


ARC'S D&D Experience Across the DOE Complex and Commercial Nuclear Sites

Interregional Workshop on Optimization of Technology Selection for Decommissioning of Large and Small Nuclear Installations
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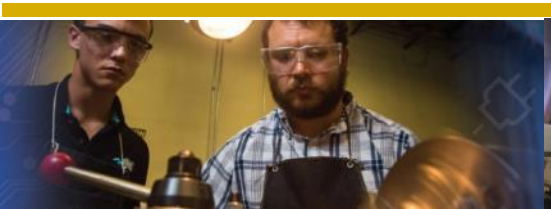
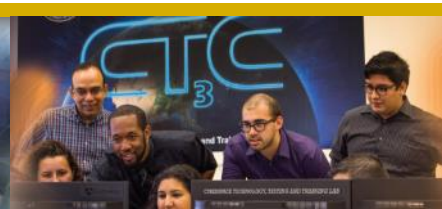


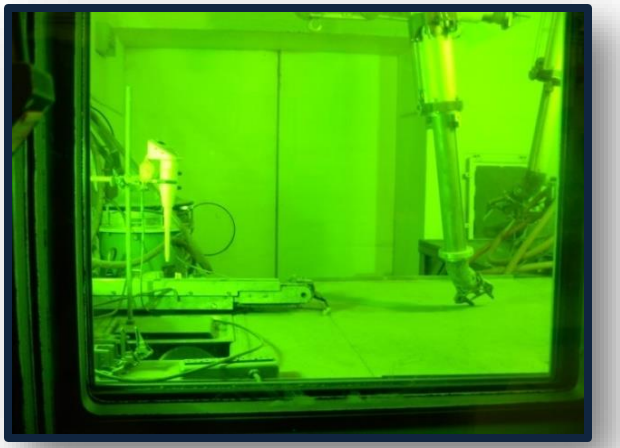



PROBLEM DESCRIPTION

- Many DOE facilities scheduled for D&D across the DOE Complex.
- Hazards (radiological, chemical, and structural) can limit or prevent the use of traditional manual techniques.
- Since 1993, D&D Technologies have been tested and evaluated at FIU's ARC.
- Also, D&D knowledge needs to be captured, retained, and disseminated.

DOE EM Environmental Challenges

60 Year Legacy of R&D and Production of Nuclear Weapons



ARC's Technology Test & Evaluation

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TECHNOLOGY: CONJET ROBOT 363 HYDRO-DEMOLITION
SURFACE: CONCRETE CEILING DEMOLITION

Data Collected

- Area: 390.20 ft^2
- Total Length Cut: 273 ft (horizontal & vertical cuts)
- Thickness: 8 in
- Front Flange Thickness: 12 in
- Production Rate: 10.27 ft/hr or 6.85 ft^2 /hr
- Cutting Rate: 113.28 ft/hr or 75.52 ft^2 /hr

TECHNOLOGY: CONJET ROBOT 363 HYDRODEMOLITION
SURFACE: CONCRETE WALLS DEMOLITION

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Data Collected

- Area: 400 ft^2
- Total Length Cut: 268 ft (horizontal cuts)
- Thickness: 8.5 in
- Production Rate: 6.34 ft/hr or 6.75 ft^2 /hr
- Cutting Rate: 48.91 ft/hr or 34.72 ft^2 /hr
- .

HAND LANCE OPEN BLASTING SYSTEM CONCRETE COATED CEILING DECONTAMINATION

Data Collected

- Area Blasted: 210.4 ft^2 @ 55,000 psi, 4.146 gpm
  - Production Rate: 2.14 ft^2 /min
  - Blasting Rate: 2.55 ft^2 /min
- Area Blasted: 135.4 ft^2 @ 36,000 psi, 3.932 gpm
  - Production Rate: 1.03 ft^2 /min
  - Blasting Rate: 2.35 ft^2 /min
  - High pressure low flow rate

ULTRA DECKBLASTER CONCRETE COATED FLOOR DECONTAMINATION

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Data Collected

- Area Blasted: 177.60 ft^2 @ 55,000 psi, 4.146 gpm
  - Production Rate: 2.1 ft^2 /min
  - Blasting Rate: 22.2 ft^2 /min
- Area Blasted: 165.67 ft^2 @ 36,000 psi, 3.932 gpm
  - Production Rate: 2.1 ft^2 /min
  - Blasting Rate: 5.92 ft^2 /min

