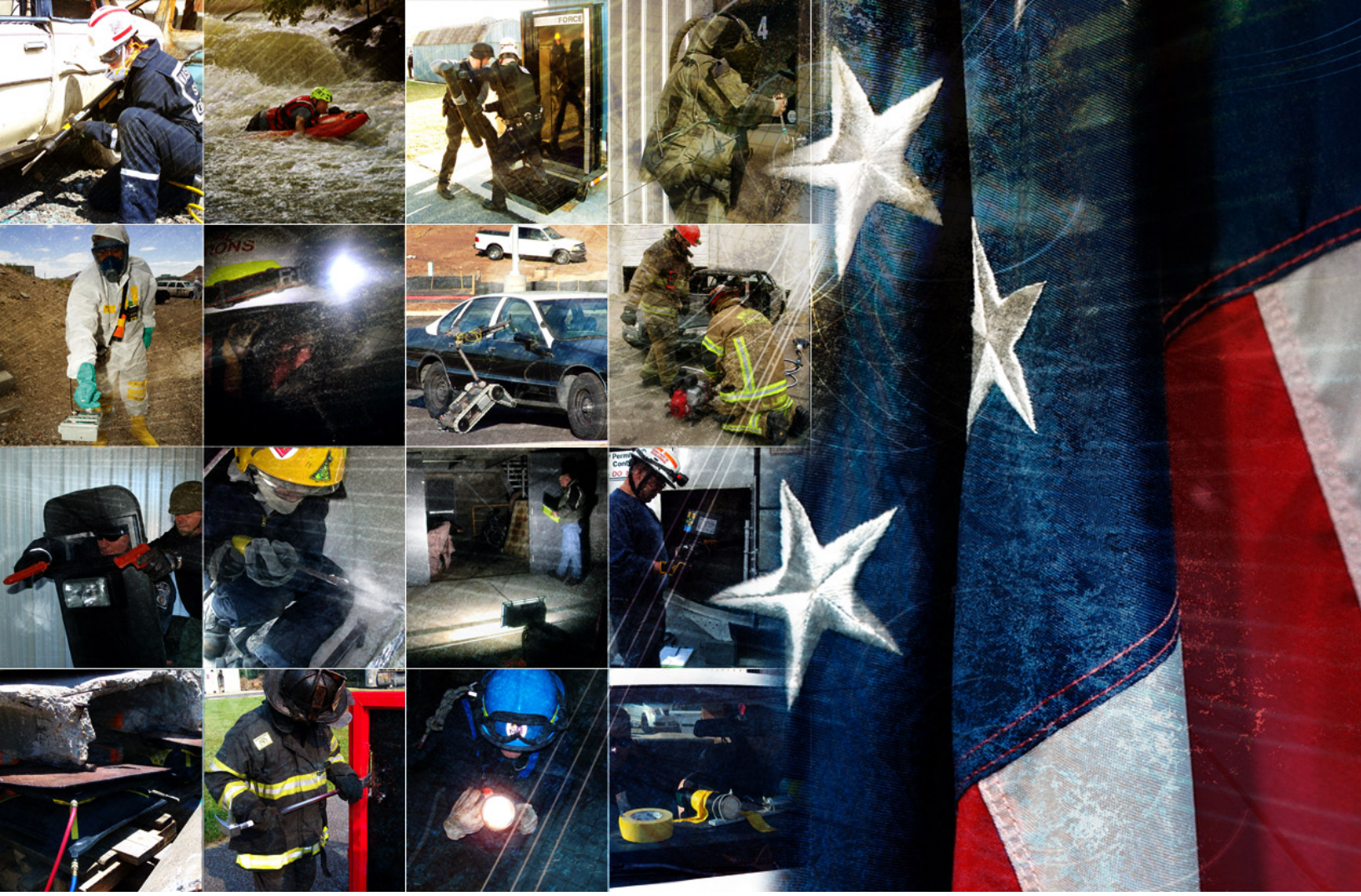

System Assessment and Validation for Emergency Responders (SAVER)

Standoff Radiation Detectors Market Survey Report

August 2013

Homeland Security

Science and Technology

U.S. Department of Homeland Security

SAVER

System Assessment and Validation for Emergency Responders

Prepared by the National Urban Security Technology Laboratory

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FOREWORD

The U.S. Department of Homeland Security (DHS) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders making procurement decisions. Located within the Science and Technology Directorate (S&T) of DHS, the SAVER Program conducts objective assessments and validations on commercial equipment and systems, and provides those results along with other relevant equipment information to the emergency responder community in an operationally useful form. SAVER provides information on equipment that falls within the categories listed in the DHS Authorized Equipment List (AEL). The SAVER Program mission includes:

- Conducting impartial, practitioner-relevant, operationally oriented assessments and validations of emergency response equipment; and
- Providing information, in the form of knowledge products, that enables decision-makers and responders to better select, procure, use, and maintain emergency response equipment.

Information provided by the SAVER Program will be shared nationally with the responder community, providing a life- and cost-saving asset to DHS, as well as to Federal, state, and local responders.

The SAVER Program is supported by a network of Technical Agents who perform assessment and validation activities. Further, SAVER focuses primarily on two main questions for the emergency responder community: "What equipment is available?" and "How does it perform?"

As a SAVER Program Technical Agent, the National Urban Security Technology Laboratory has been tasked to provide expertise and analysis on key subject areas, including chemical, biological, radiological, nuclear, and explosive weapons detection; emergency response and recovery; and related equipment, instrumentation, and technologies. In support of this tasking, NUSTL conducted a market survey of commercially available standoff radiation detectors (SRDs). SRDs fall under AEL reference number 07RD-04-SGND titled Detector, Gamma/Neutron, Standoff.

Visit the SAVER section of the Responder Knowledge Base (RKB) website at https://www.rkb.us/saver for more information on the SAVER Program or to view additional reports on SRDs and other technologies.

