# Developing Virtual Reality Training for Nuclear and Radiological Search and Response

*Argonne National Laboratory's Virtual Reality Training Software is a distributed training tool with realistic scenarios for nuclear and radiological search and response. Rich virtual urban environments supplemented by simulated multiple deployable detectors and radiation physics support trainee response to hidden radiological and nuclear materials.*

## Problem/Opportunity

Current tabletop and field-based exercises for responding to improvised nuclear device (IND)/radiological dispersal device (RDD)/Accidental Release scenarios are inadequate in terms of simulated detector readings, radiation physics modeling, scenario planning, mobile team communications and actions, situational awareness, and temporal realism. Argonne's Virtual Reality Training Software addresses these issues with an online, multiuser, interactive virtual reality training simulator for weapon of mass destruction (WMD) scenarios. The Argonne software focuses on radiological and nuclear scenarios by integrating modern first-person video game technology with radiological and nuclear models, equipment simulators, and incident management procedures, supporting an online virtual reality environment that enables controllers to develop scenarios and first responders to perform their roles in a safe virtual environment.

Argonne's Virtual Reality Training Software 1) reduces the need for cost-prohibitive classroom-based training, 2) overcomes the limitations of using detection instruments in field scenarios, and 3) increases the realism of team interaction, communication, and command participation. A feature-rich virtual reality environment overcomes the expense and logistical complexities of full-scale exercises, provides a more realistic training experience than tabletop exercises, and increases the number of people who can be trained together, building team effectiveness through shared experience.



## Approach

Argonne's Virtual Reality Training Software combines a readily available gaming platform (Unreal Engine), which has been used successfully by the Department of Defense for troop training, with detection and search strategies grounded in radiation physics. The elements required to use the software include scenario definition, environment, detector portfolio, radiation physics engine, team communication, and training assessment. Participants can train alone, in a distributed team, or with expert coaches at different locations. The software runs in a Microsoft Windows® environment, but it can also be extended to other video game platforms.

## Components

A scenario might begin with first responders (for example, U.S. Department of Energy [DOE] Radiological Assistance Program [RAP] team members) deployed to search for a missing cesium-137 source hidden in a virtual cityscape. The search team would have an onscreen view of all available detection instruments and communication devices. Search team members would have the ability to communicate with command staff as they would in real life. The command staff could direct the search teams based on the simulated radio communications.
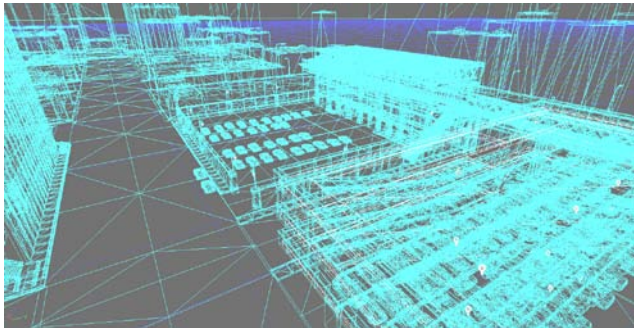


The physics engine supporting the Argonne Virtual Reality Training Software has been extended to incorporate spherical isotopic sources and gamma detectors in a multiperson outside and building environment that shields the source. Each participant has access to a set of detectors and can communicate via standard voice software for gaming. The multiperson team aspects could be extended to include different roles and communication options. Advanced features such as mobile search vehicles, plume dispersion of contamination, and options for conversion and incorporation of customized 3D environments could also be considered. These features would facilitate use of the tool for a broader range of exercises with additional specification of detail or customization of the application.

## Future

The Argonne Virtual Reality Training Software is currently available for multiplayer demonstration. The demonstration software is an on-site system networked to a remote server that exercises integrated team capabilities to detect radiation, using more realistic source scenarios than are currently used in tabletop exercises where radioactive dispersal, detection, and team interaction are simulated in a static, non-realistic manner. Future enhancements would make use of the Internet, allowing virtual reality exercises to be conducted through a distributed environment that improves participation, interaction, and identification of issues for resolution.

In addition to offering more realistic training and planning experience to a wider audience, Argonne's Virtual Reality Training Software reduces costs by reducing the need for travel.