

# White Paper

## Germanium Detection Search Systems to Locate Special Nuclear Material or Improvised Nuclear Weapons

ORTEC grows high purity germanium crystals at its Tennessee facility, and has developed and deployed thousands of high purity germanium detectors over 30 years. ORTEC germanium detection systems are already being used by organizations such as the US Departments of Justice, Energy, Defense, and Homeland Security as well as their international counterparts in the global war on terrorism. When it comes to the combination of the ability to DETECT and IDENTIFY radioactive materials based upon their gamma ray signature, HPGe detectors offer by far the best combination of sensitivity and selectivity, the latter deriving from the “energy resolution” and the former from the available detector physical size in addition to energy resolution. ORTEC has recently developed a flexible packaging scheme that allows these systems to be deployed in a variety of configurations for mobile searches, vehicle searches, and aerial searches.

The ORTEC Detective-EX, a HPGe detector in a hand-held portable isotope identifier, has been deployed throughout the world in the Global War on Terrorism. This technology has proven to be the best available to correctly identify radiological or nuclear material and eliminate false positive results caused by innocent radioactive material. Moreover, due to the better sensitivity/selectivity, these instruments are better at detecting radioactive mixtures and shielded radioactive sources than methods employing other detector technologies. Therefore, it is much more difficult for a terrorist organization to “hide” SNM from an ORTEC Detective by shielding it or by trying to “disguise” it with a legitimate radioactive source.

The advances ORTEC has made recently in the use of HPGe technology has enabled these detectors to be adapted for use in aerial, vehicular, or maritime search system configurations. ORTEC has eliminated the single drawback of HPGe systems, the requirement for cryogenic cooling, by incorporating a miniature Stirling Cooler in the design. This design concept was originally incorporated into the Detective-EX in 2004 and has proven to be extremely rugged in real world applications. These systems have been successfully deployed

by numerous government agencies such as the FBI, the DOE Megaports program, WMD CST Teams, DOE RAP Teams, etc.

Standoff detection capability (the ability to detect radioactive material from a distance), is an important requirement for any radiological/nuclear search system. Standoff detection implies that the detector itself “sees” a wide field of view due to the distances involved. It is likely that innocent sources of radiation (such as natural sources or medical sources) will also be within the field of view and it is therefore important to be able to identify different radioactive isotopes (nuclides). An ideal radiological search system, deployed in aerial searches, sea searches, and mobile searches, would confirm the presence of radiological sources and correctly identify the source.

For portable search applications, ORTEC has very recently developed an interchangeable detector module or “IDM”. An IDM is a completely integrated detector subassembly that builds on the success of The Detective-EX. The IDM incorporates an 85mm diameter high purity germanium crystal, Stirling cooler, and signal processing electronics into a rugged and flexible package. The modular design allows for maximum flexibility in configuring systems or sub-systems to application-specific needs. Multiple IDM’s may be configured into arrays and employed for a specific search application. By adding more IDM’s to an array, it is possible to increase the standoff detection range for a source of a given strength. These IDM’s can be mounted on or in UAV’s, helicopters, fixed wing aircraft, ships, and vehicles to search for radiological or nuclear material. For example, if a intelligence reports indicated that a possible terrorist radiological or nuclear threat existed in a particular city, it is now possible to quickly deploy a search system consisting of multiple IDM’s that could search, locate, and identify the potential threat. The array can be designed to allow rapid and easily installation in almost any suitable vehicle.