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1. INTRODUCTION

Standoff radiation detectors (SRDs) are devices that can locate a radiation source from a distance and determine whether or not it constitutes a threat. To provide emergency responder and law enforcement organizations with information on SRDs, the System Assessment and Validation for Emergency Responders (SAVER) Program conducted a market survey on commercially available SRD systems.

This market survey report is based on information gathered between February 2013 and April 2013 from a search of vendor websites, industry publications, an emergency responder focus group, and a government-issued Request for Information (RFI) posted on the Federal Business Opportunities (FedBizOpps) website (https://www.fbo.gov).

For inclusion in this report, SRD systems had to meet the following criteria:

- Commercial off-the-shelf (COTS) products;
- Larger than personal or handheld radiation detectors;
- Able to determine the direction of radiation sources;
- Able to distinguish threats from background and normally occurring radiation;
- Mounted in a vehicle or designed to be mounted in a vehicle; and
- Able to detect radiation sources from a standoff distance that depends on the application.

Although radiation detection backpacks may meet the above criteria, they are not included in this report, but are discussed in other SAVER publications.

Due diligence was performed to develop a report that is representative of products in the marketplace.

2. STANDOFF RADIATION DETECTOR OVERVIEW

Illicit radioactive material is a danger to the public in a variety of ways. For instance, special nuclear material (SNM) such as uranium-235 and plutonium-239 can be used in the construction of an improvised nuclear device. Industrial radioisotopes such as cobalt-60 can be dispersed into the environment through a radiological dispersal device, also known as a "dirty bomb." High-activity sources can also be used to harm the public without their knowledge with what are known as radiation exposure devices. Although the vast amount of radioactive material is used for legitimate and beneficial purposes, law enforcement and homeland security personnel need to be able to quickly determine which radioactive materials constitute a potential threat.

SRDs search for radioactive material from a certain standoff distance so that a wide area of coverage can be obtained and so that search operations can be performed covertly. SRDs contain features that assist operators in locating and identifying the radioisotope in the source of radiation. SRDs may be deployed on land, sea, or air. They can be mounted in many different mobile platforms such as vans, trucks, sport utility vehicles (SUVs), boats, helicopters, and other aircraft. The requirements for detector sensitivity vary with each application. In general, SRDs

must contain detectors that are sensitive enough to be able to detect and distinguish a threatening radiation source from an appropriate distance that allows for effective and covert searches.

2.1 Current Technologies

The key technologies employed in commercially available SRDs are gamma detection, neutron detection, source localization, and features associated with system software and communications. Gamma detection includes distinguishing threats from naturally occurring radiation through gamma spectroscopy.

2.1.1 Gamma Detection

Gamma detectors are used in SRD systems to determine the radiation exposure rate and the radioisotope present in a detected radiation source.

Radiation exposure rate is a measure of the intensity of gamma rays (and X-rays if present) at a point in space. The exposure rate of background radiation varies, but is typically in the range of 1 to 10 micro-Roentgens per hour (μR/h). When a radiation source is present, exposure rate readings can be thousands of times higher than background. In this case, the exposure rate reading would likely be expressed in milli-Roentgens per hour (mR/h).

Spectroscopic gamma detectors are needed to determine the radioisotopes that make up the source. These detectors measure the gamma energy spectrum, which is the number of counts in each gamma energy range plotted against energy. Spectroscopic gamma detectors generally measure gamma energies in a range from approximately 30 to 3,000 kiloelectron volts (keV). Each radioisotope emits gamma rays with characteristic energies. For instance, cesium-137 emits gamma rays of 662 keV. A peak in a measured gamma spectrum at this energy is indicative of the presence of cesium-137. SRD systems contain radioisotope identification software that matches peaks in measured gamma spectra with gamma-ray energies emitted by various radioisotopes. The software will generally contain a library of radioisotopes and will assign a threat level to each based on whether it is naturally occurring, medical, industrial, or SNM. Vendors have proprietary identification algorithms that may result in performance differences between systems with the same detector type.

An important property of a spectroscopic gamma detector is its resolution, which is defined as the ability to distinguish closely spaced peaks in a gamma spectrum. The most commonly used spectroscopic gamma detector is thallium-doped sodium iodide (NaI(Tl)), which has adequate resolution for identifying most radioisotopes. Thallium-doped cesium iodide (CsI(Tl)) has poorer resolution than NaI(Tl), but can handle more severe levels of shock and vibration. Cerium-doped lanthanum bromide ($LaBr_3$:Ce) detectors have approximately twice the resolution of NaI(Tl), but are more costly. High-purity germanium (HPGe) detectors are semiconductor crystals that must be cooled to liquid-nitrogen temperatures before being operable. Most SRD systems using HPGe detectors contain a built-in refrigeration system that requires several hours of cooling time during startup. HPGe detection systems cost more than most other detector types, but have the advantage of very high resolution.

All gamma-detecting SRD systems included in this report contain spectroscopic gamma detectors. Many of these systems also contain non-spectroscopic gamma detectors to increase detection range or add sensitivity to the system. For example, the Geiger-Müller (G-M) tube can measure very high exposure rates, whereas most spectroscopic gamma detectors will overload at

approximately 100 mR/h. SRD systems may also contain plastic scintillators, which can be made in large sizes at relatively low cost. Plastic scintillators such as polyvinyl toluene (PVT) are often used to add detection sensitivity to an SRD system.

2.1.2 Neutron Detection

Neutrons are uncharged particles that are emitted during nuclear fission and by industrial neutron sources. Some radioisotopes, particularly californium-252 and plutonium-240, can fission spontaneously, emitting neutrons. Since the SNM plutonium always contains some plutonium-240, it emits a significant number of neutrons. Therefore, detection of neutrons in quantities above background indicates a possible threat.

One of the challenges for neutron detection is being sure that the radiation being detected is really neutrons and not gamma rays, which are usually more numerous. The sensitivity of neutron detectors to gamma rays varies with the detection material and detector design. Low gamma sensitivity is desirable since this minimizes false neutron alarms caused by the presence of gamma rays.