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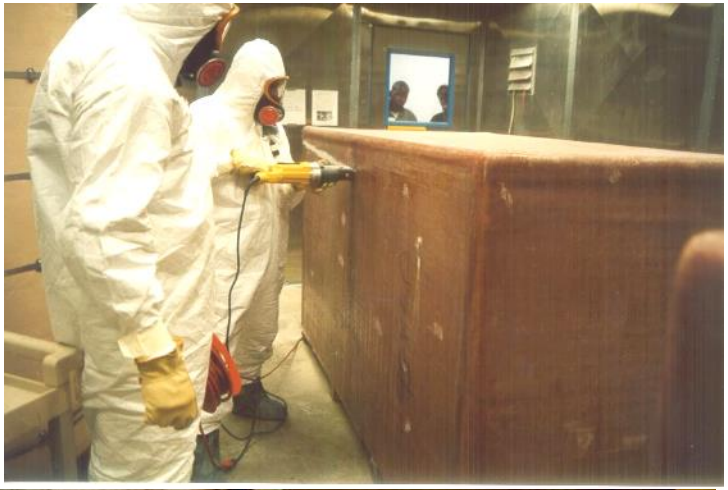
SIZE REDUCTION TECHNOLOGY T&E




- Developed a mockup representing a DOE facility consisting of:
  - Structural steel members (I-beams, C-channels)
  - Two inch thick plates
  - Piping
- Conducted T&E of size reduction technologies
  - Mechanical cutting systems
  - Thermal cutting systems

SIZE REDUCTION TECHNOLOGY FOR LOS ALAMOS NAT. LAB



- Technology cutting ***"bake off"***
  - LANL LSDDP provided two technicians to perform cutting operations. ARC SOW and testing protocols were followed.
  - ARC developed mockup crates and provided PermaCon facilities, and test engineers for data collection.
  - Cutting tool tested: Reciprocating saw (Dewalt) & Circular Saw

Large Scale Demonstration & Deployments Projects (LSDDPs)

Chicago Pile 5 Reactor Decommissioning

- Focused on decontamination and dismantlement of the Chicago Pile 5 (CP-5) Research Reactor facility.
- Work included removal of the reactor internals & biological shield and decontamination of the reactor building.
- Provided DOE with the opportunity to test innovative D&D technologies to provide meaningful cost & performance information.
- Evaluated the technology demonstrations and collected technical, cost and benchmarking data.
- Prepared Innovative Technology Summary Reports (the Green Books)

Large Scale Demonstration & Deployments Projects (LSDDPs)

C Reactor Interim Safe Storage at Hanford

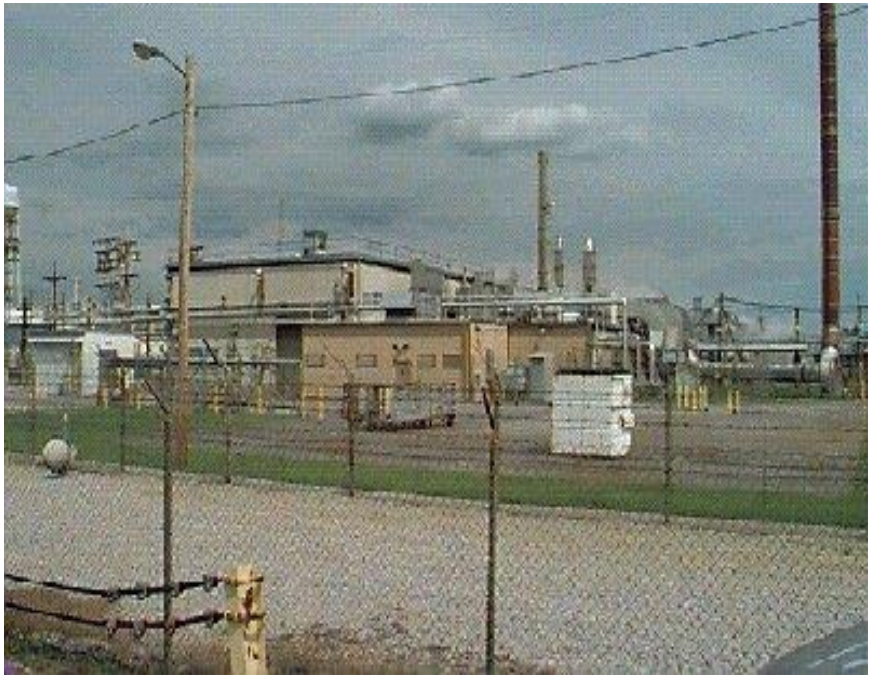
- Scope of this LSDDP was to place the C Reactor facility in a low-cost, safe-storage condition for up to 75 years, pending its final disposal.
- Aimed to demonstrate and implement innovative technologies to reduce the footprint of the facility.
- Activities included the demolition and removal of the 105-C building structure around the reactor block and removal of the fuel storage basin
- Prepared Innovative Technology Summary Reports (the Green Books)

