV Leakage — Completed in March 2018

Water Circulation Technology for PCV

Full-scale test of Repair Technology for PCV Leakage — Completed in March 2018

Full-scale Test For PCV Water Circulation Technology

Internal Investigation/Analysis Technology

<Indirect Investigation>

Fuel Debris Detection Technology For RPV — Completed in July, 2016

Upgrading For **Identifying Conditions Insides the reactor** — Completed in March, 2018

<Direct Investigation>

Investigation Technology For inside PCV — Completed in March, 2018

Technology for **Detailed Investigation Of inside PCV**

Investigation Technology For Inside RPV

Fuel Debris **Sampling** Technology

Characterization And Analysis of Fuel Debris — Completed in March 2019

On-site Verification Through **X-6 Penetration**

On-site Verification of **Deposits**

Development of Technology For Retrieving Fuel Debris/ Reactor Internals

Dust Collection System for Retrieving Fuel Debris and Reactor Internals

Technology for **Collection, Transfer And Storage** of Fuel Debris

3 .R&D for Radioactive Waste

Technology for **Proceeding Process Methods** of Radioactive Waste

Technology for **Treatment and Disposal** of Solid Radioactive Waste

Completed in March 2019

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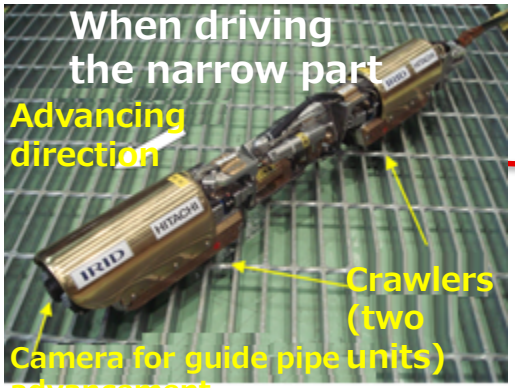
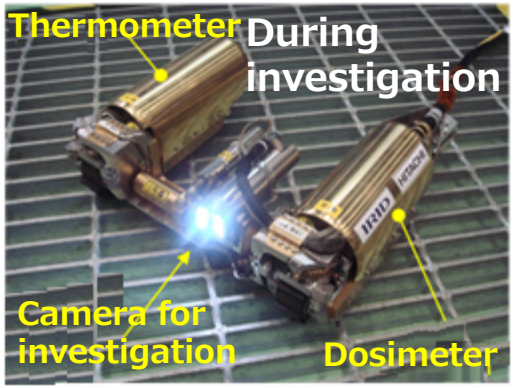
Investigation of inside PCV by using Robots

Investigation of outside the pedestal (Unit 1)

○Shape-changing robot (B1,B2 investigation)



