3.6 Reduced Access Characterization Subsystem

Technology Needs

Many facilities exist in the DOE complex that have become radiologically contaminated through years of research and service. These facilities include hot cells, glove boxes, fuel storage buildings, and process buildings. As many of these facilities are prepared for D&D, the need arises for surveillance and characterization before, during, and after cleanup activities. Characterization is currently being performed in these areas by having a radiation control technician manually monitor radiation levels with hand-held instruments. Although this method is effective for small or hard to reach areas, automated floor characterization systems can be much more effective in larger buildings such as the 300+ acre K-25 facility located at ORNL. During the past two years, a large Mobile Automated Characterization System (MACS) has been developed jointly by the SRTC and ORNL. The MACS platform is designed to carry multiple radiation sensors and perform automatic floor characterization of large areas. During the development of MACS, it was found that a significant floor area exists in most facilities that is not readily accessible by a large-floor characterization system. The Reduced Access Characterization Subsystem (RACS) is being developed to operate as a subsystem of MACS and provide characterization of areas inaccessible to MACS.

Technology Description

The RACS activity provides for the development and demonstration of a stand-alone robotic floor characterization system that can work cooperatively with MACS to perform tedious floor characterization and provide superior radiological data collection and storage. The RACS system, shown in Figure 3.6-1, consists of the RACS robot, which is based on a commercially available robot, and a homing/repeater beacon called TRACS. In a typical inspection, RACS and TRACS will be carried on a platform onboard MACS. When MACS arrives at a limited access region, the MACS operator will send

Figure 3.6-1. RACS Robot and TRACS Homing/Repeater Beacon

a deploy command to RACS, which incorporates current global position of the MACS robot and coordinates of the area RACS is to survey. RACS then leaves MACS, drops the TRACS beacon, and surveys the area specified while MACS continues its survey. RACS will transmit radiation and position data back to MACS via TRACS where it is incorporated into the facility map. When RACS has completed its survey, it will retrieve the TRACS beacon and wait until MACS returns. When MACS is in position, RACS will receive a stow command and board its carrying platform on MACS. RACS can also be used as an independent system, if necessary.

Benefits

This technology will allow automated characterization of floor areas that could not have been characterized by larger automatic floor characterization systems. Automated floor characterization, particularly of large areas, can be done much more quickly than manual methods. In addition, the data obtained from automated floor characterization will be more detailed and accurate than manual methods, and can easily be integrated into an overall facility map. The use of automated systems will remove radiation control technicians from potentially hazardous areas and reduce overall personnel exposure by identifying areas that pose health risks prior to possible personnel exposure.

Collaboration/Technology Transfer

This technology has been developed at INEL in collaboration with private industry. All the robotic equipment used in the development of RACS has been procured to INEL specifications from IS Robotics, Inc.

Accomplishments

- The RACS robot and TRACS beacon were procured from industry.
- RACS behaviors for deployment and surveying a rectangular area have been written and incorporated into the system.
- The interface to the radiation sensor was completed and radio transmission of RACS data back to MACS was accomplished.
- RACS was demonstrated at a major programmatic technology demonstration.

TTP Information

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Bibliography of Key Publications

Anderson, M.O., M. D. McKay, and B. S. Richardson. "Multirobot Automated Indoor Floor Characterization Team," presented at the IEEE International Conference on Robotics and Automation, Minneapolis, Minnesota (April 1995).