Large Scale Demonstration & Deployments Projects (LSDDPs)

Fernald Plant 1

- Decommissioning of Plant 1 Complex at the Fernald environmental Management Project.
- Demonstration of innovative technologies at the Fernald Plant 1 site.
- Collection of real time data for D&D technologies and comparison of baseline & innovative technologies.
- Provided detailed technology assessments and participated in the technology screening.
- Prepared Innovative Technology Summary Reports (the Green Books)

Large Scale Demonstration & Deployments Projects (LSDDPs)



Savannah River Site (SRS) 321-M Fuel Fabrication Facility

- Provided technical support to DOE's SRS & identified technologies applicable to the SRS site.
- Prepared performance information on the selected technologies and provided a detailed technology assessment & technology screening.
- Demonstrated technologies in an actual contaminated environment & obtained field, operational, and cost data for D&D technologies.
- Developed & reviewed test plans and project administration.
- Prepared Innovative Technology Summary Reports (the Green Books)

Large Scale Demonstration & Deployments Projects (LSDDPs)

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- Large Scale Demonstration Project - INEEL
- Large Scale Demonstration & Deployment Project - Los Alamos
- Mound Tritium Large-Scale Demonstration and Deployment Project (LSDDP)

ARC Technology Development for D&D

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Summary of Past Technologies:

- Integrated Vertical and Overhead Decontamination System
- Mobile Integrated Pipe – Decontamination and Characterization System
- On-Line Decontamination and Characterization System
- In-Situ Pipe Decontamination System

Integrated Vertical and Overhead Decontamination (IVOD) System

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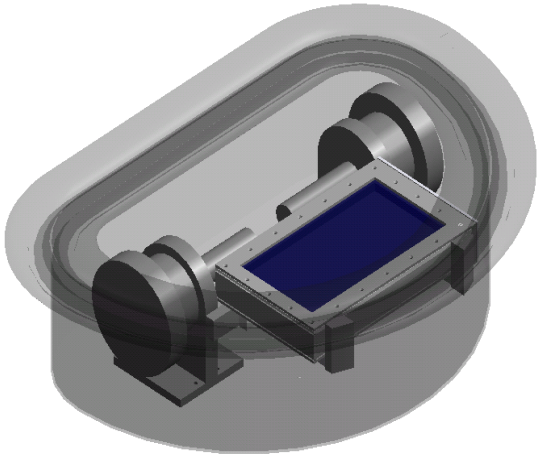
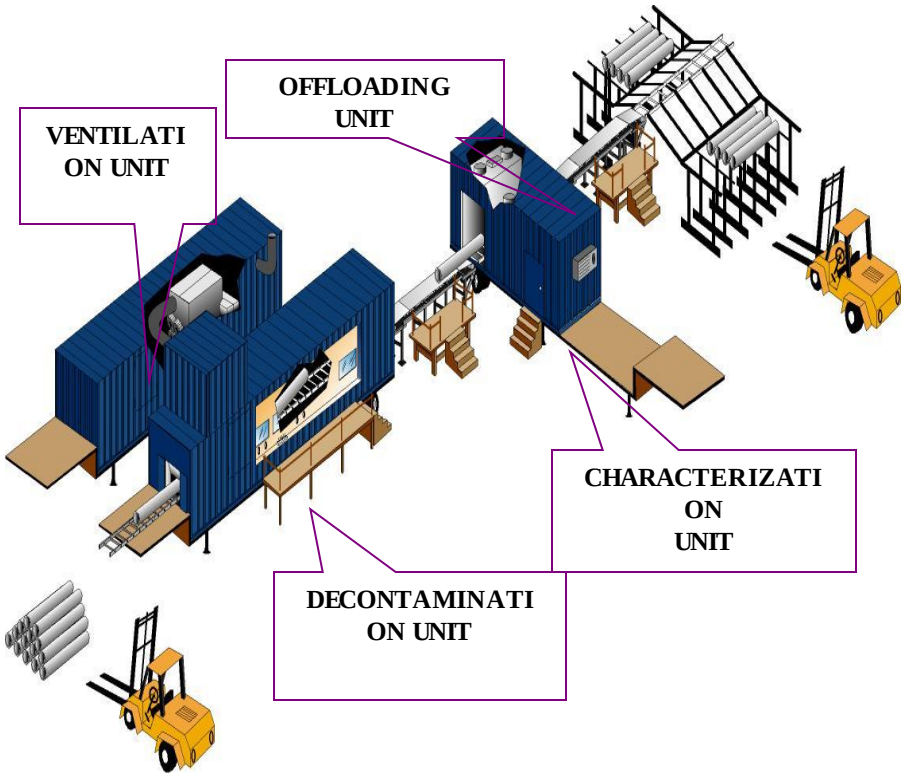


