



D&D Technology

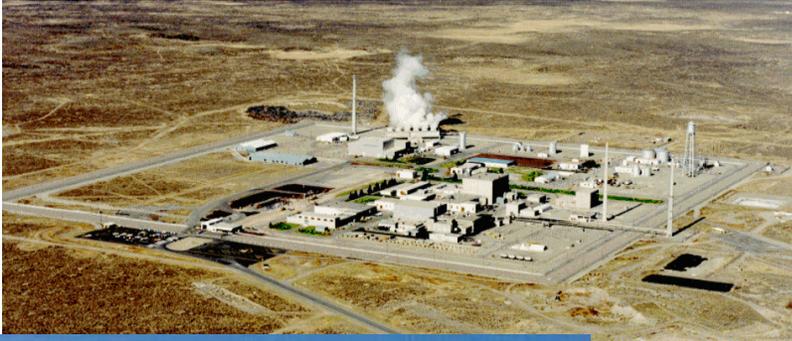
Demonstrations and Deployments at the INEEL

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INEL has safe and successful D&D history



- **52 reactors and associated facilities**
- **Over 50 facilities D&D'ed**
- **Over 100 facilities demolished**
- **Technology Deployment well integrated with Operations**
- **University/Industrial D&D Partners**



INEEL's D&D Technology Program

Large Scale Demonstration and Deployment Project (LSDDP)

- Evaluate, through full-scale demonstration, the benefit of using new or improved technology to perform D&D Operations.
- Provide convincing data that will outweigh the risk associated with first time use of a new technology.
- Fuel storage canals and associated underwater and underground facilities.

ASTD Integrated Decontamination & Decommissioning Project (ID&D)

- Use innovative, proven technologies in D&D operations to reduce:
 - Cost
 - Radiation Exposure
 - Waste Volume
 - Schedule



INEEL D&D Partners

LSDDP TEAM

- Parsons International
- BNFL
- LMITCO
- Florida International
- Idaho State University
- TLD Services
- US Army Corp.
- DOE FETC
- Technology Vendors

ID&D TEAM

- INEEL
- ANL
- FEMP
- DOE FETC
- Technology Vendors



INEEL Demonstration/Deployment Process

- Identify INEEL Needs
- Select Appropriate Technologies
- Demonstrate/Deploy Technologies
- Complete Independent Benefit Analysis
- Publish/Disseminate Results



INEEL LSDDP Facilities

- Initial Engine Test (IET) Control Room
- Advanced Reactivity Measurement Facility/Coupled Fast Reactivity Measurement Facility (ARMF/CFRMF)
- Test Reactor Area (TRA) Filter Pits

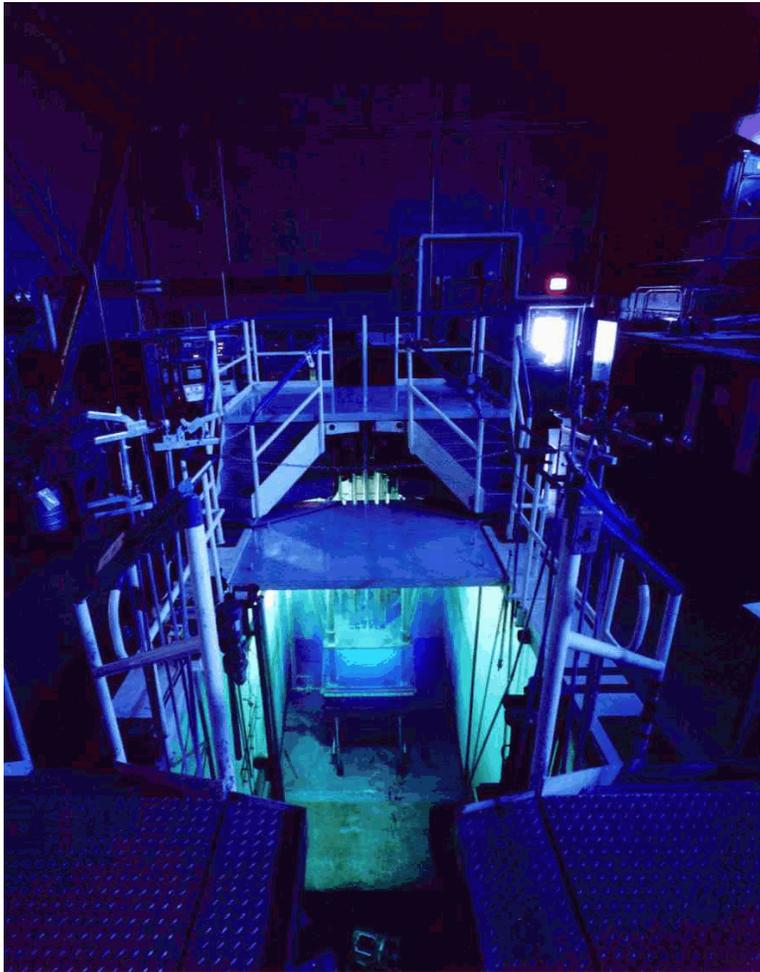


INEEL IET Control Room

- INEEL Test Area North (TAN)
- Massive Underground Concrete Structure
- Control Center for Aircraft Nuclear Engine Tests in 50s & 60s
- Asbestos, mercury, lead contamination
- Little or no radioactivity remaining



