SWAMI, Stored Waste Autonomous Mobile Inspector

by

K. McCarthy

Westinghouse Savannah River Company

Savannah River Site

Aiken, South Carolina 29808

M. R. Duignan

A document prepared for KOREA ATMONIC ENERGY RESEARCH INSTITUTE at Yusong, Taejon from 07/16/95 - 07/22/95.

DOE Contract No. **DE-AC09-89SR18035**

This paper was prepared in connection with work done under the above contract number with the U. S. Department of Energy. By acceptance of this paper, the publisher and/or recipient acknowledges the U. S. Government's right to retain a nonexclusive, royalty-free license in and to any copyright covering this paper, along with the right to reproduce and to authorize others to reproduce all or part of the copyrighted paper.

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED *at*

MASTER

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

This report has been reproduced directly from the best available copy.

Available to DOE and DOE contractors from the Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831; prices available from (615) 576-8401.

Available to the public from the National Technical Information Service, U. S. Department of Commerce, 5285 Port Royal Rd., Springfield, VA 22161

SWAMI, Stored Waste Autonomous Mobile Inspector

Technology Brief

Highlights

- Scientists at the Savannah River Technology Center have developed a robotics system called SWAMI, the Stored Waste Autonomous Mobile Inspector.
- The system improves the inspection and inventory of drums containing low-level radioactive, hazardous and mixed wastes, while greatly reducing personnel exposure to hazardous materials.
- SWAMI is a modified version of the HelpMate robot produced by Transitions Research Corporation of Danbury, Conn.
- Additions to the robot include off-board control and display, on-board control, radio ethernet communications, image recording, image compression; image storage; bar-code reading; radiation survey and radiation data display.
- The Savannah River Technology Center is the applied research and development laboratory serving the Savannah River Site. Westinghouse Savannah River Company operates the center for the Department of Energy.
- Additional information is available from:
Westinghouse Savannah River Company
227 Gateway Drive
Aiken, SC 29803
Tel. [800] 228-3843
Fax [803] 652-1898.

A mobile robot named SWAMI, developed by scientists at the Savannah River Technology Center is making the tedious and potentially dangerous job of drum inspection safer and more efficient.

Department of Energy sites store tens of thousands of drums containing low-level radioactive, hazardous and mixed wastes around the country. Regulations require weekly inspection of these drums—a monotonous, time-consuming task workers perform in hostile environments.

Reduces personnel exposure

The robotics system improves the efficiency, documentation and accuracy of drum inspections and inventory, while greatly reducing personnel exposure to hazardous materials. Also, tests show that a mobile robot can detect floor contamination more reliably and accurately than tedious manual surveys.

With decommissioning of closed nuclear facilities expected to generate more waste, robotic systems will play a crucial role in future waste inspection and inventory.

SWAMI performs inspections autonomously after an inspector operating the host computer sends the robot on its way. The robot captures an image of each drum and reads the bar codes, storing the data it gathers on an on-board computer. SWAMI also transmits data back to the host computer to allow operators to monitor the vehicle's location, condition and other relevant information in real time. After the inspection, drum images are studied to detect any suspect containers, and inventories are updated with bar-code data.

Radiation survey

The robot also conducts a radiation survey of the floor during each inspection. If high contamination is found, it stops and notifies appropriate personnel. Data is used to generate radiation maps of both alpha and beta/gamma levels in facility aisles.

SWAMI is a modified version of the HelpMate robot produced by Transitions Research Corporation of Danbury, Conn. Until now, the HelpMate has been used for hospital applications such as meal delivery to patients. Technology Center additions to this robot include off-board control and display, on-board control, radio ethernet communications, image recording, bar-code reading, radiation survey and radiation data display.

The on-board control system, developed by the University of South Carolina, supervises all of SWAMI's subsystems and conforms to the Generic Intelligent System Control. This

SWAMI, Stored Waste Autonomous Mobile Inspector

computer architecture is used throughout the Department of Energy's robotics program to cut costs and development time and to maximize reuse and compatibility of software.

Introducing SWAMI II

A second-generation SWAMI, SWAMI II, is under development. SWAMI II will feature an image analysis system to identify rust spots and rust streaks, a structured light system and analysis system to identify drum dents and blisters, and an interface with a drum computer database. The robot also will be able to navigate backward in a dead-end aisle. SWAMI II will be demonstrated at the Fernald Environmental Management Project (Fernald, Ohio) in the summer of 1995.

Floor plans of existing and planned waste storage sites can be integrated into the robot's control and guidance components to allow it to operate in many different facilities.

The SWAMI project is part of the Department of Energy's technology transfer initiatives and is coordinated among several federal, academic and commercial entities. Technology Center innovations resulting from this effort are available to the private sector for commercialization.