



Yes, it's possible ! 不可能を可能に !

# ~ Toward the Decommissioning of Fukushima Daiichi Nuclear Power Station ~

## The activities of ABLE Co., Ltd.

**ABLE Co., Ltd.**

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Futaba-gun, Fukushima-ken

TEL 0240-25-8996

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<https://www.abe-can.jp>

Corporate Name	ABLE Co., Ltd
Location	Fukushima-ken, Futaba-gun, Hirono-machi, Kamikitasako, Iwasawa 1-9
	Head Office Function : Hirono Office/Factory
	Bases : Kashiwazaki Office, Hamaoka Office, Kobe Service Office, Tokyo Service Office, Iwaki Service Office
	Head Office: Fukushima-ken, Futaba-gun, Okuma -machi, Ottozawa, Chuodai 551-6
Foundation	March 14th, 1991
Founder	Yukihide Sato (Actual Executive Director)

## <Company Histor>

- 1991 **Founding** of ABLE Construction at Fukushima-ken, Futaba-gun, **Tomioka-machi**
- 1995 Changing of corporate name to ABLE Co., Ltd.
- 1997 **Relocating** of Head Office to Fukushima-ken, Futaba-gun, **Okuma-machi** and Setting up of Kashiwazaki Office
- 2004 Setting-up of Tokyo Service Office
- 2011 Relocating of Office, due to Great East Japan Earthquake
- 2012 **Relocating of Head Office Function and Factory to Hirono-machi**
- 2013 Setting-up of Iwaki Service Office

## Before the Great East Japan Earthquake

Business mainly for nuclear power stations **as a subcontractor** to TEPCO its affiliated companies, manufacturers of nuclear reactors and civil construction companies.

*Engaged in inspection of reactor internals, CRD, emergency generators, and construction work as well as maintenance work for NPPS of Higashidori, Oma and others nuclear power stations.  
Active work for Rokkasho-mura reprocessing plant.*



*Offering Solution-oriented type business, by being familiar with the field work for prime contractors.*



## March 11th, 2011, Disaster of Great East Japan Earthquake

*Since then, facing a big change*

Devoted to settle the chaos on 1F site under serious difficulties, as a local company which suffered from the disasters as well  
(Participated in almost all major projects as a subcontractor)

Immediately after the Earthquake Disaster

### 1. Ensuring power supply

- Carrying-in of batteries for instrumentations in the main control room (diversion of cars and from J-village)
- Cabling for restoration of main power supply
- Refueling of temporary generators under high-dose environment

➡ **Work continued for 24 hours without a break, and without eating or drinking**



## Immediately after the Earthquake Disaster

### 2. Cooling of spent fuel pool, etc.

(Prime contractor: Tokyo Power Technology Ltd.)

*Operation of mobile concrete pumps with arms of length 62 m, with the nicknames “Giraffe” and “Zebraa”*

### 3. Installation work of 1F flocculation and precipitation facilities (AREVA)

(Prime contractor: Tokyo Energy & System Inc.)

Fabrication, transportation and field-laying work for piping in system operating 24 hours a day



## Immediately after the Earthquake Disaster



4. Installation of cooling water circulation system piping  
(Prime contractor: Tokyo Power Technology Ltd., Tokyo Energy & System Inc.)
5. Electrical work for spent fuel pool cooling system  
(Prime contractor: Kajima Corporation)
6. Transportation and treatment of retained water  
(Prime contractor: Tokyo Power Technology Ltd., Tokyo Energy & System Inc.)