Advanced Reactivity Measurement Facility/Coupled Fast Reactivity Measurement Facility



- **INEEL's Test Reactor Area (TRA)**
- **2 Aluminum underwater research reactors**
- **Fuel elements removed**
- **15 feet apart in common water canal (8'W x 28'L x 18'D) 30,000 gallons**

TRA Filter Pits

TRA-655, 704, 705, 706, and 755



- Network of buildings, structures, tunnels containing large underground air filters
- Concrete construction 10' underground
- Canister type Charcoal filters in lead and concrete shielding
- Pipes and ducting
- Lead, asbestos, radioactive contamination
- Confined spaces

Innovative Technologies being Demonstrated

TECHNOLOGY

Copper Recycling
PCB Analyzer
Concrete Recycling
Metal Alloy Analyzer
Electromagnetic Radiography (EMR)
Big On Asbestos (BOA)
Automatic Locking Scaffolding System
Lead Paint Analyzer
Robotic Surveyor
Robotic Climber Scabbler
Remote Underwater Characterization System
Soft Sided Containers

SUPPLIER

NUKEM Nuclear Technologies
Philips Analytical
Excel Recycling and Manufacturing, Inc.
NITON Corporation
Mission Research Corporation
Robotics Institute, Carnegie Mellon Un.
Excel Modular Scaffolding and Leasing Corp.
NITON Corporation
ChemRad
Bartlett Services
Inuktun Services Ltd.
Transport Plastic, Inc.



Remote Underwater Characterization System



- **Characterized the ARMF/CFRMF reactors in August 1998**
- **Identified radiation levels higher than previously detectable**
- **Identified objects on the pool floor previously not visible due to restricted access**
- **Inuktun Services Ltd.**
- **Modified by INEEL**
 - **added auto-depth control**
 - **integrated gamma radiation detector**

Soft Sided Containers



- **Packaging of Low Level Waste/Debris**
- **260 cubic foot capacity compared to 96 cubic foot**
- **\$380 per container vs. \$750 for metal boxes**
- **Moulds around itself for void volume reduction**
- **DOT IP-1 Approved**
- **Transport Plastics, Inc.**

Soft Sided Containers

- DOT IP-1 approved strong tight container
- Low Specific Activity (LSA) material
- Surface Contaminated Objects (SCO)
- Easy to load and handle
- Approved for bulk object pipes, concrete, metal, valves, etc.



Innovative Technologies being Deployed

<u>Technology</u>	<u>Site</u>	<u>Supplier</u>
BROKK Demolition Robot Pipe Explorer	INEEL, ANL-E INEEL	BROKK Holmhed Science and Engineering Associates
GammaCam	INEEL	AIL Systems, Inc.
DDROPS	INEEL	INEEL
Oxy-Gasoline Torch	INEEL, FEMP, ANL-E	Petrogen, Inc.
Personal Ice Cooling System	INEEL, FEMP, ANL-E	Delta Temax, Inc.
Hand Held Shear	FEMP	Lucas Rescue Tools, Inc.
Track-Mounted Shear/Grapple	FEMP	John Deere, Pemberton Mfg., and Tiger Mfg.
Soft Sided Containers	INEEL	Transport Plastics, Inc.