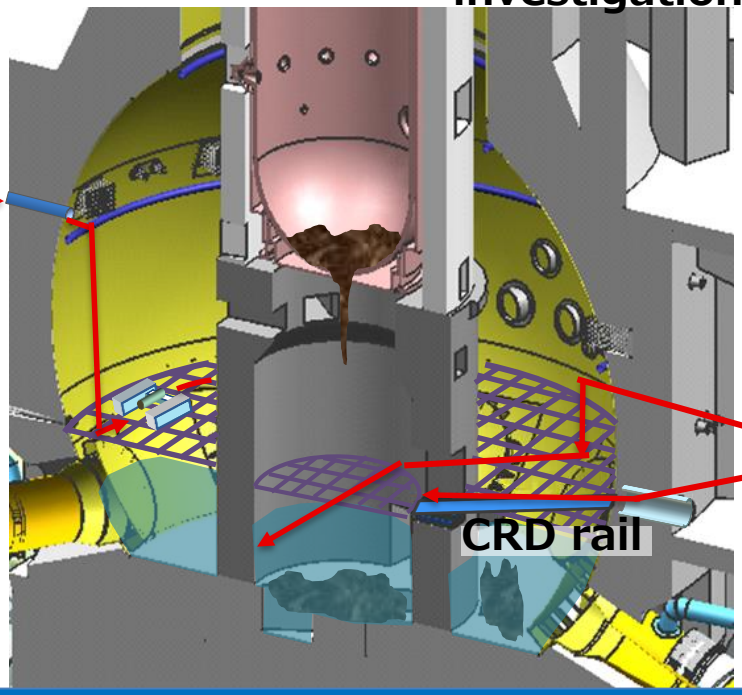
Shape changing

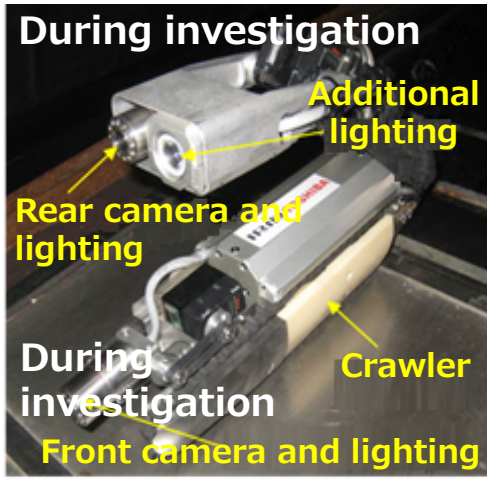


(Note) The robot for B1 investigation is shown in the above photos

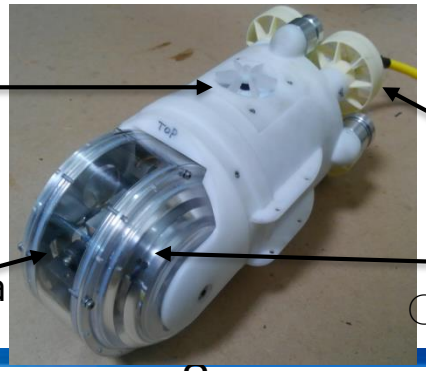
Investigation of inside the pedestal (Unit 2)

○Remotely operated crawler robot for investigation (A2 investigation)





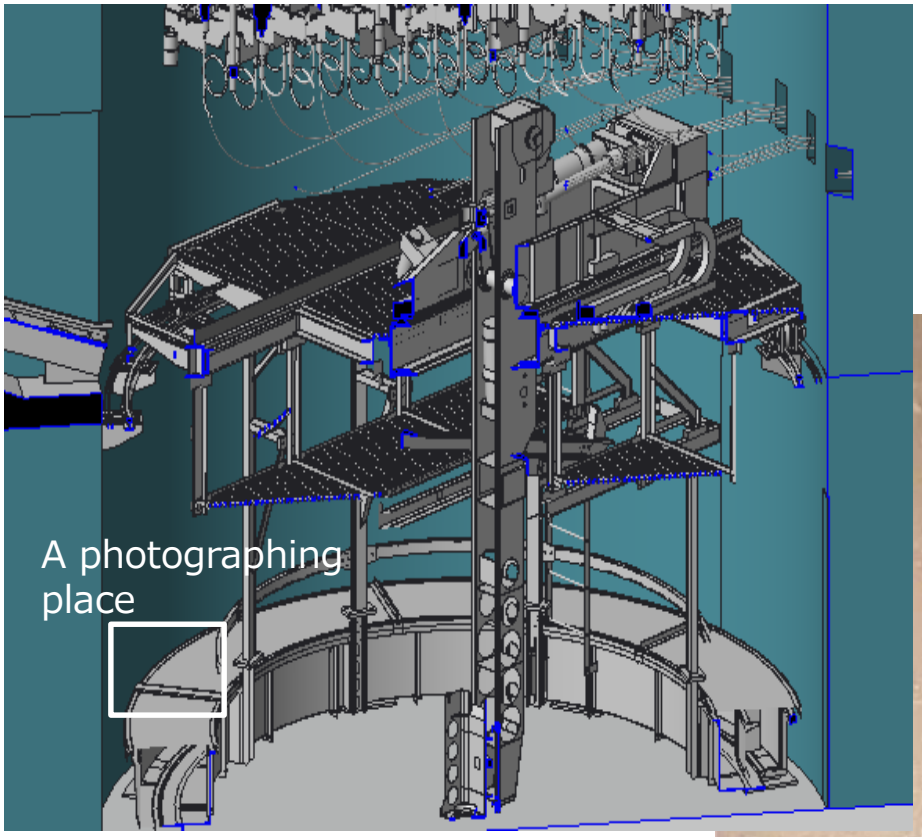
Investigation of inside the pedestal (Unit 3)



