

## 5.6 COOPERATIVE TELEROBOTIC RETRIEVAL

### TECHNOLOGY NEED

Current retrieval scenarios for buried waste indicate a need to selectively retrieve “risk-driven” hazard items from a buried-waste site. This technology will remove those items while maintaining the integrity of the containers in which the hazards were stored.

### TECHNOLOGY DESCRIPTION

A value engineering study has determined the type of delivery system required to transport dual manipulation capability to a waste-retrieval digface. The delivery system, a gantry crane, can transport the manipulators and other retrieval equipment, as required, to support the waste-retrieval operation. Other equipment that could be deployed includes a sundering/vacuum system, digface-characterization equipment, and miscellaneous waste-handling tools.

The remotely operated, sundering/vacuum system, as displayed in Figure 5.6-1, will be used to remove soil and debris from around the waste objects. End-effectors for the sundering/vacuum system are designed to break up hard soil, carefully clean around buried objects, and ensure that large sheets of plastic and other objects do not plug the system. The vacuumed debris will be placed in a transport container for subsequent removal and treatment. The system has been developed for total remote control of the functions, including control of the delivery system, manipulator freedom, and sundering/vacuum system.



Figure 5.6-1. Remotely Operated Retrieval System.

As a common platform for support to a waste-retrieval operation, the gantry crane is equipped with two cooperative, telerobotic manipulators (multi-manipulator capability), each attached to a telescoping mast. A 5-ton hoist, also mounted on the gantry crane, supports the manipulators in deploying ancillary tools. The crane system will support:

- Archeological excavations (soil sundering/vacuum equipment)
- Digface characterization [INEL radiation, magnetics, volatile organic compound sensors, Pacific Northwest National Laboratory (PNNL) holographic impulse radar]
- Waste retrieval from the excavation
- Delivery of waste to the proposed transport system

The primary objective is to deploy a system with the capability to perform selective retrieval at a buried-waste site. Two robotic manipulators are installed on the delivery system. In tandem, these manipulators, along with the sundering/vacuum system, can selectively remove soils and debris from around an article, and retrieve that article.

## **BENEFITS**

The system has been developed to demonstrate that available technology can be integrated and deployed in a realistic waste-remediation scenario. Since cost savings associated with this technology depend on the application and operation scenario, quantitative cost analyses have not been performed. The primary driver for the technology is improved worker safety. Cost savings are expected from removing workers from hazardous environments. Additional cost savings will be realized by reducing the need for personal protective equipment in hazardous environments.

## **COLLABORATION/TECHNOLOGY TRANSFER**

Industry participation has been key to the present success of this project. American Crane and Equipment supported development of the delivery system (gantry crane) for this project. Advances made in the expansion of the control system were supported by Cinetrix Inc., and Schilling Development. Concepts Engineering Group supported and supplied the sundering/vacuum system. Dimension Technologies supplied and supported the stereovision system.

## ACCOMPLISHMENTS

- Purchased the gantry crane, associated deployment mechanisms, telerobotic manipulators, hydraulic drive unit, and components of the system's control unit
- Integrated technologies developed under separate tasks or research efforts (i.e., digface characterization and soil vacuum/sundering tool), into the system
- Commenced individual component testing of the system in FY95, with integrated field testing to be conducted in FY96

## TTP INFORMATION

Cooperative Telerobotic Retrieval technology development activities are funded under the following TTP:

TTP No. ID76LF25, "Landfill Retrieval Implementation"

## CONTACTS

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## BIBLIOGRAPHY OF KEY PUBLICATIONS

None at this time.