

Feasibility study project of cutting fuel debris and dust collection technologies for Innovative Approach <Taisei Corporation>

Purpose and Goal

The purpose of this project is to develop of remote long boring technique for fuel debris retrieval to support Innovative Approach for fuel debris retrieval.

The target is concept and feasibility study of newly developed robot boring machine and new diamond bit with new design which cut the fuel debris expected to have high hardness and vary in the properties from the operation floor level and dust, cooling water and boring cuttings collection & storage equipment.

Based on this study, specific development plan would be designed.

Application of boring technique proved in TMI -2, this development would establish state-of-the-art boring technique with safety, efficiency and reliability.

Overview and Feature

Remote robot boring machine

- Boring pedestal from one opening on operation floor with tilt and swing.
- Rod bolster structure to support rod in 35m space.
- New developed auto rod & auto bit connection, exchange mechanism.
- Complete remote control including automatic. Self travelling by crawler.
- Available of multipurpose boring such as rotary percussion etc.

Diamond bit, Drilling tools

- Applicable for diverse property of debris by PDC, surface, impregnated bit.
- New design special bit form, diamond and matrix.
- Non core bit with high certainty in boring, core bit for sampling.
- Drilling tools for fuel debris core sampling.

Dust, fuel debris cuttings collection & storage equipment

- Infinitesimal dust with water boring, auxiliary dust suppression system.
- New design suction & delivery equipment in reference to TMI-2.
- Collection equipment with separator for small fuel debris canister of 1F.

Auxiliary system for remote operation

- Photogrammetric measurement system for fuel debris dimension and form.
- Remote dose monitoring system for boring work place.
- Safety & facilitation of remote operation promoted by auxiliary system.

Focusing point, strong field

KOKEN 地球に
する会社。

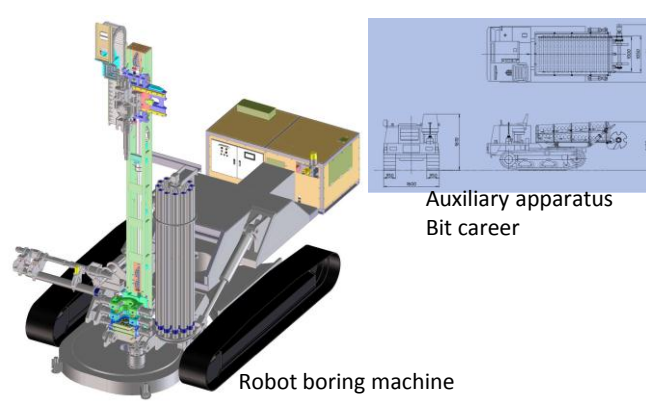
MAIKAI

- Organization includes top boring maker of KOKEN and Christensen.
- Efficient and effective development with world-class technology.

Outcome obtained

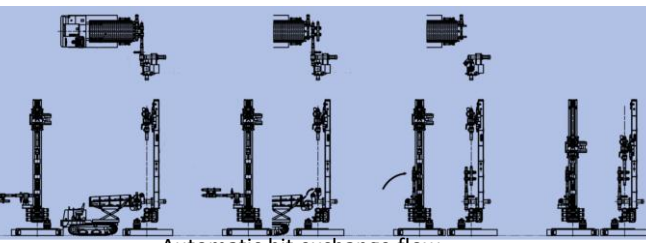
Robot boring machine

- Concept of robot boring machine
- Structure of individual parts
- Specification of boring machine
- Basic calculation of boring machine
- Support structure of rod, tip fixture
- Rod size specification, shape
- Automatic rod connection procedure
- Automatic bit exchange procedure
- Specification of bit career
- Automatic control flow of machine
- Control, oil and electricity system
- Countermeasures for long boring
- Concept of test stage & elevator
- Assembling, layout, preparation
- Check plan of robot boring machine