○Submersible Crawling Robot

○Hanging camera on extension rod

Unit 2 investigation: Pedestal Floor



Bottom of the Unit 2 PCV
(An overhead image)

Pedestal floor and wall
Fuel debris? and a fuel assembly handle

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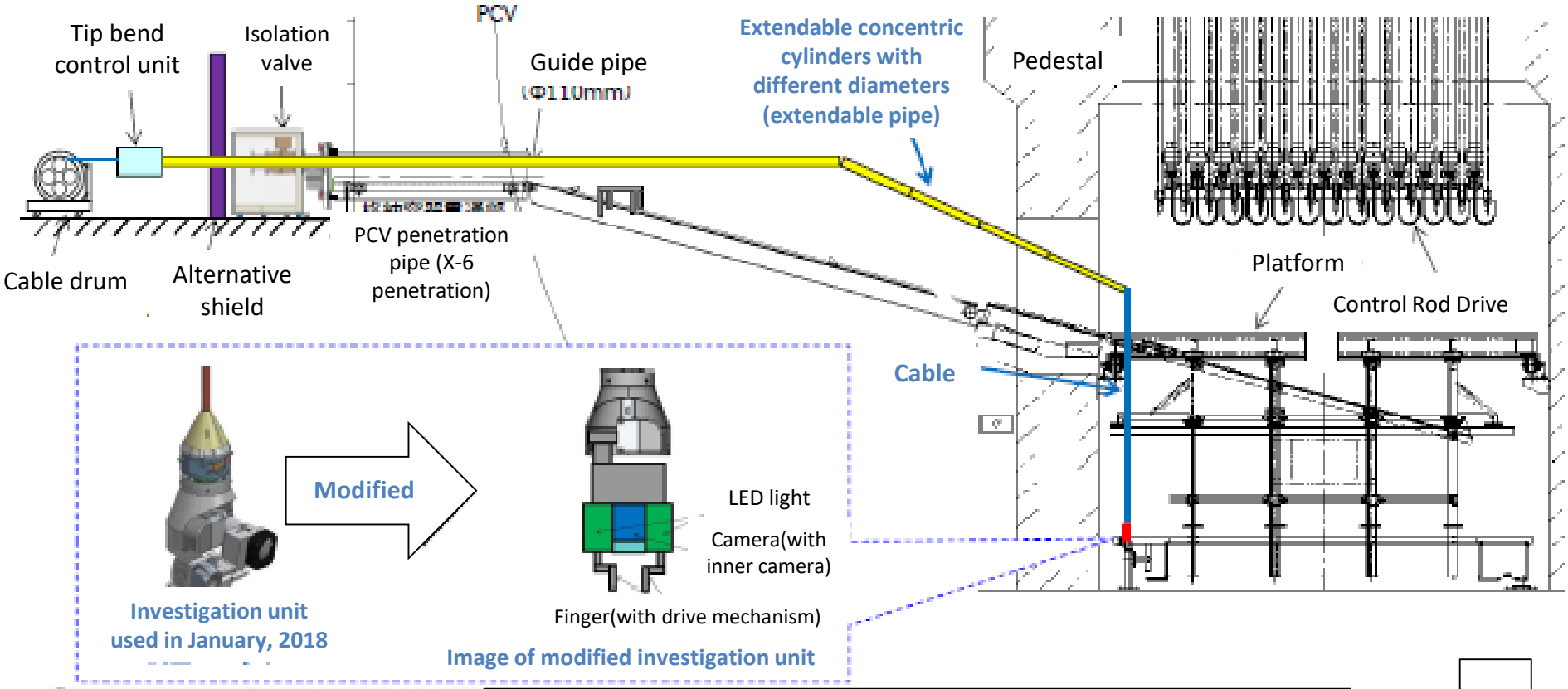
Contact with Deposits (Unit 2)

Investigation date: Feb.13, 2019

- **The properties of the deposits (hardness and fragility, etc.) that were observed on the bottom of the pedestal in Unit 2 were unknown, therefore it is important to understand the mobility beforehand.**
- **It is considered that the investigation unit used in January, 2018, will be modified, and the mechanical force will be added to the deposits to observe the behavior of the deposits.**



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Concept diagram of Unit 2 PCV internal investigation using the guide pipe

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Contact with Deposits (Unit 2)

Investigation date: Feb.13, 2019

The investigation report is provided by Tokyo Electric Power Company (TEPCO) Holdings, Inc.