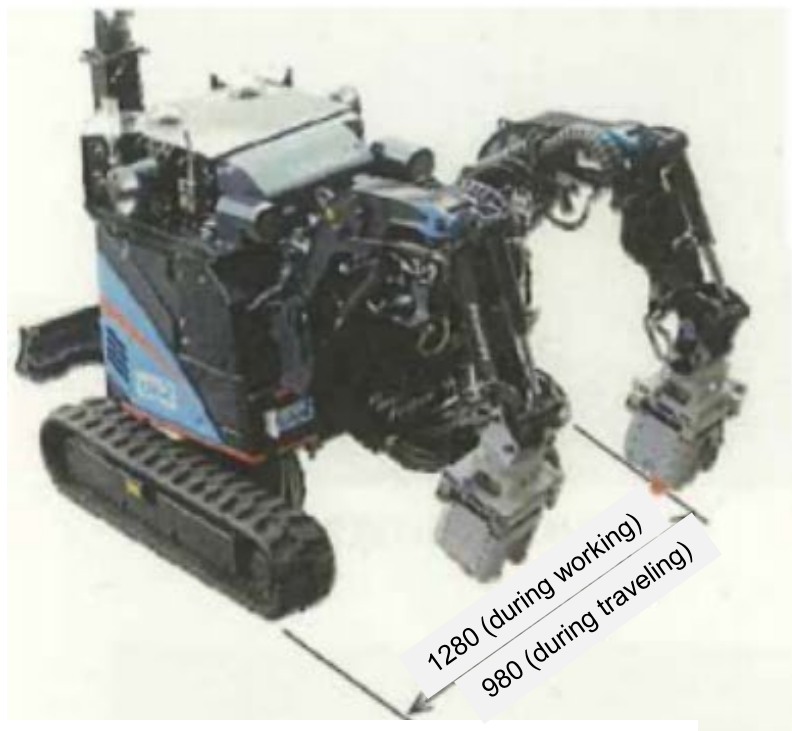
## Immediately after the Earthquake Disaster



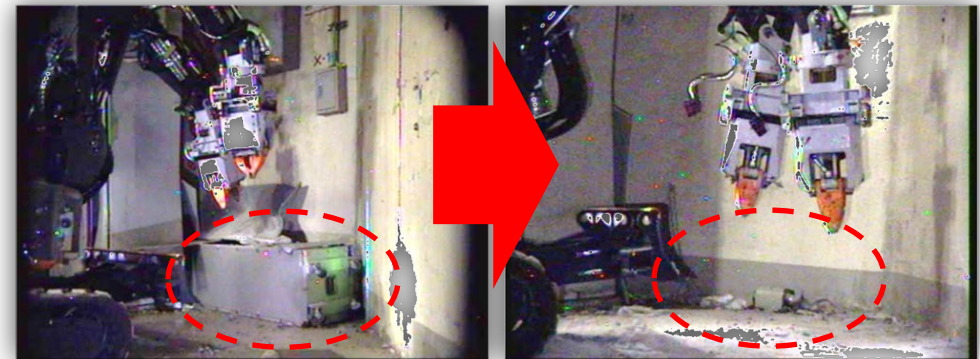
### 7. Debris removal using double-arm heavy machinery type robot – operation of robot

(Prime contractor: Hitachi, Ltd.)

#### Main specification of double-arm robot



“Robot manufactured by Hitachi, Ltd.”



Before removal

After removal



## Immediately after the Earthquake Disaster



### 8. ALPS (Advanced Liquid Processing System)

Operation and maintenance work

(Prime contractor: Toshiba Corporation)

#### ALPS (Advanced Liquid Processing System)

Installation state of the system

Date of photograph: Sept. 16<sup>th</sup>, 2012



#### Adsorption Tower (Processing column)

Date of photograph: Mar. 27<sup>th</sup>, 2013

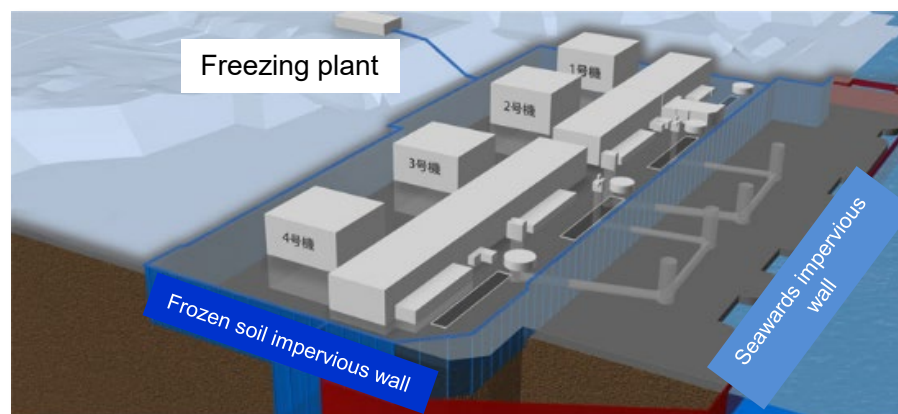


## Immediately after the Earthquake Disaster



### 9. Installation of temperature sensors in frozen soil wall

(Prime contractor: Kajima Corporation)