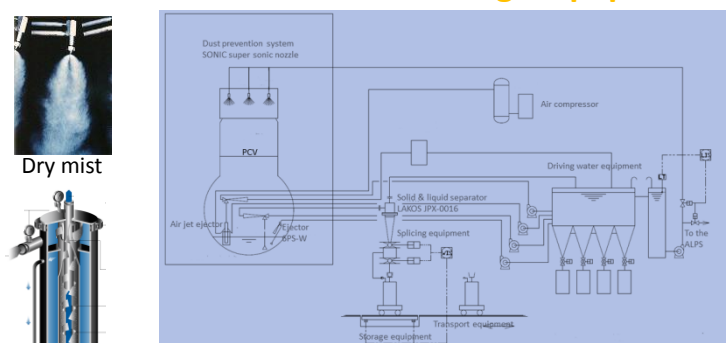
Auxiliary apparatus
Bit career

Robot boring machine



Automatic bit exchange flow

Fuel debris collection & storage equipment



Dry mist

Dust, fuel debris collection and storage system flow

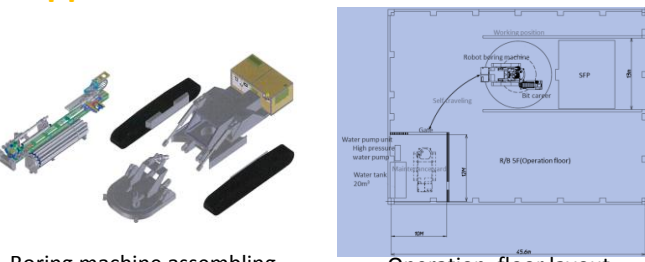
- Concept of dust suppression equipment
- Concept of collection & storage equipment
- Fuel debris collection & storage system flow

Separator

Ejector

Disk pump

Application to the site



Boring machine assembling

Operation floor layout

Development schedule, cost

- Development schedule & cost study
- 2-years development in the shortest
- 4-years development considering leveling

Development schedule

Item / Year	FY1 (2015)	FY2 (2016)	FY3 (2017)	FY4 (2018)	FY5 (2019)	FY6(2020)
Robot boring Machine	Detailed design	Prototype production test	Operation test	Prototype development (improvement)	Demonstration test (20m)	Comprehensive test
Bit & Drilling tools	Debris test piece design & manufacture	Debris test piece manufacture	Debris test piece manufacture	Debris test piece manufacture	Debris test piece manufacture	Application
Fuel debris collection & storage	Storage equipment basic design	Storage equipment detailed design	Storage equipment prototype	Demonstration test	Actual development	Application
Photogrammetric measurement	Photo device basic design	Photo device detailed design test	Photo device prototype	Demonstration test	Actual development	Application
Dose monitoring	Monitoring device design test	Monitoring device manufacture	Monitoring device test	Demonstration test	Actual development	Application
Major Achievements	Debris test piece design, manufacture	Debris test piece manufacture	Storage equipment prototype	Storage equipment detailed design	Storage equipment manufacture	Storage equipment demonstration

Diamond bit

Noncore bit 95 mm

- Large cuttings (6 Blade)
- Fixture (Concave shape) Shell (inner)
- Fixture (Concave shape) Shell (outer)
- Fixture (Concave shape) Shell (outer)

Core bit 95 x 57 mm

- PDC + metal hybrid Shell (inner)
- Same shape as TMI-2 Shell (inner)
- Stability (Convex shape) Shell (inner)
- Fixture, Stability Shell (inner)

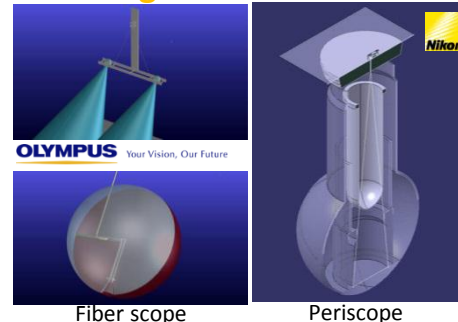
Principle: Shearing, Fracture

Principle: Grinding

New design diamond bit (partial)

Photogrammetric measurement

- Photographing device
- Lighting equipment
- Resolution confirmation
- Applicability of technique

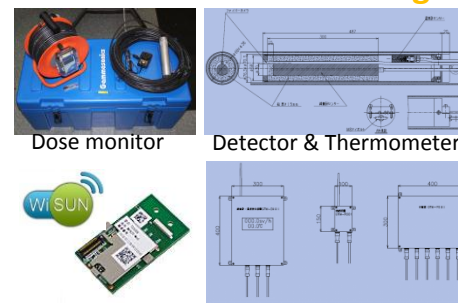


Fiber scope

Periscope

Remote dose monitoring

- System concept
- High dose detector
- Wireless com device
- Thermometer



Dose monitor

Detector & Thermometer

Wireless communication device

Challenges and Issues in the future

- Design, prototyping and operation confirmation
- Demonstration of 35m space bring
- Interface with method
- Auxiliary equipment design & system
- Slurry drain route from pedestal to 5F
- Antecedent real demonstration (core sampling)