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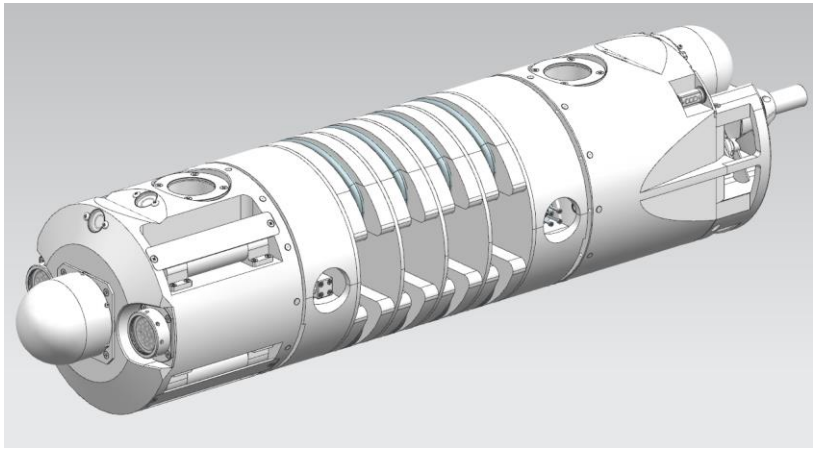
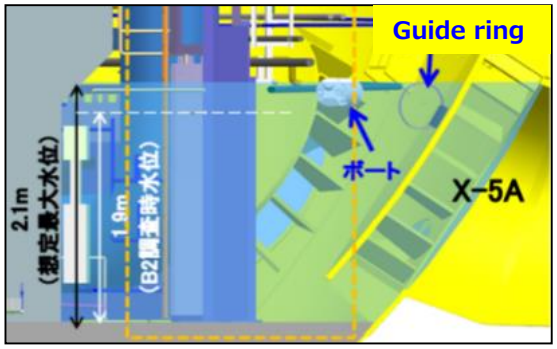
Boat Type Access Device

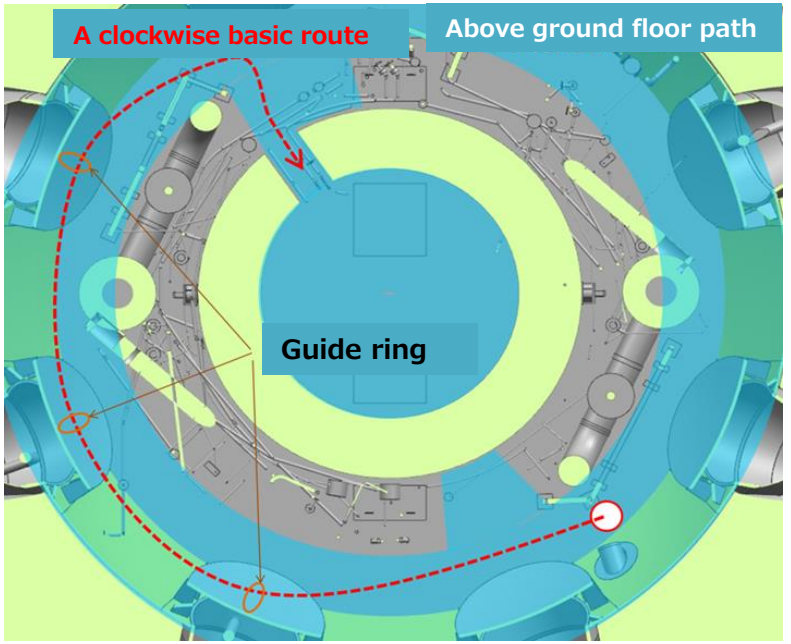
- A boat type access device has been developed, which can move on a wide range of the water surface in the primary containment vessel (PCV).