Layout plan of impervious wall of frozen soil



## Proposal and receipt of order for work utilizing remote control robots

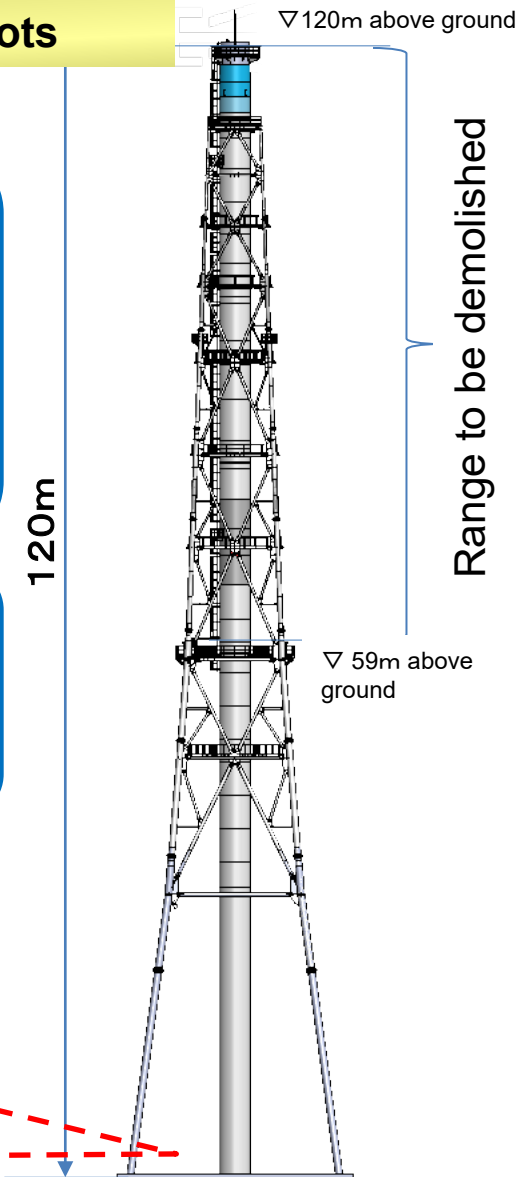
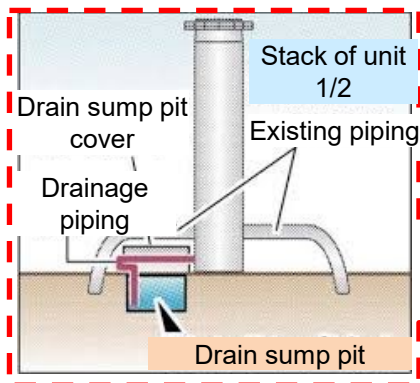
- (1) Drainage work on sump pits under stack of Unit 1/2 on 1F

Completion May 2016 ~ Mar. 2013

Since then, continuously received orders for drainage work and completed countermeasure works against inflow of rainwater

- (2) Demolition work on upper part of stack of Unit 1/2 of 1F

Oct. 2017 ~ Now in progress





### Reasons why our company could receive orders

- Local company in Fukushima-ken
- Speedy in decision-making, through taking advantage of small and medium-sized enterprises
- Short manufacturing schedule as well as cost reduction through combining off-the-shelf handy products and inspiring through the development
- Much of knowledge and insights on the sites, as a company active in this field for a long time and familiar with the existing structures
- Proposal for development and manufacture of robots, and working procedures making the best use of our knowledge and insights
- Enthusiasm and commitment to the reconstruction of our Fukushima