- IVOD was designed for removing layers of concrete from wall, ceiling, and floor surfaces & metal surfaces combined with a real-time characterization information system.
- IVOD design included a shrouded concrete shaving decontamination unit (Marcrist).
- IVOD employed a self-propelled remote joystick-operated robotic deployment system.
- IVOD was also equipped with a waste collection and handling system rated for nuclear use.
- Collaboration between RedZone Robotics, Bartlett and FIU

Mobile Integrated Piping Decontamination and Characterization System (MIP-DC)



- MIP-DC designed to provide an additional option for the disposal of contaminated pipe
- MIP-DC system allows for the free release of pipes thus reducing disposal costs & increasing the amount of material that can be recycled.
- The system is composed of
  - *Decontamination module*
  - *Characterization module*
  - *Ventilation module*
  - *Off-loading module*

Mobile Integrated Piping Decontamination and Characterization System (MIP-DC)

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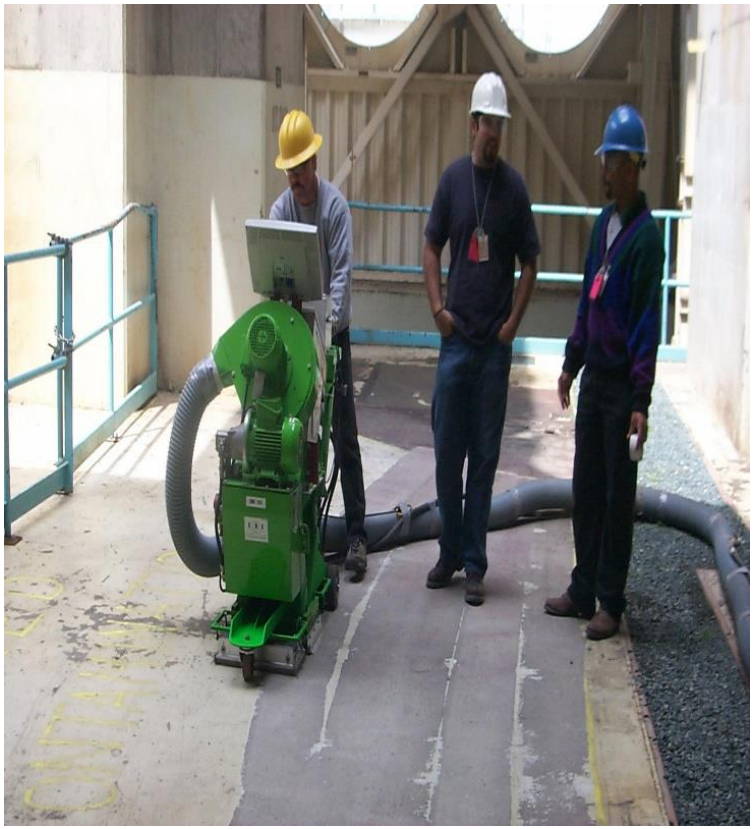
- The MIP-DC was demonstrated at Consumer Energy's Big Rock Point Facility (BRP) in Michigan.
- Pipes were fed in through the Decon module for blasting and then carried to the Charac. Module to check for remaining contamination.
- If no contamination is found, the pipe was ready for free release, else the pipe can be loaded onto Decon unit again for further decontamination.
- Pre-decon and post-decon radiological surveys were collected by BRP's HP personnel using a hand-held frisker and by taking smears for gamma analysis in the lab.

On-line Decontamination and Characterization System

- The System has following components:
  - Decontamination unit
  - Characterization Sensors
  - Vacuum+Waste Collection System
- The decontamination technology uses a Centrifugal Shot blast system.
- The gas proportional radiation sensors are placed before and after the shot blaster.
- The Vacuum+Waste Collection system collects chipped concrete from the blast.

On-line Decontamination and Characterization System



- The technology was demonstrated in the turbine-generator building at Rancho Seco Nuclear Power Facility, Sacramento CA.
- A computer and a flat panel display, mounted on the machine, display the count rate from both detectors for a real-time measurement of decontamination.
- The demonstration area had pre-decon surface contamination levels in the range of 200-1600 cpm/ft^2 as obtained from a pancake frisker survey.
- The demonstration showed the system's capability to identify the contaminated areas.