The most common and efficient way to detect neutrons is to first slow them down from fission energies (fast neutrons) to very low energies (thermal neutrons) by passing them through a moderating material such as high-density polyethylene (HDPE). They can then be readily captured by certain materials such as helium-3, lithium-6, and boron-10, which absorb thermal neutrons thousands of times more effectively than most other materials. When these materials capture neutrons, they emit charged particles. In electronic detectors or scintillators, the charged particles from neutron capture produce a large signal that can be distinguished from the smaller signal produced by gamma rays.

The most common type of neutron detector in use is the helium-3 proportional counter. Helium-3 proportional counters are particularly effective due to their high sensitivity to neutrons and low sensitivity to gamma rays. At the time of the writing of this report, however, they are not widely available due to the scarcity of helium-3. Some of the SRD systems described in this report have helium-3 detectors listed as an option. It should be noted that this option is being phased out and may not be available much longer. In some cases, it is only available if the customer can supply the helium-3.

Neutron detectors using lithium-6 and boron-10 are now widely deployed in SRDs and other radiation detection systems. Lithium-6 is incorporated into glass scintillators, often panels of scintillating fibers. When bombarded with neutrons, lithium-6 glass-scintillating fibers emit visible light, which can be detected using a photomultiplier tube. Boron-10 gives off charged alpha particles when it captures neutrons. A thin layer of boron-10 can be coated on the inside of a gas proportional counter, which detects the emerging alpha particles. Boron-10 can also be coated on a scintillator such as silver-doped zinc sulfide (ZnS(Ag)), which emits visible light in response to alpha particles. Lithium and boron detectors can be manufactured to create large detectors at relatively low cost.

2.1.3 Source Localization

One of the main characteristics of an SRD is its ability to determine the location of a source. One way to achieve this is to have right- and left-side detectors with some shielding between them. Other systems have detector arrays with multiple detection zones that can more accurately

determine the direction of the source by comparing the radiation exposure rate at each zone. More complex systems use detectors with collimators to shield out radiation from certain angles. Collimators reduce the field of view of a detector, but also reduce the contribution of background radiation, which helps to distinguish a weak radiation signal from the background. Multiple collimated detectors positioned at different angles can be used to form an effective standoff detection system.

Source imaging, a complex method for determining the exact location of a radiation source, is not yet widely available in commercial systems and is discussed in Section 2.4.

2.1.4 Software and Communications

SRD systems generally come with a software package that contains features for processing, storing, and displaying data. The software usually runs on a laptop or personal computer (PC) that may or may not be included with the system. Other equipment common to SRD systems includes speakers for alarm annunciation, global positioning system (GPS) satellite receivers for determination of latitude and longitude, IEEE 802.11 wireless transceivers (also known as Wi-Fi) for short range data transmission to other wireless devices, and third-generation (3G) or fourth-generation (4G) cellular modems for transmission of data to a command center or reachback facility.

Typical features of SRD system software include:

- Radioisotope identification;
- Generation of alarms from gamma and/or neutron radiation measurements;
- Transmission of alarms to a remote handheld device (remote paging);
- Display of gamma exposure rate and/or neutron count rates in various detection zones;
- Display of gamma spectra, identified radioisotopes, and threat-level assessment;
- Display of vehicle position on a geographical information system (GIS);
- Display of the position of detected sources;
- Routines for testing the energy calibration of gamma detectors with a check source;
- Training routines that allow the operator to view screens that display when threatening materials are detected; and
- Utilities that allow data to be organized and sent to a reachback facility.

2.2 Applications

SRDs are used by law enforcement and emergency responder personnel to find lost, stolen, illegal, or potentially threatening radiological sources. They can be used in a variety of search configurations on land, sea, and air.

When mounted in cars, trucks, or trailers, SRDs can be used in the following ways:

- Screening before events;
- Screening Presidential routes;
- Searching large areas (parking lots, housing developments, etc.);
- Screening traffic at chokepoints;
- Scanning traffic at patrolling speed;
- Scanning large storage facilities; and
- Mapping background radiation levels across large areas.

When mounted in boats, SRDs can be used for:

- Searching ports and marinas;
- Scanning traffic at ferry terminals;
- Scanning other boats and ships; and
- Covering marine border crossings.

When mounted in planes or helicopters, SRDs can be used for:

- Surveying for radiological plumes;
- Searching for sources on the ground; and
- Covering remote border crossings.

2.3 Standards/Regulations

The standard most relevant to SRDs is American National Standards Institute (ANSI) N42.43, titled *Testing and Evaluation Protocol for Mobile and Transportable Radiation Monitors Used for Homeland Security.* This document establishes performance requirements and testing protocols for mobile and transportable alarming radiation detectors. Specifications are included for the following test categories: radiological, temperature and humidity, electrical and electromagnetic, electrostatic discharge, impact and vibration, moisture and dust, and drop.

ANSI N42.42, titled *Data Format Standard for Radiation Detectors Used in Homeland Security*, specifies a standard Extensible Markup Language (XML) data format used for both required and optional data that is generated by radiation measurement instruments. Data display and analysis software tools that are available at laboratories and reachback centers are designed to read ANSI N42.42 compliant data files. The use of a standard data format allows a large number of software tools to be able to read data from the radiation measurement instruments of all vendors that comply with the standard.

Many vendors reported ingress protection (IP) ratings for the enclosures used in their systems. The IP standard is specified in the International Electrotechnical Commission (IEC) 60529 standards document, titled *Degree of Protection Provided by Enclosures*. The rating is specified as "IP" followed by two numbers that are codes for dust protection and water protection, respectively. Dust protection codes range from 0 (no protection) to 6 (total protection). Water protection codes range from 0 (no protection) to 8 (protected against long periods of high-pressure water immersion).