# Details of order received

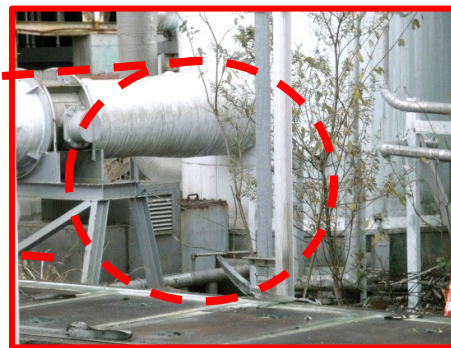
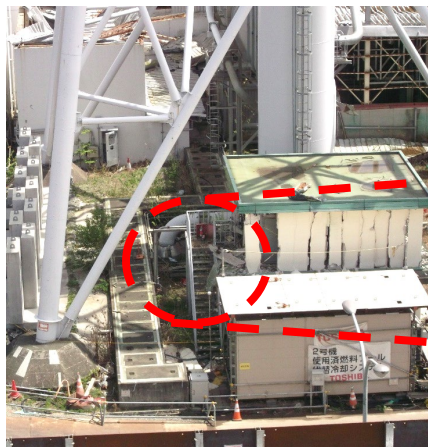
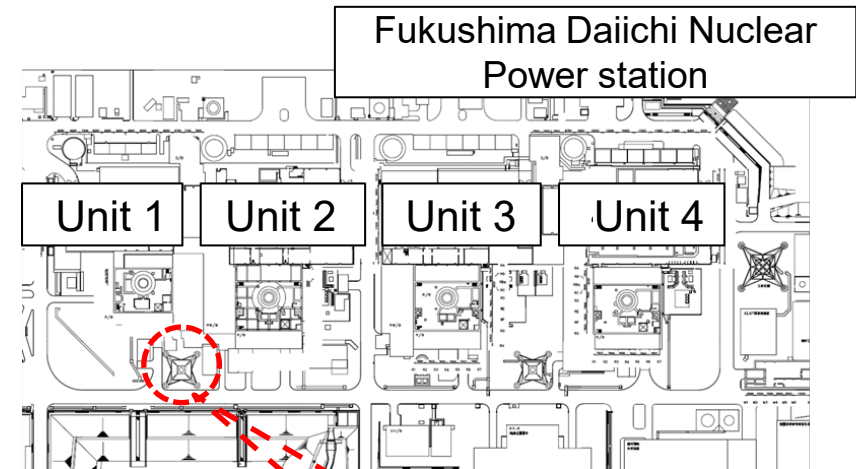
Yes, it's possible !  
不可能を可能に !

## (1) 1F-1W stack sump pit drainage work

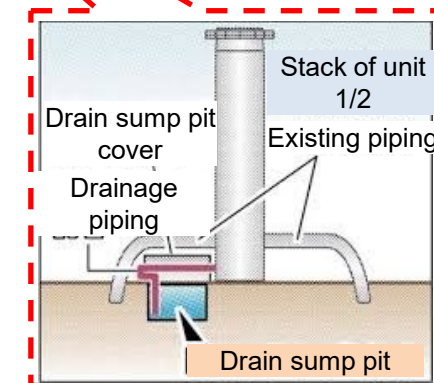
### Background of the proposal

In the stack of unit 1/ 2, rainwater passing through the stack, which was contaminated due to venting during the Earthquake Disaster, was retained in underground sump pits as contaminated water. Therefore, drainage of the contaminated water was in the urgent need.

But, as there was a high radiation dose at ground level around the stack, work by manpower was very difficult. Hence, we proposed to handle the drainage work utilizing a remote control robot, and the proposal was accepted and ordered



Situation of the drain sump pit



## (1) 1F - 1W stack sump pit drainage work

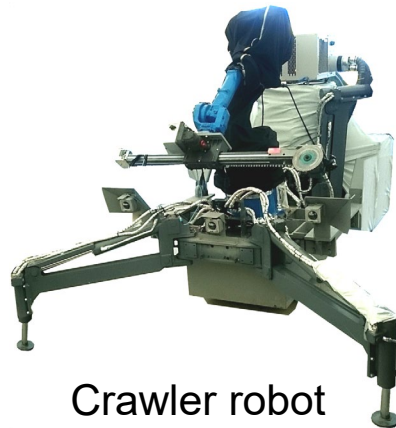
### Details:

- Collaboration of crawler robot and crane robot through remote control
- Carrying-in crawler robot near sump pits by hoist using a crane to avoid obstacles
- The 6-axis robot attached to the crawler robot, and a pivotable sub-crane 6-axis robot mounted at the tip of the crane, perform drainage work through remote control

The name of this robot is “Goddess”