Example: Guide ring installation
- Diameter: φ25cm
- Length: Approx. 1.1m
- Thrust: Over 25N

Appearance of the boat type access device





Operation line of the device

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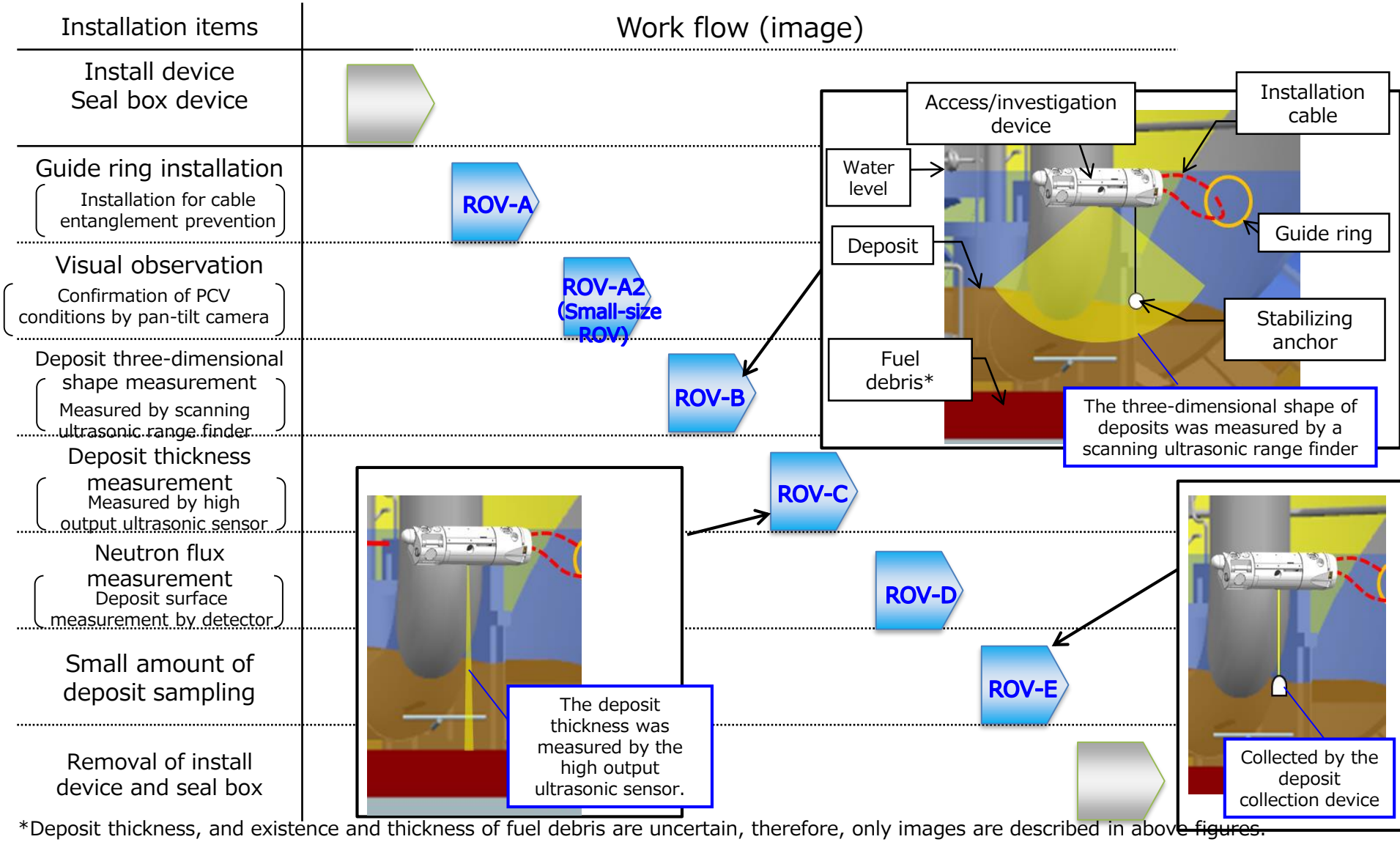
Unit 1 : Boat Type Access Device

- The 6-kind of boat type access/investigation device with submersible function will be prepared.



*Deposit thickness, and existence and thickness of fuel debris are uncertain, therefore, only images are described in above figures.