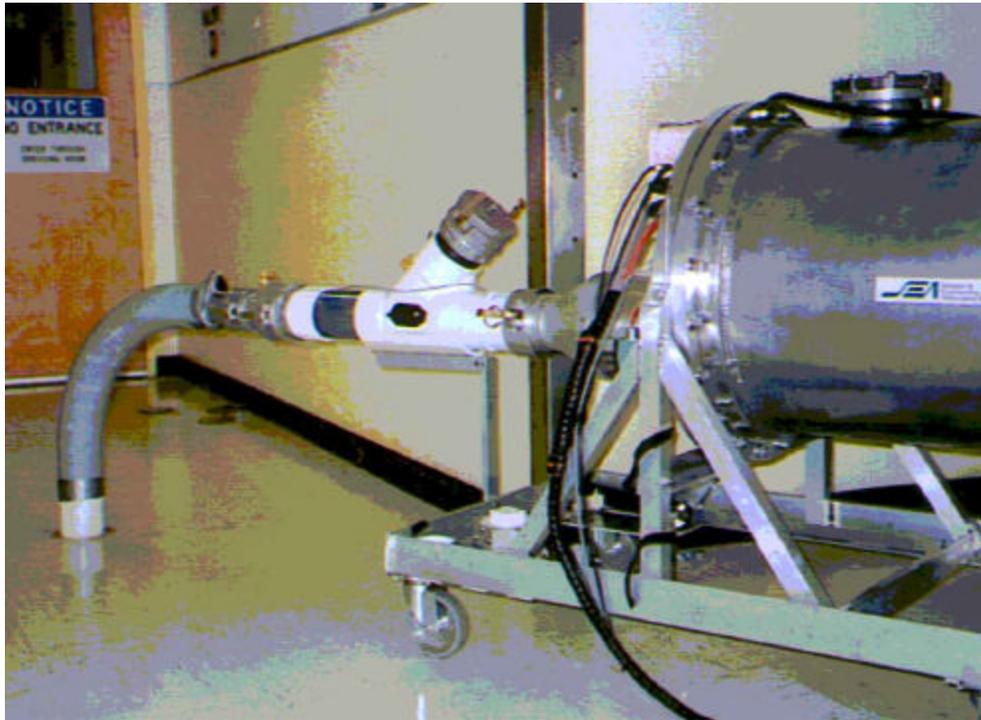


BROKK 250BM Demolition Robot



- **Mobile demolition robot**
- **Tethered or radio remote controlled**
- **Multiple end-effectors:**
 - Scabbler
 - Hydraulic shear
 - Hammer
 - Grapple
 - Bucket
- **Reduces radiation exposure**
- **Increases Safety**
- **BROKK Holmhed Systems AB**

Pipe Explorer



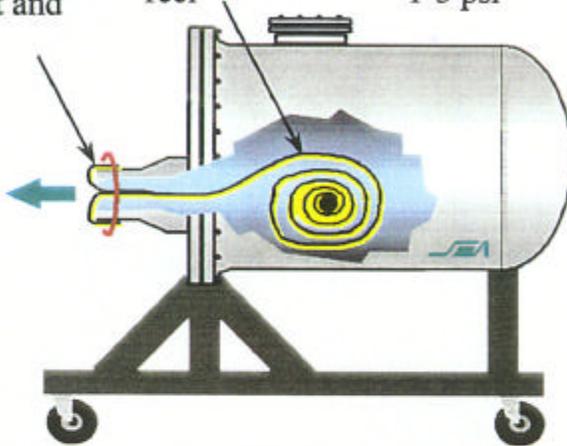
- **Characterizes piping contamination in situ**
 - alpha, beta, gamma, video, position
- **Membrane prevents contamination of sensor**
- **Pipe runs up to 122m, and 5-45cm diameter**
- **50% of pipe can be blocked**
- **Science and Engineering Associates, Inc.**