**Development of crawler robot**



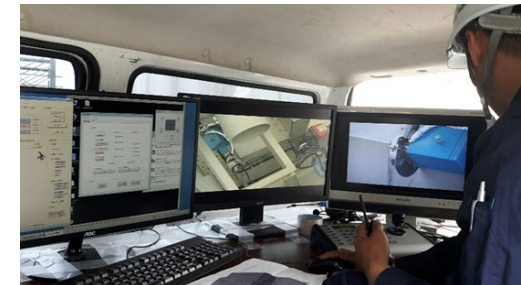
**Crawler robot**



**Crane robot**



**Development of crane robot**



**Views of monitoring by remote control**



# Details of order received

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## (1) 1F-1W stack sump pit drainage work

Start of the development

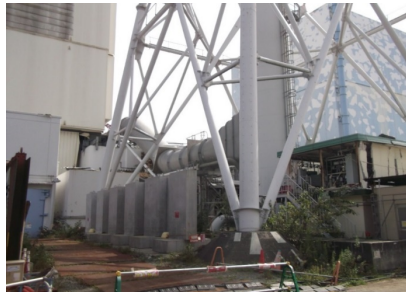
Essential to complete the field survey in a short time because of the high radiation level

ABLE

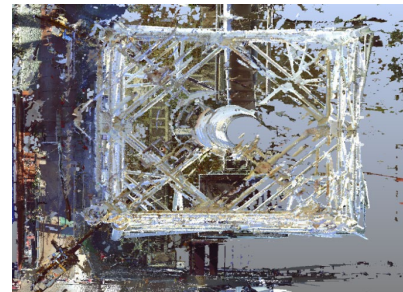
Field survey by 3D scanner



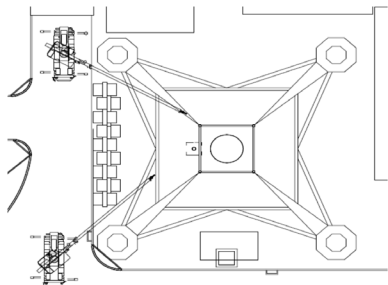
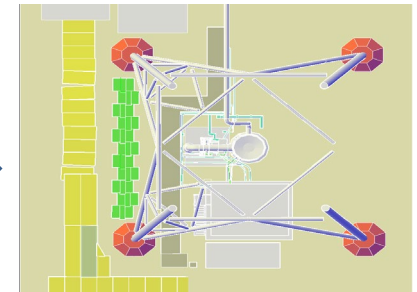
Data collection



Design by collected data



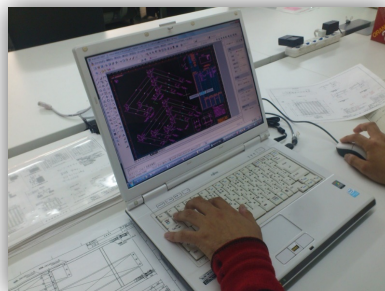
Reproduction of field using mock-up



Plan of stack of Unit 1/2



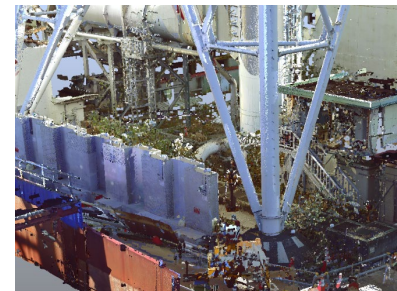
Photography of the field



Conversion to AUTO CAD on the desk



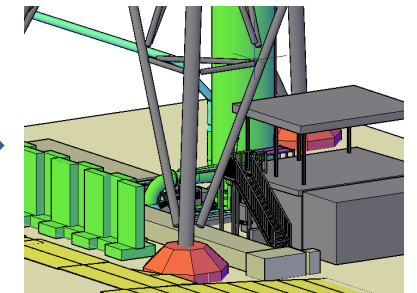
3 D scan point group data



3D scan point group data



Conversion to 3 D AUTO CAD



Conversion to 3D AUTO CAD



Development of work plan meeting the field conditions through converting scanned data to 3D CAD

# Details of order received

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## (1) 1F-1W stack sump pit drainage work