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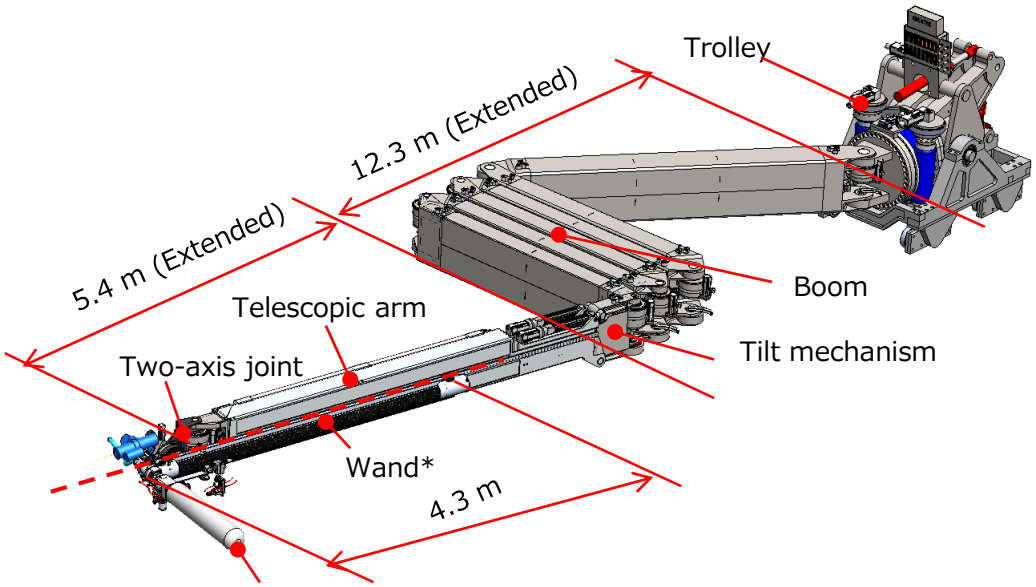
Arm Type Access Device

- An arm type access device has been produced, which can access on a wide range through the penetration of the primary containment vessel (X-6 penetration) for control rods maintenance.
  - Total length of the arm: Approx. 22m
  - An investigation device up to 10kg can be loaded.



Arm type access device

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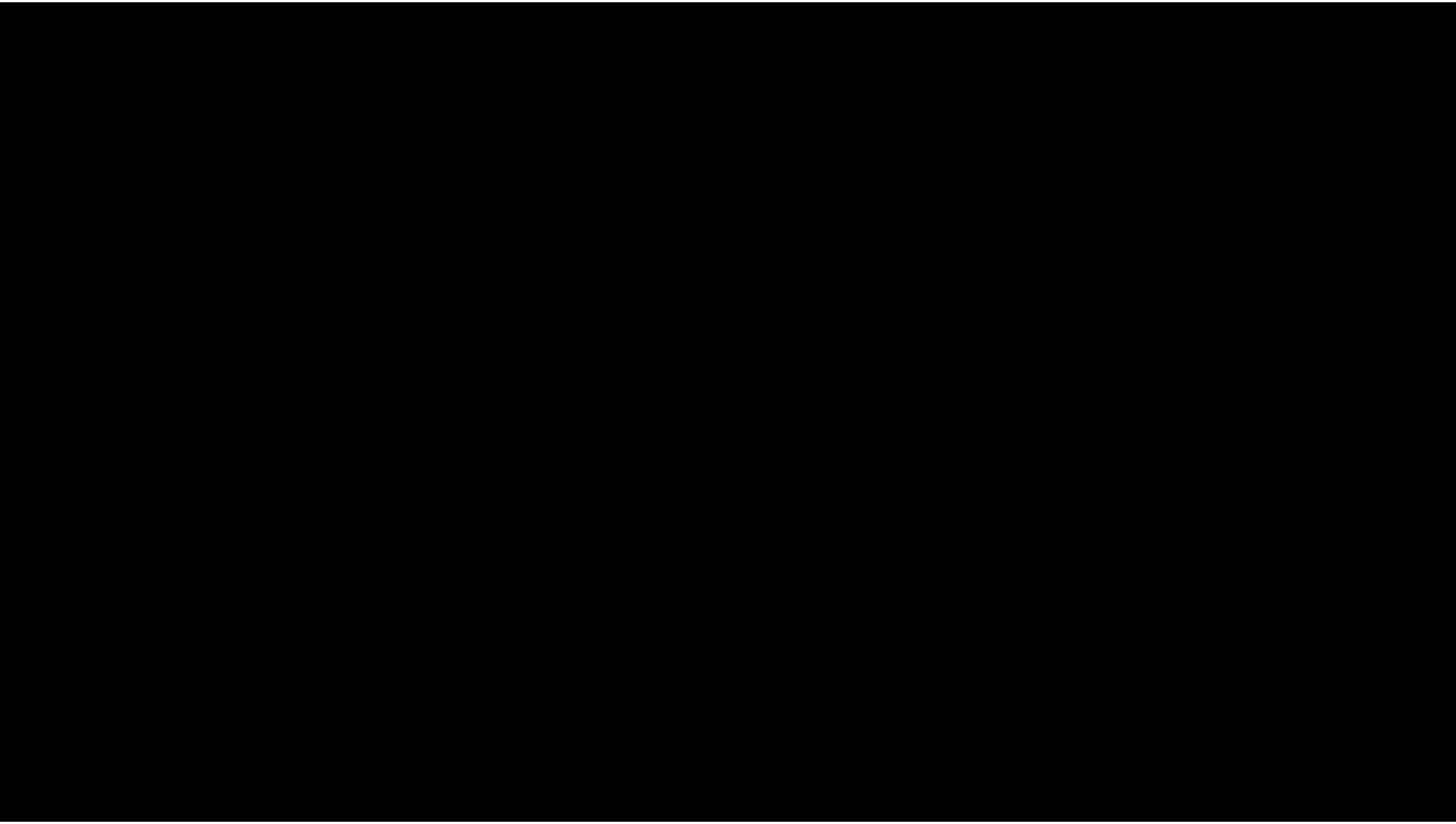
Arm Type Access Device (image video)