2.4 Emerging Technologies

Many developmental SRD systems use advanced imaging techniques for locating radioactive sources. Imaging gives the precise location of the source and also improves the probability of distinguishing a threat from background since a threat is concentrated in one spot while background is spread over a large area. One method of imaging uses a *coded aperture*. This technique involves placing the detector within shielding material that contains one or more apertures. Either the detector or the shield is then rotated, and sensors on the shield capture aperture positions at each point in time. System software correlates variations in the detector signal with aperture position to determine the angle the source makes with the detector. Coded apertures work with gamma and neutron detectors and give a wide field of view compared with other imaging methods.

Another technique, called *Compton imaging,* makes use of the phenomenon known as Compton scattering, which occurs when a gamma ray transfers part of its energy to a detector and exits at an angle that depends upon the amount of energy deposited. Compton imaging systems deploy layers of flat panels containing scintillating detector arrays so that scattered gamma rays will register on more than one detector panel. When gamma rays in time coincidence register on multiple panels, system software can determine the scattering angles. This data is then used to find the incident angle of the gamma rays and, thus, the position of the source. Compton imaging is more effective with high-energy gamma rays, while encoded apertures are more effective with low-energy gamma rays. Neutrons can also be imaged by measuring their scattered path between two detector panels and the energy deposited in each detector, a technique similar to Compton imaging.

An image is normally displayed on a screen with color coding for source intensity and coordinates indicating the position of the source relative to the detection vehicle.

3. PRODUCT DATA

The SRD systems covered in this report range in price from $15,150 to $1,200,000. These systems contain a wide range of environmental and detection capabilities. Some systems are designed for airborne use only, while others can be used on land, sea, and air. Most of the systems contain both gamma and neutron detectors. However, one system contains only gamma detectors and one system only neutron detectors. One system performs source imaging. Four of the systems can be purchased with a vehicle. In each case, the vehicle is an SUV.

Products are listed in alphabetical order by vendor. The product data was obtained directly from the vendor except where otherwise noted. The information obtained has not been independently validated by the SAVER program.

Features in Table 3-1 are defined as follows:

Company indicates the manufacturer of the SRD system.

Product indicates the product name of the SRD system.

Cost indicates the price of the SRD system as quoted by the vendor in U.S. dollars. If a cost range is given, this indicates that the price of the system varies according to options that the buyer may choose.

Equipment Size indicates the length, width, and height of the equipment in the SRD system, including enclosures, but not including the vehicle in which the equipment is mounted. Values are rounded to the nearest inch.

Weight indicates the weight of the equipment in the SRD system, in pounds, including enclosures, but not including the vehicle in which the equipment may be mounted.

Gamma Detectors indicates the types of gamma detectors used in the SRD system, the size of each detector, and the number of detectors.

Neutron Detectors indicates the types of neutron detectors used in the SRD system, the active area of each detector, and the number of detectors.

Operating Environment indicates the types of environment (land, sea, air) in which the SRD system is designed to operate.

Wireless Capabilities indicates the wireless technologies (Wi-Fi, cellular 3G, etc.) that are included with the SRD system and with which data can be transmitted to another location.

Alarm Modes indicates the types of alarms (audio, video, vibrate) that the SRD system is capable of generating when a radiological source is detected.

Remote Paging indicates whether or not the SRD system can transmit alarms to a separate handheld device.

Check Source Routine indicates whether or not the SRD system has a built-in test routine that allows the operator to place a check source in the vicinity of the detectors to ensure proper energy calibration and operation of the system.

Training Mode indicates whether or not the SRD system has a feature in which the software simulates sources and alarms for training purposes.

Command Center Connectivity indicates whether or not the SRD system can connect and exchange data with an agency's command and control center.

GPS/Recall Mode indicates whether or not the SRD system contains GPS position capability and whether or not the SRD system can play back stored radiation data linked to position and time.

Table 3-1. Product Comparison Matrix

Company	Product	Cost ($)	Equipment Size (Length x Width x Height) (inches)	Weight (pounds)	Gamma Detectors	Neutron Detectors	Operating Environment	Wireless Capabilities	Alarm Modes	Remote Paging	Check Source Routine	Training Mode	Command Ctr Connectivity	GPS/Recall Mode
Bubble Technology Industries, Inc.	FlexSpec Mobile	195,000 – 260,000	39 x 54 x 36	550	NaI(Tl) 2 x 4 x 16 inches 4 each	Lithium-6 17 x 9.5 inches 2 each	Land, Sea, Air	Wi-Fi, 3G/4G cellular	Audio, Video	Yes	Yes	No	Yes	Yes/ Yes
FLIR Radiation, Inc.	iFind Compton Camera 442	600,000 – 1,200,000	80 x 51 x 76	1,985	NaI(Tl) 3 x 3 x 3 inches 16 each; and PVT 3 x 3 x 3 inches 16 each	None	Land, Sea, Air	Wi-Fi (opt)	Video	Yes	Yes	No	Opt	Opt/
Innovative American Technology, Inc.	Mobile Radiation Verification System	175,000	25 x 45 x 39	232	NaI(Tl) 2 x 4 x 16 inches 4 each	Lithium-6 4 x 25 inches 4 each	Land, Sea	Wi-Fi, cellular	Audio, Video, Vibrate	Opt	Yes	Yes	Yes	Yes/ Yes
	Rapid Deployment Radiation Verification System	75,000	28 x 32 x 32	150	NaI(Tl) 2 x 4 x 16 inches 2 each	Lithium-6 4 x 25 inches 2 each	Land, Sea, Air	Wi-Fi, cellular	Audio, Video, Vibrate	Opt	Yes	Yes	Yes	Yes/ Yes
Mirion Technologies, Inc.	SPIR-Ident Mobile Monitoring System	285,000	13 x 17 x 35 (each of 3 cases)	260	NaI(Tl) 4 x 4 x 16 inches 4 each	Opt: BZnS(Ag) 1.9-inch diameter x 19 inches	Land, Sea, Air	Wi-Fi, 3G/4G cellular	Audio, Video	Opt	Yes	Yes	Yes	Yes/ Yes
Nucsafe, Inc.	ARDIMS Aerial Pod System	NA	73 diameter x 13 length (each pod)	180	NaI(Tl) 2 x 4 x 16 inches 4 each	Lithium-6 26.7 x 8.8 inches 2 each	Air	Wi-Fi	Audio, Video	Opt	Yes	No	Yes	Yes/ Yes
	Guardian Predator Portable Radiation Detection Kit	NA	28 x 22 x 14	68	NaI(Tl), CsI(Tl), PVT, G-M tube (many configuratons available)	Lithium-6 19 x 9 inches; or Helium-3 16.5 x 8.5 inches	Land, Sea, Air	Wi-Fi	Audio, Video, Vibrate	Opt	Yes	No	Yes	Yes/ Yes