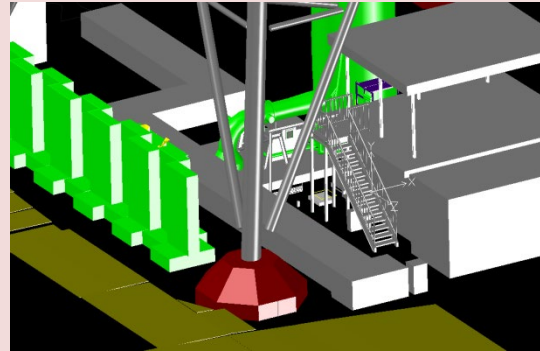
Start of development

Reproducing the field by a sophisticated mock-up based on 3D design data

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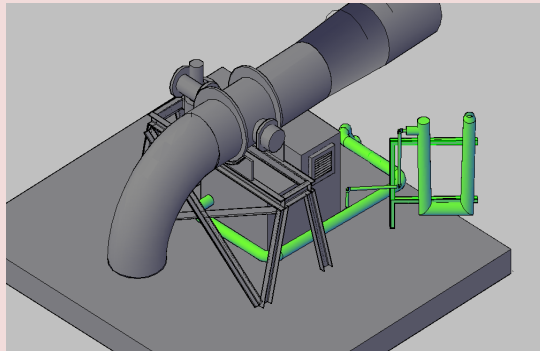
Photography of the field



Conversion to 3D  
AUTO CAD



Full-scale mock-up  
assembly



Confirmation of work schedule and training 15



# Details of order received

Yes, it's possible !  
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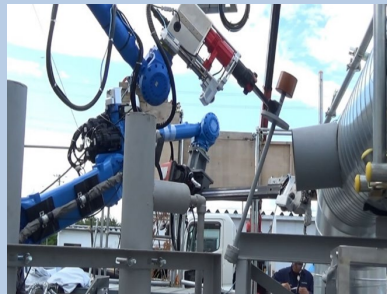
## (1) 1F-1W stack sump pit drainage work

### Starting of development

Scenes of training on remote-control using mock-up (left), and view of work in the field (right)



Training on cutting of pit cover



Training on installation of water gauge



Training on collaborative operation of crawler/crane robots



Training on remote-control



Cutting of pit cover



Installation of water gauge



Collaborative operation of crawler/crane robots

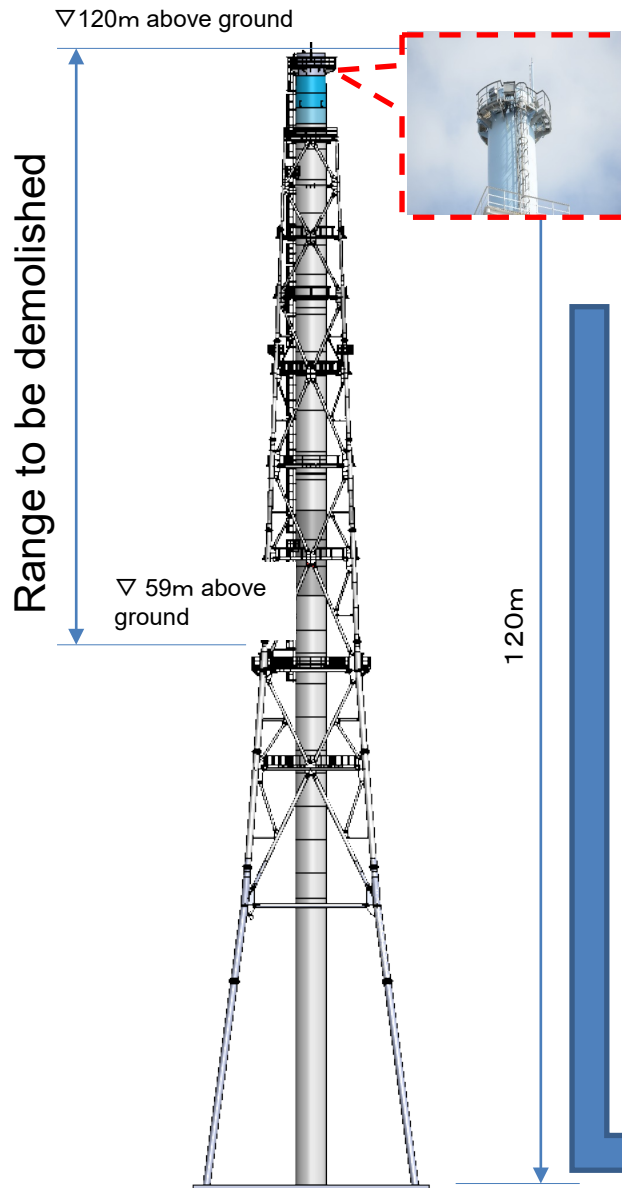


Remote control



# Details of order received

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## ② Demolition work on upper portion of stack of 1F – Unit 1/2

### Background

Fractures and deformation identified at the upper portion of the stack of 1F-Unit 1/2 caused by the Earthquake Disaster. Despite no risk of collapse, demolition of the stack was deemed to be necessary.