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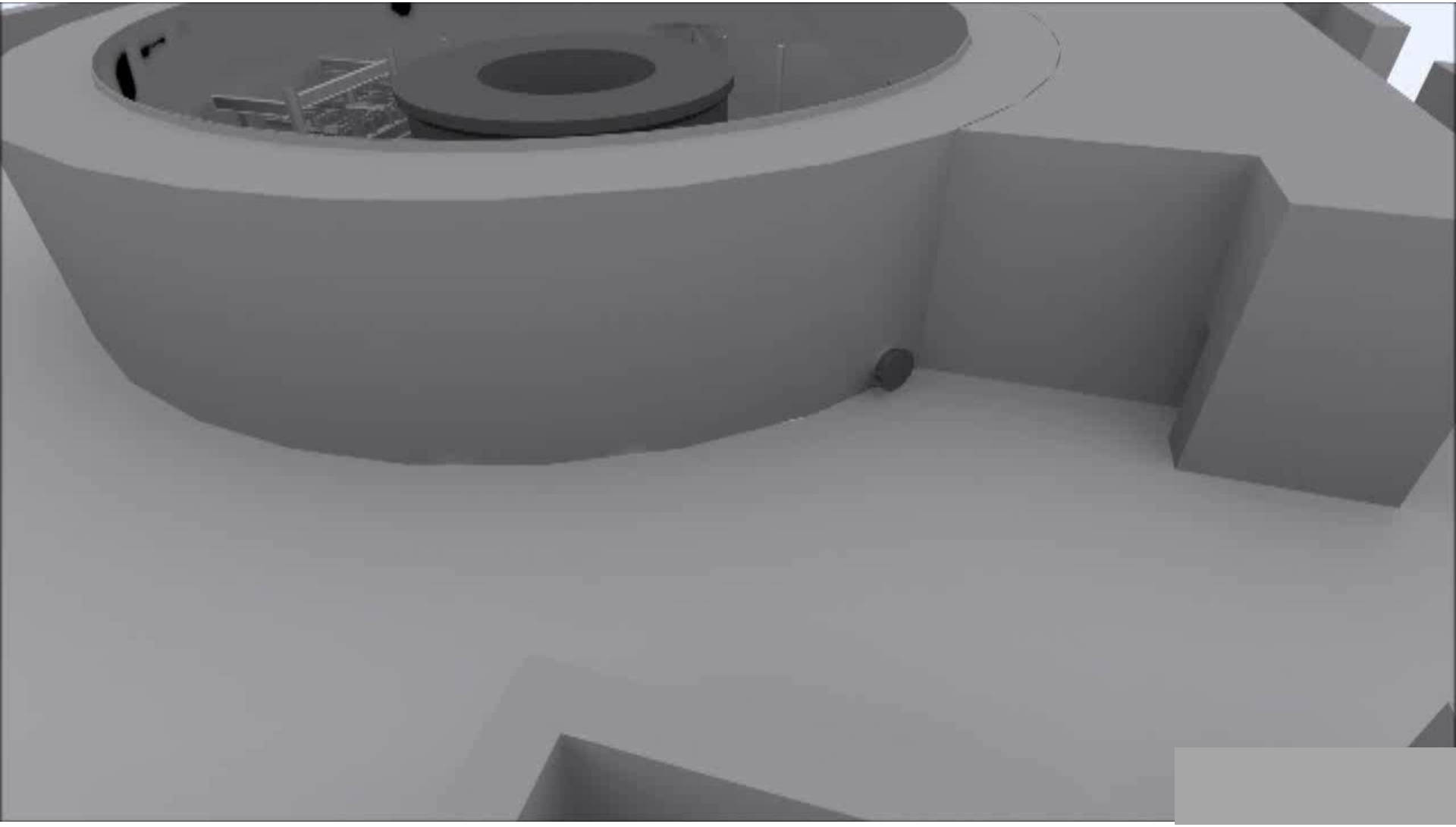
Fuel Debris Retrieval Technology (example)