Table 3-1. Product Comparison Matrix (continued)

Company	Product	Cost ($)	Equipment Size (Length x Width x Height) (inches)	Weight (pounds)	Gamma Detectors	Neutron Detectors	Operating Environment	Wireless Capabilities	Alarm Modes	Remote Paging	Check Source Routine	Training Mode	Command Ctr Connectivity	GPS/Recall Mode
ORTEC®	Detective-200	95,000 – 380,000	15 x 10 x 17	47	HPGe 3.3-inch diameter by 1.2-inch height	Helium-3 0.5-inch diameter by 4 inches; or (2) Lithium-6 4 x 10 inches	Land, Sea, Air	Wi-Fi (Cellular, Satelllite optional)	Audio, Video	Yes	Yes	No	Yes	Yes/ Yes
Proportional Technologies, Inc.	Straw Standoff Neutron Detector	15,150 – 48,500	6 x 8 x 43 *	85 †	None	Boron-coated straw	Land, Sea	None	Audio, Video	No	Yes	No	No	No/ No
Radiation Solutions, Inc.	RS-500 Digital Airborne Gamma-Ray Spectrometer	NA	29 x 22 x 11	250	NaI(Tl) 4 liters 5 each	NA	Air	NA	NA	NA	NA	NA	NA	NA/ NA
	RS-700 Mobile Radiation Monitoring System	NA	27 x 6 x 7	70	NaI(Tl) 4 liters 1 or 2 per case	Helium-3 2-inch diameter by 32 inches	Land, Air	NA	NA	NA	NA	NA	NA	Yes/ NA
Thermo Fisher Scientific, Inc.	Mobile Matrix ARIS	NA	NA	NA	NaI(Tl) 7-liter probes 2 each	Helium-3; no other information is available	Land, Sea	Multiple options available	NA	NA	NA	NA	NA	Yes/ Yes

Notes:
* Size varies by model; the size of the largest model is reported here
† Weight varies by model; the weight of the heaviest model is reported here

Abbreviations:
NA = information not available
Opt = feature is optional
NaI(Tl) = thallium-doped sodium iodide
CsI(Tl) = thallium-doped cesium iodide
HPGe = high-purity germanium
BZnS(Ag) = boron with silver-doped zinc sulfide
PVT = polyvinyl toluene
G-M tube = Geiger-Müller tube
3G, 4G = third generation, fourth generation cellular
Wi-Fi = contains wireless transceiver

3.1 Bubble Technology Industries, Inc., FlexSpec Mobile

COST: $195,000 without vehicle; $260,000 integrated with Chevy Tahoe
GSA SCHEDULE: No
WARRANTY: 1 year for sensor kits; vehicle comes with manufacturer's warranty

The FlexSpec Mobile is a mobile radiation detection system that provides high-sensitivity gamma and neutron detection with left versus right directionality. The sensor kit can be procured as a standalone kit, which can be moved from one vehicle to another, or integrated with a vehicle. The standard vehicle for an integrated system is the Chevrolet Tahoe. All detectors can be extracted without interference from other system components. The standard Tahoe system comes with a removable custom installation frame. Universal frames or ruggedized cases are also available to accommodate other installation scenarios, including maritime and airborne applications.

FlexSpec Mobile
Courtesy of Bubble Technology Industries, Inc.

The standard FlexSpec Mobile sensor kit includes four NaI(Tl) gamma detectors, two lithium-6 scintillating neutron detectors, a control box, a Panasonic Toughbook computer, and a universal mounting kit. Other sensor configurations, including G-M tubes and $LaBr_3$:Ce detectors, are available. The system provides radioisotope identification, alarm categorization, and real-time mapping of alarms with integrated GPS. Left- and right-side data are stored separately and stamped with time and location. The system software runs on the laptop and can be monitored and controlled remotely over FlexSpec's secure Wi-Fi network by any authorized, web-enabled smart phone or tablet. A 3G wireless connection (4G optional) allows transmission of data to reachback centers. FlexSpec Mobile features automatic generation of the Domestic Nuclear Detection Office (DNDO) Joint Analysis Center (JAC) form, populated with alarm data and user information captured at system login. Spectra are attached to the JAC form. Additional information can be added by the operator.

The default display shows left/right histograms, GPS mapping, recent alarm history, and basic system health information. When an alarm is generated, the map is hidden, and the alarm notification is displayed with a colored arrow indicating alarm classification and left/right source position. Additional details, such as the radioisotope identified, confidence level, GPS location, and time are viewable at the bottom of the screen in an alarm-history table. Each gamma spectrum can be viewed during alarm notification or from the alarm-history table. Additional screens include manual mode, a health screen, a custom-settings screen, and a help screen.

The system is ready for operation from a cold-start within 10 minutes. Energy calibration is performed automatically and continuously using natural background radiation. Radioactive sources or periodic factory calibration are not required. However, a check source can be presented and the correct radioisotope identification and peak position can be verified through the gamma spectrum. Manual energy calibration with a check source is not required and is not supported in the standard system software.