In-Situ Pipe Decontamination System

- System adapted a COTS mechanical blasting system.
- System was modular and adaptable to pipes with diameters between 3 to 12 inches.
- Wheelbase adapted to the internal contour of the pipe allowing for operation around elbows and other pipe fittings.
- Spring action assured that the Blast head remains aligned with the center axis of the pipe.
- Manual operation: The system was pushed along the length of the pipe by an operator.
- The system used a Vacuum Blast Decontamination System.

ROBOTICS IN D&D

- Remote handling by machines (e.g, robotics) plays a critical role in protecting personnel and the environment during potentially hazardous D&D activities and operations.
- By utilizing and improving the capabilities of existing remote technologies, Facilities undergoing D&D can significantly reduce the exposure of its workers to hazards.

APPLICATION OF ROBOTICS

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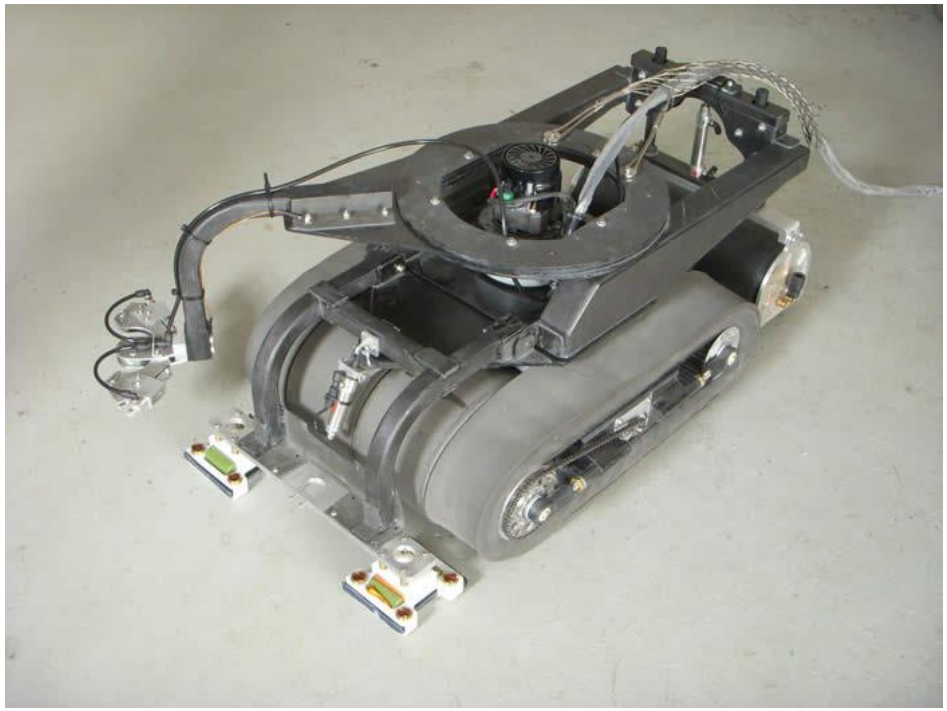
- The application of robotic technologies in D&D can:
  - Provide remote access to high-risk and hard-to-reach areas.
  - Reduce worker exposure to workplace hazards.
  - Reduce worker exposure to injuries from repetitive tasks.
  - Improve productivity by assisting worker.

EXAMPLES OF ROBOTICS IN D&D

ICM Climber Machine



- ✓Portable
- ✓Remote controlled
- ✓Can climb virtually any surface
- ✓Can adapt various characterization and decontamination tools to climber

EXAMPLES OF ROBOTICS IN D&D

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EXAMPLES OF ROBOTICS IN D&D

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- **LaserSnake2** by OC Robotics
- Integrated snake-arm robot and laser cutting technology
- Deployed for in-situ decommissioning of a nuclear cell at the First Generation Reprocessing Plant in Sellafield, England.

EXAMPLES OF ROBOTICS IN D&D

- Decontamination robots
- By International Research Institute for Nuclear Decommissioning
- Used on upper floors of reactor building of the Fukushima nuclear power plant

D&D KM-IT - WWW.DNDKM.ORG

A web-based knowledge management information tool custom-built for the D&D user community by FIU-ARC in collaboration with DOE, EFCOG, and the former DOE ALARA Centers (at Hanford and SRS).

D&D KM-IT MODULES

- D&D Hotline
- Technology Module
- Vendor Module
- Collaboration Tools
- Mobile Applications
- Lessons Learned
- Documents
- Pictures/Videos
- Search Tools
- Training
- Specialists
- Best Practices
- Fixative Module

Questions

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