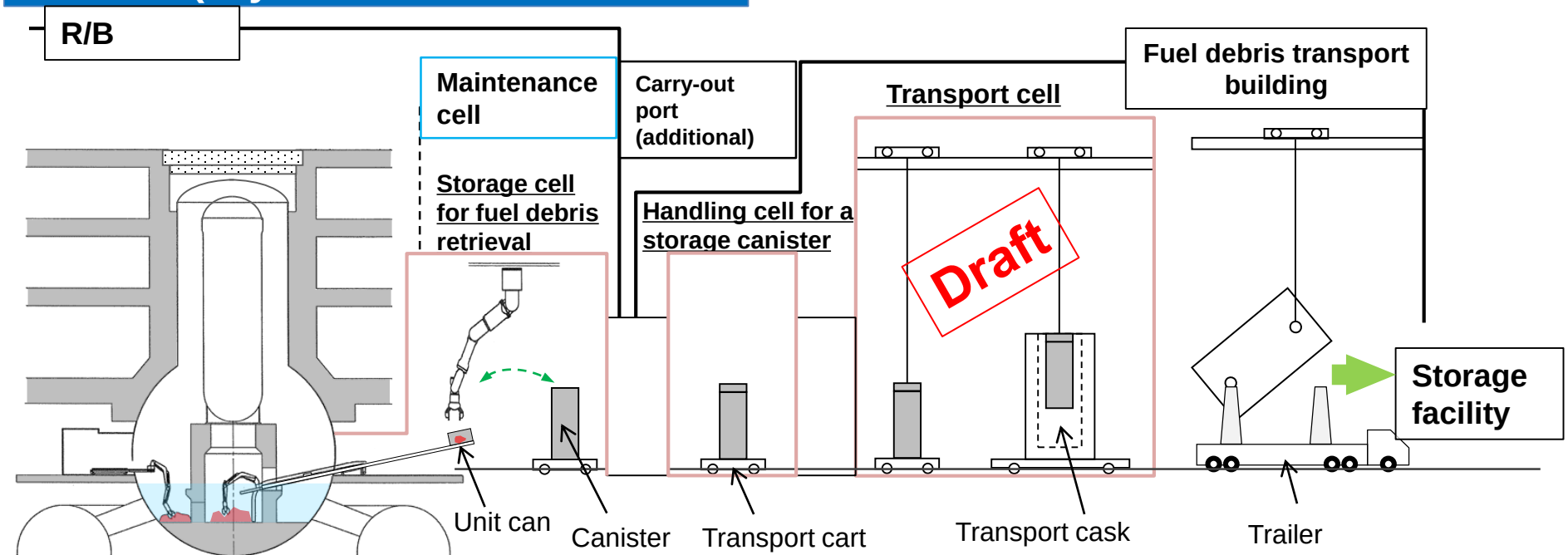
Collection, Transfer and Storage of Fuel Debris

Canister design

⇒Response to 1F specific requirements

- High fuel exposure and enrichment → high reactivity
- MCCI → hydrogen generation caused by core concrete interaction
- Injecting sea water, melting cable → effects caused by salt and impurities

Transfer (Dry –side access method)



Fuel debris retrieval → Storing in canister → Washing a canister → Storing canister in a transport cask → Carrying out a transport cask

End of presentation