Due to the very high does rate close to the ground, human access impossible.

Thus remote handling using a large-scale crane equipped with remote control robots planned and proposed

Full-scale mock-up assembled for the purpose of verifying the performance of robots, the execution plan, etc., as well as operation and skill-up training of personnel.



## ② Demolition work on upper portion of stack of 1F-Unit 1/2

Start of development

Examination of operating range of 6-axis robot by means of 3D CAD

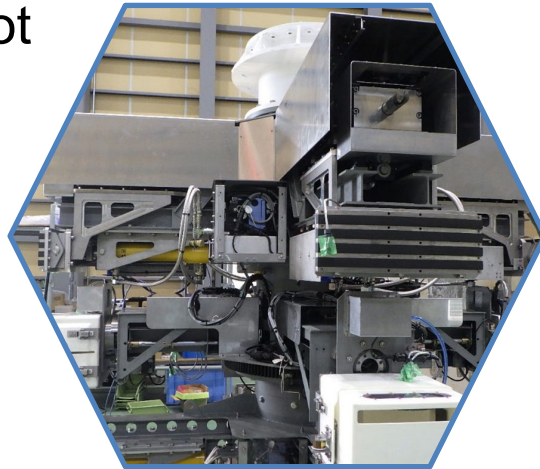


## ② Demolition work on upper portion of stack of 1F-Unit ½

Start of development

Actual scenes in robot  
development

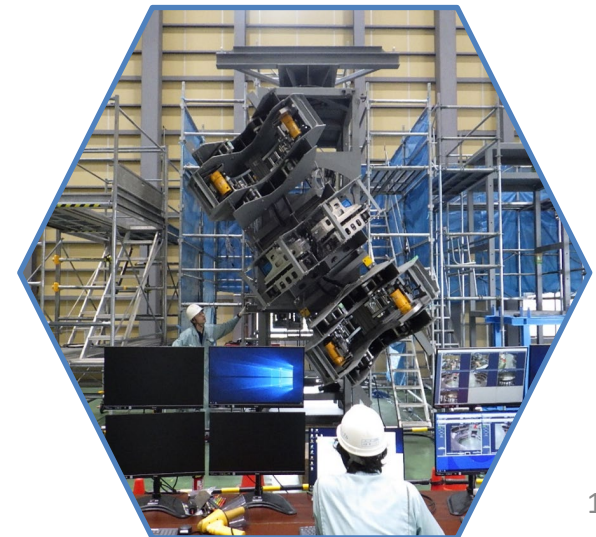
Stack shell  
cutting  
machine



Main  
member  
cutting  
device



Diagonal  
member  
cutting  
device





# Details of work

Yes, it's possible !  
不可能を可能に !

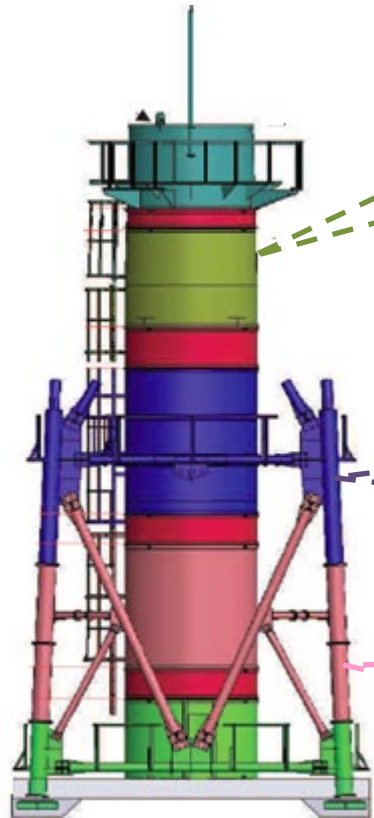
## ② Demolition work on upper portion of stack of 1F-Unit 1/2