Stage 1

Membrane wrapped around canister outlet and sealed

Membrane rolled up on reel
Canister pressurized to 1-5 psi

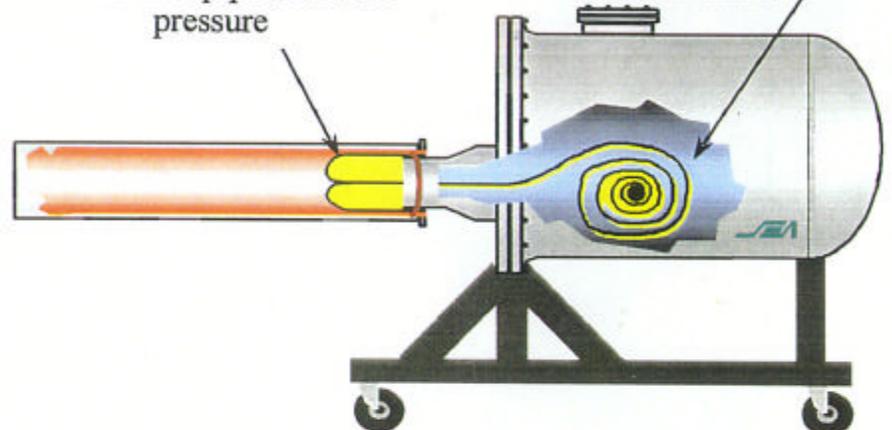
Pipe to be surveyed



Stage 2

Membrane inverts and extends into pipe under air pressure

Tether/signal cable rolled up on reel beneath membrane

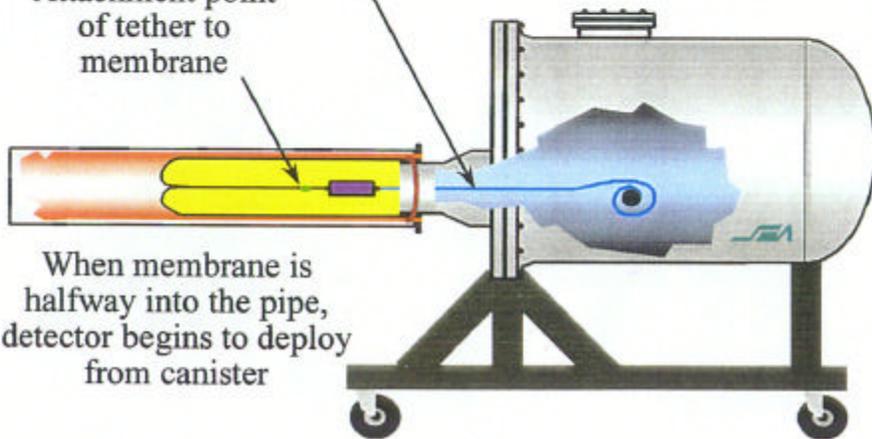


Stage 3

Attachment point of tether to membrane

Tether/signal cable

When membrane is halfway into the pipe, detector begins to deploy from canister



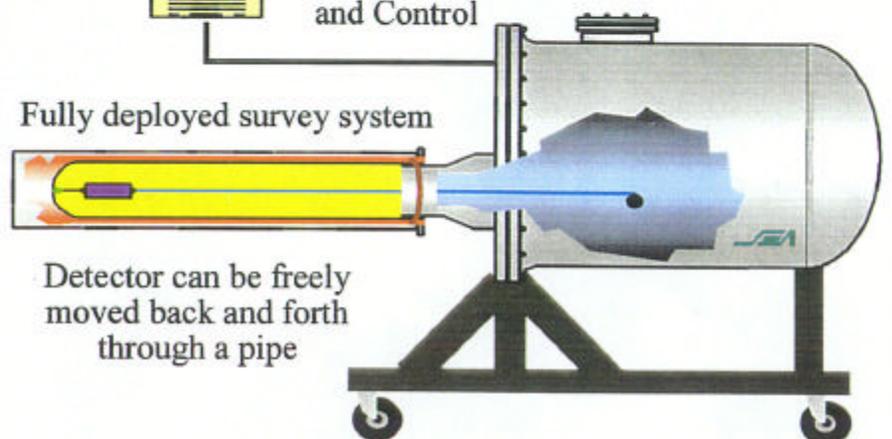
Stage 4



Data Acquisition and Control

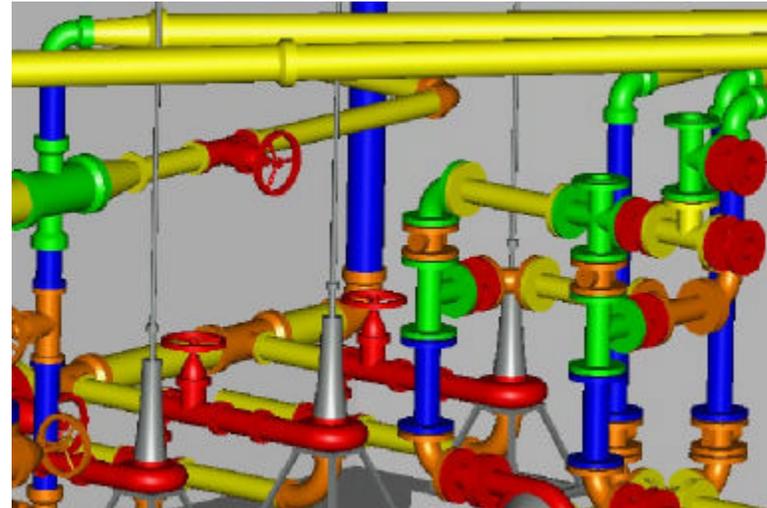
Fully deployed survey system

Detector can be freely moved back and forth through a pipe



Decontamination, Decommissioning and Remediation Optimal Planning System (DDROPS)

- Solid geometric modeling and optimization technique
- To identify locations for segmenting contaminated materials,
- To determine packaging routines resulting in improved packaging densities,
- To minimize radiation exposure,
- Inventory/manifest of waste contents
- INEEL Patent Pending



INEEL D&D Technology Results are being Published

- Technology Fact Sheets
- Innovative Technology Summary Reports (ITSR)/Greenbook
- Conferences/electronic publications
- Videos/photos
- **<http://id.inel.gov/lsddp>**
- **<http://id.inel.gov/idd>**