The FlexSpec Mobile sensor kit is powered from the 12-volt direct current (DC) vehicle battery and draws an average current of 7.5 amps and a maximum current of 14 amps. Shore power requires the installation of an optional power supply. The operating temperature range is -4°F to 122°F. The system's gamma detectors are thermally and mechanically protected with insulating foam. The gamma detectors are packaged in a gasket-sealed aluminum enclosure that protects against water ingress, electromagnetic interference (EMI), radio frequency interference (RFI), and impact. The neutron detectors are encased in HDPE and are protected against vibration in the shock-mounted detector bracket. For in-vehicle operation, the system electronics are packaged in an Underwriters Laboratories (UL)-listed IP20 electrical enclosure. Other enclosures are available for outdoor installations. Connections between the sensors and the system control box are made with MIL-DTL-38999 bayonet connectors. All connectors are locking.

Maintenance contracts that start at $10,000 per year are available with up to 5 years payable up front. Remote and onsite training can also be arranged. Repair options include shipping the equipment to the vendor's facility or having the vendor send a repair technician. Trade-ins and vendor-provided disposal are available. Customers may also receive trade-in value for other mobile systems where gamma or neutron detectors can be re-used.

3.2 FLIR Radiation, Inc., iFind Compton Camera 442

COST: 600,000 - $1,200,000; cost varies based on configuration and options
GSA SCHEDULE: No
WARRANTY: 1 year; extended warranties are available for 5 years

The iFIND Compton Camera (iCC) 442 is a standoff gamma radiation detection system that provides source location via Compton imaging. The default configuration provides a four-square array of detectors in two planes. PVT detectors are arranged in the scatter plane and NaI(Tl) detectors are arranged in the absorber plane. A minimum of 16 detectors are needed in each plane. More can be purchased as an option. The Compton camera imaging is overlaid on top of real-time video, and radioisotope detection and identification software is integrated into the system.

iFind Compton Camera 442
Courtesy of FLIR Radiation, Inc.

The iCC 442 is designed for mobile applications and can be mounted in a truck, trailer, or small marine vessel. It fits in the bed of a full-size pickup truck or oversized van in its current configuration. It can also be tailored to fit in a variety of vehicles, vessels, and rotary wing aircraft. According to the vendor, the system has been evaluated by the Defense Threat Reduction Agency (DTRA) and DNDO.

The system has three modes of operation: detect mode, identify mode, and locate mode. In detect mode, which is the default for the system, algorithms generate a sum spectrum from all detectors and search for a radioactive source by scanning for an increased count rate in certain regions of interest in the spectrum. When an alarm is triggered, the system automatically switches to identify mode and produces a list of isotopes found. The system then automatically enters locate mode and determines the direction of the source using its Compton imaging capability. All data

is stored on an internal Windows-based server computer, and results are displayed on the operator's screen in a Web-browser application. Operators can view the estimated source direction superimposed on the live video from the optical camera. Gamma spectra are not visible in operating modes, but are available for reachback and replay. The vendor's reachback and replay software are standard features. GPS and Wi-Fi capability are options.

The iCC 442 has a built-in heating, ventilation, and air conditioning (HVAC) system that provides a constant temperature within its enclosure. Approximately 20 minutes is needed for calibration and detector warm-up or cool-down at system start. Potassium-40 in the background is used as a calibration source upon startup of the system.

The system operates from a power input of 105 to 132 volts alternating current (AC) and draws less than 6 amps root mean square. Other voltage inputs are available with a modification. The system is not waterproof in its default configuration, but can be supplied with an enclosure that is rated IP54 when closed for transport and IP52 when operating. The instrument stands on a rubber buffer, and foam rubber between the detectors and detector housing provides additional shock absorption. Commercial grade connectors are standard, but can be upgraded to meet customer specifications.

Maintenance contracts are available with up to 5 years payable up front. Pricing is determined by specific customer requirements. On-site operator training is available within the continental United States for $3,500 for the first day and $2,500 per additional day. One day is usually sufficient. Repairs can be made on-site or at the vendor's facility. Disposal options are not currently available.

3.3 Innovative American Technology, Inc., Mobile Radiation Verification System

COST: $175,000 without vehicle
GSA SCHEDULE: No
WARRANTY: 1 year

The Mobile Radiation Verification System (MRVS) provides standoff detection and/or perimeter protection against radiological hazards. Mounted on a vehicle or boat, the system detects hidden threats in containers, buildings, vehicles, or in vessels approaching a harbor. The MRVS can be mounted on top of or inside a vehicle as a permanent installation or as a removable system. It can optionally be purchased with a Chevrolet Tahoe or Chevrolet Suburban. A slide-out tray with legs and wheels facilitates installation and removal. This technology is suitable for military marine interceptors, police vehicles or vessels, emergency responders, and private vehicles or vessels deployed in support of industry.

Mobile Radiation Verification System
Courtesy of Innovative American Technology, Inc.

The MRVS provides gamma and neutron detection, radioisotope identification, source location, GPS mapping, a graphic user interface, and reachback capabilities consistent with N42.42. The

MRVS determines source direction within 2 to 5 degrees using the patented Radiation Detection Finder (RDF) technology. The design has no moving parts and provides source direction in a 360-degree field of view by sandwiching together detectors aligned at a 90-degree angle to one another. The MRVS has compass information and GPS mapping displayed to identify the MRVS position and the source direction and position. The system is dynamic and can follow the source movement.

The user interface displays the alarm conditions, background radiation, radiation exposure, system health status, and a map derived from GPS data. An arrow indicator displays the current position and orientation of the vehicle. If suspect materials are detected, an alarm tone sounds and a visual alarm flashes in a specific color that represents the threat level. Details about identified materials are displayed in the identification table. This includes source type, intensity, and confidence level. If a gamma source has been detected and the RDF is installed, a vector is displayed on the map emanating from the center icon in the direction of the source and indicating its location.

