Robotic All Terrain Monitoring

The INL has elevated environmental monitoring to a new height – one that is unmatched in the realm of autonomous and remote radiological monitoring. The technology is embodied in the Robotic All Terrain Vehicle (RATV). This equipment shortens the time and effort required to survey large areas suspected of having radiological contamination, increases worker productivity by six to nine times and virtually eliminates human exposure to environmental hazards.

Overview

In the 1960s, INL used hand-held radiation survey and mapping instruments to assess and document the environmental impact of operations. This was tedious work that exposed workers to hazardous conditions and limited their access during normal and emergency operations. Automation was introduced in the mid 1980s using a meter resolution global positioning system (GPS), DOS computers and scintillation radiation detectors mounted on four-wheel drive vehicles.

By the late 1990s, INL's Environmental Services Program began using the RATV for environmental monitoring operations as it was being developed through a joint research venture between INL and Utah State University's Center for Self-Organizing and Intelligent Systems.

Advanced Capabilities

The RATV is built on a commercially available hydrostatic eight-wheel drive amphibious vehicle platform. This platform supports a scintillating radiation detector mounted on the front and a high-resolution gamma spectrometer mounted on the rear of the vehicle. It also has a control computer that accommodates manual, remote or fully autonomous operations. The RATV was recently modified with sub-meter differential GPS and field hardened graphical user interface computers. It was also programmed for manual and autonomous control of parallel path swathing that minimizes "skip" and "overlap" while performing track-to-track passes. This is a necessary and vital capability for cost-effective operations.

The RATV is 10 feet long, five feet wide and about seven feet to the tip of its antennae. It can climb a 45-degree slope and is capable of being operated manually, remotely or autonomously.

Field Deployments

The RATV has been used to survey areas that were historically surveyed manually using 1980's technology. These surveys were performed at INL Test Reactor Area, Test Area North and the Auxiliary Reactor Area. In each of these events, data from the scintillation detector is directly imported into specialty software and maps, such as the one shown in the center column at right, can be quickly prepared to report survey results to state regulators.

As well as being used to perform routine surveillance and screening activities, the RATV can also be used to

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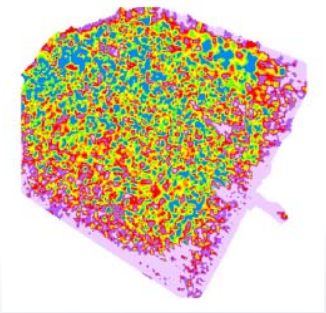
characterize and remediate contaminated areas by evaluating specific isotope concentrations in surface soils. This is accomplished by taking field measurements using both the RATV and the in-situ gamma spectrometer in contaminated areas within sites of concern. Gross counts are compared to the in-situ measurements and graphed. A regression is performed to develop an equation that converts counts per second to isotopic concentrations. Areas where target cleanup levels have been met are easily identified. Subsequent remote surveys show the progress of remediation efforts and identify areas where additional work is required to achieve remediation goals.

Added Value

During ground surveys significant cost and timesavings are realized due to a reduction in the number of workers needed to perform the survey. And, beyond reducing worker exposure, project managers are able to obtain accurate and complete field data in hazardous environments. In addition to the obvious cost savings shown in the above routine surveys, the RATV can also save time spent screening areas to reduce the number of in-situ surveys required. It can quickly locate areas of elevated radioactivity that can be further investigated using in-situ gamma spectrometry to verify contamination levels.



Computer generated maps based on survey data can be prepared the same day the information is collected in some cases.

Benefits and Results

The RATV platform has many unique benefits and successful results that contribute to improved surveys, including:

- Providing accurate data before, during, and after an incident for complete results
- Reducing exposure and increasing worker safety
- Taking samples in remote, inaccessible, or hazardous environments
- Reducing environmental impacts and operating costs
- Reducing fire hazards associated with conventional survey vehicles
- Minimizing interference with remediation efforts
- Providing real-time video photography.

The RATV performs parallel swathing in autonomous operation while observers (inset photo) in the control center program track-to-track GPS coordinates, see and hear audiovisual signals on monitors, and view in-progress mapping and tracking data.

For more information

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