How the actual work can be done

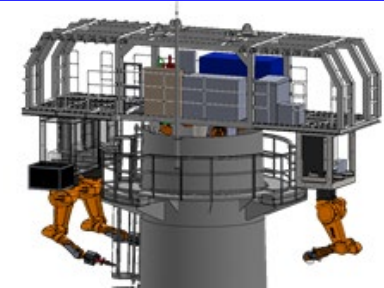
Demolition from the upper portion of the stack, making full use of 3 types of robot



Stack mock-up built on the premises of ABLE with the same size as the upper portion of the stack



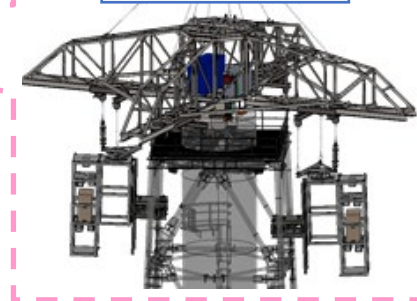
Stack shell demolition equipment



Main pillar cutting machine



Fabrication of diagonal member cutting machine



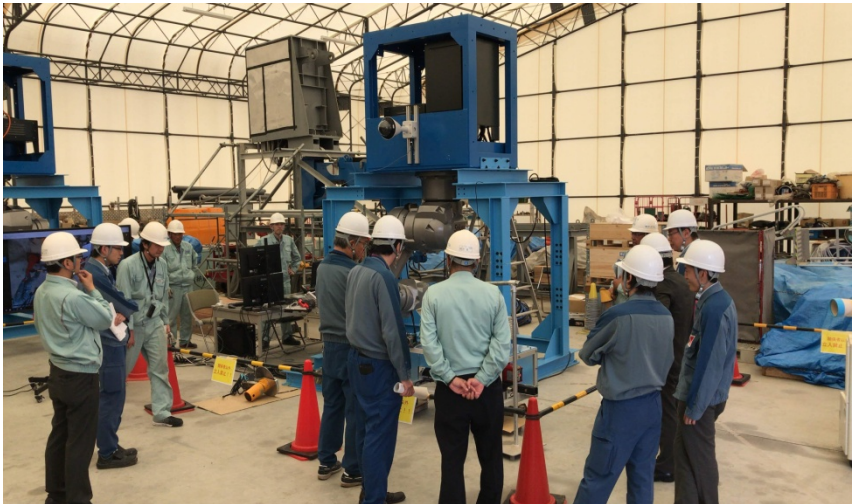
# Details of order received

Yes, it's possible!  
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## ② Demolition work on upper portion of stack of 1F-Unit 1/2

Collaborative work with TEPCO

View of examination



Development meeting



Prayer for safety @Naraha shrine





# Further development of disaster response robot toward decommissioning

Yes, it's possible!  
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ABA DEE



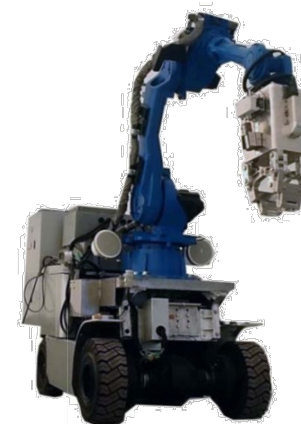
Debris removal robot - remote control work



•Development of underwater robot for investigating the state of water retained under the building, and execution of the work

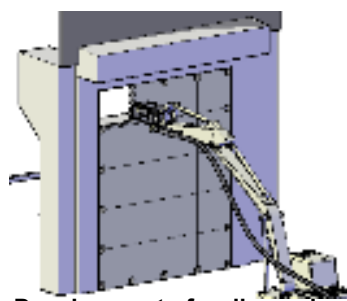


Development of rooftop protective layer removal robot, and execution of the work



Collaborative robot equipped with arm hand

## Realization



Development of wall opening robot, and execution of the work



Collaborative robot equipped with multi-attachments





≡ABLE≡

# 感謝祭

12月8日(土)

## のご案内

### 世界初の

遠隔解体装置など  
さまざまなロボットを  
展示いたします

## ロボットを見学

presented by  
こども  
ミュージアム  
プロジェクト

## お父さん応援企画

ロボットの遠隔操作車両にみんなの描いた絵やメッセージがラッピングされます

みんなの  
応援メッセージが  
バスになる

## 芋煮会

当日は芋煮をご用意いたしますので  
是非ご参加ください。





# Thank You for Your Attention!