Alarm data is stamped with date, time, GPS position, and spectral data associated with the alarm. The data is not accessible without a pass code. All data is stored and can be transmitted in N42.42 format. Data can be recalled using the target history utility, which displays a chronological list of completed inspections. Each record displays an identification number, the time and date of the event, GPS position, alarm state, type of detection (including intensity and confidence level), identified nuclides, and spectral image.

A software application running on a handheld device can be used to operate and monitor the system over a Wi-Fi connection. This application provides a similar interface as the system console. Alarms can be set to vibrate with the handheld display.

The MRVS is ready in less than one minute and will compensate temperature changes. Neutron detectors are calibrated in the factory. Gamma detectors require periodic cesium-137 calibration checks. The system operates from a vehicle battery and consumes 26 watts with the RDF activated. Other power options include an onboard generator, shore power, and backup battery. The MRVS enclosure has an IP67 rating and is shielded for EMI and RFI. Shock mountings are provided on the enclosure. MIL-DTL-26482 rated connectors are used throughout. The operating temperature range is -40°F to 122°F. The MRVS complies with the ANSI N42.43 standard.

Maintenance contracts are available and can be tailored to the customer's needs. A training course is offered with the system. Charges consist of travel expenses and time of vendor personnel. Vendor-provided disposal is available.

3.4 Innovative American Technology, Inc., Rapid Deployment Radiation Verification System

COST: $75,000 in default configuration; price varies with options
GSA SCHEDULE: No
WARRANTY: 1 year

The Rapid Deployment Radiation Verification System (RD-RVS) is a self-contained standoff radiation detection system housed in rugged, sealed, stackable cases with handles. It can be placed in a wide variety of vehicles, vessels, or aircraft. The technology is suitable for military marine interceptors, police vehicles or vessels, emergency responders, and private vehicles or

vessels deployed in support of industry. The RD-RVS detects hidden threats in containers, buildings, vehicles, or in vessels approaching a harbor.

Rapid Deployment Radiation Verification System
Courtesy of Innovative American Technology, Inc.

The RD-RVS offers a variety of gamma, neutron, and power modules that can be configured to create the desired system. NaI(Tl) detectors are available with a 2-inch by 4-inch cross sectional area and lengths of either 8 or 16 inches. The standard gamma module contains two NaI(Tl) detectors with dimensions of 2 by 4 by 16 inches. Lithium-6 neutron detectors are available in different sizes and configurations. When equipped with a Radiation Direction Finder (RDF) module, which is optional for the RD-RVS, the system can also direct the user to the source of gamma radiation.

The warm-up time, calibration requirements, RDF capability, software, display, communications, and data storage are similar to the MRVS system in section 3.3.

The system operates from a vehicle battery and consumes 26 watts with the RDF activated. Other power options include an onboard generator, shore power, and backup battery. The RD-RVS enclosure has an IP67 rating. Electronics are shielded in a metal housing and use differential signaling in key areas to protect against RFI. Shock mountings are provided on the enclosure. Components are separated by form-fitting foam cutouts within the case. Connectors are rated MIL-DTL-26482 and offer IP68/IP69 protection in mated and unmated conditions, respectively. The operating temperature range is -40°F to 122°F. The RD-RVS complies with the mechanical performance requirements of the ANSI N42.43 standard.

Maintenance contracts, training, and vendor-provided disposal are available.

3.5 Mirion Technologies, Inc., SPIR-Ident Mobile Monitoring System

COST: $285,000; price varies with specific accessory models (PC, GPS, cases, mounts, etc.)
GSA SCHEDULE: No
WARRANTY: 1 year

The SPIR-Ident Mobile Monitoring System is a mobile radiation monitor for vehicles, helicopters, airplanes, and vessels. The system can also be used as a temporary fixed portal for pedestrian and vehicle traffic. The SPIR-Ident technology automatically distinguishes between innocent alarms and alarms of interest such as SNM and industrial radioisotopes.

The SPIR-Ident Mobile Monitoring System consists of radiation sensors, GPS, and a computer running SpirSERVER and SpirMOBILE software. The SpirServer software manages connectivity to the sensors and maintains a database of all radiation measurements linked to time and location. The SpirMOBILE software features a GIS display that allows the operator to use custom maps or the capabilities of the Google Earth program for the representation of data anywhere on the globe. SpirMOBILE software replays missions, exports data, publishes reports, and analyzes data for deferred processing.

The standard version is configured in two detector cases and one interface case. A PC and cables are included in the interface case. These cases can be placed in the rear compartments of an SUV, fastened with straps in a rotary or fixed-wing aircraft, or placed as temporary cargo on a vessel deck. Special versions for permanent installation have also been developed. For example, roof-mounted containers for land-based vehicles and custom permanent installations on aircraft have been designed and deployed.

SPIR-Ident Mobile Monitoring System
Courtesy of Mirion Technologies, Inc.

The default configuration contains two NaI(Tl) gamma detectors in each detector case. Optionally, a neutron detector can be substituted for the second gamma detector in any case. The neutron detector available consists of boron-10 and ZnS(Ag) contained within a 4-centimeter thick block of polyethylene moderator. Although the default configuration consists of two detector cases, additional cases can be purchased. The detectors do not require periodic calibration, but the system does contain a check source routine that allows operators to check the detection resolution and peak position. The standard system allows for left and right source discrimination only, but special arrangements can be provided upon user request. For example, in a roof-case with four detectors in a square arrangement, the radiation direction can be determined within 45 degrees.

The SpirMOBILE application displays the current and most recent radiation measurement results, provides customizable sound and audio alarms, and allows operator commands. The user interface is based on the Single Document Interface concept. All pertinent information and commands are on a single screen. Only limited actions are needed and are available with a few commands accessible by touch screen or mouse. Measurements, alarms, identifications, spectra display, a large mapping area, and a list of previous alarms are visible. Gamma spectra can be displayed in real time and in various configurations based on user-selected software settings. A replay mode is available that recalls all details of previous measurements in the identical way it was captured.

The system records data in a local database. Data can be extracted in single events or groups of events and exported for reachback consistent with the N42.42 format. Data can be sent using a Web connection via Wi-Fi or cellular (3G or 4G depending upon the user's PC choice). Optionally, special needs, such as satellite transmission, can be accommodated.

The SPIR-Ident requires a power input of 85 to 264 volts AC or 10 to 32 volts DC. An internal battery provides up to 8 hours of standalone operation. The associated PC runs on its own batteries. The standard SPIR-Ident cases are built of polyester resin-strengthened glass fiber and have an IP54 rating for dust and moisture. The standard operating temperature range is -4°F to 122°F. This can be upgraded to -40°F to 122°F upon request. The connectors are rated MIL STD series C38999.

Maintenance contracts that are similar to extended warranties are available, with the cost based on a percentage of the sales price. An example would be 3 percent of the sales price for the

second year, 5 percent for the third year, etc. One day of on-site training is included with the system. Additional days cost $1,500 to $2,500 depending upon the location. Repairs can be made on-site or at the vendor's facility. Disposal options are not currently available.

3.6 Nucsafe, Inc., ARDIMS Aerial Pod System

COST: Costs vary with configuration
GSA SCHEDULE: GS-07F-0725X
WARRANTY: 1 year for parts and labor

The Nucsafe ARDIMS Aerial Pod System is comprised of pods designed to be attached to either a fixed-wing aircraft or a helicopter. Gamma ray and neutron pods are available, and each can be supplied with an altimeter. Detector pods are linked to a computer interface for processing of data.

ARDIMS Aerial Pod System
Courtesy of Nucsafe, Inc.

The default configuration contains one gamma pod and one neutron pod. The gamma pod assembly contains four NaI(Tl) detectors of dimensions 2 inches by 4 inches by 16 inches. The neutron pod assembly contains two solid state lithium-6 glass fiber neutron detectors, each with an active area of 26.7 inches by 8.8 inches and contained within 55.8 cubic inches of moderation material. Associated electronics and an altimeter are also included in each gamma and neutron pod. The detectors require calibration once per year.

A laptop computer with software provides data processing, control, and display. The data is stamped with time, date, and location information from an onboard GPS and altimeter. The laptop display contains gross gamma and neutron readings in numerical and graphical format along with mapping and spectra display. Standard features in the software include audible finder mode to assist with source localization, audio and visual alarms, a check source test routine, and recall mode. Remote paging is available as an option depending upon user requirements. Alarms and system health information are color coded. Data is ANSI N42.42 compliant and can be sent to reachback or to a command center by e-mail using cable or Wi-Fi.

The system can be powered from aircraft power, an onboard generator, or shore power. EMI resistance is provided by filters in each module of the system, and data is transmitted internally using differential signals. The operating temperature range is -22°F to 131°F.

Maintenance contracts are available with up to 5 years payable up front. Repairs can be made on-site or at the vendor's facility. The vendor also provides options for training, trade-ins, and vendor-provided disposal.

3.7 Nucsafe, Inc., Guardian Predator Portable Radiation Detection Kit

COST: Costs vary with model and features
GSA SCHEDULE: No
WARRANTY: 1 year for parts and labor

The Guardian Predator Portable Radiation Detection Kit is built for military, emergency responder, and law enforcement search applications. This auto-configuration mobile system can be utilized in a passenger car, pickup truck, SUV, box truck, off-road vehicle, watercraft, or aircraft. This system can also be employed as a temporary portal for vehicles or pedestrians at event venues.

Guardian Predator Portable Radiation Detection Kit
Courtesy of Nucsafe, Inc.

Auto-configuration technology allows devices to plug into a system and become operational without manual intervention, such as the setting of a software configuration file. Using this technology, many different detector types can be installed in the Guardian Predator Portable Radiation Kit. This provides the ability to utilize detectors specific to the mission with no manual setup. For example, when searching for gamma ray emitting material and radioisotope identification is required, up to five NaI(TI) detectors may be installed in one system. Neutron detector types such as helium-3 or boron-10 can also be used. The system can detect gamma rays, neutrons, alpha particles, and beta particles, and can perform radioisotope identification when the appropriate detectors are utilized.

Detector sizes and types can be selected according to the specific needs of the customer. Available gamma detectors include PVT, NaI(Tl), CsI(Tl), and G-M tubes. PVT is available in several sizes to allow for human-portable systems or for vehicle installation. NaI(Tl) and CsI(Tl) are typically provided in dimensions of 4 by 4 by 16 inches, 2 by 4 by 16 inches, or 2 by 4 inches with longer lengths. Helium-3 neutron detectors are available in several standard tube lengths for both vehicle and human-portable systems. Boron-10 neutron detectors are not available for human-portable applications due to their weight and size. Detector calibration is required once per year, and system startup is a 3-minute process.

The system comes with a laptop computer, a wrist-mounted liquid crystal display (LCD), and an option for a handheld personal digital assistant (PDA). Radiation alarms are visibly displayed on all devices and audibly through an earphone or through an optional external speaker. The wrist display and PDA can be set to vibrate upon alarms, with the vibration level proportional to the radiation level. Standard features in the software include audible finder mode to assist with source localization, a check source test routine, and recall mode. System health is color-coded along with alarms. Mapping is only available on the laptop display. Data is ANSI N42.42 compliant, is stamped with time, date, and GPS location, and can be sent to reachback or to a command center by e-mail using cable or Wi-Fi. Gamma spectra are not viewable unless downloaded to another program.

The system contains a lithium-ion battery charged by a standard AC power outlet. Other options for powering the equipment are vehicle battery, onboard generator, shore power, and backup battery. Batteries can be purchased that will power the system for 8 to 20 hours. The system enclosure is waterproof and can be submerged in water for 30 minutes. The operating temperature range is -22°F to 131°F. EMI resistance is provided by filters in each module of the system, and data is transmitted through shielded cables using differential signals.

Maintenance contracts are available with up to 5 years payable up front. Repairs are made at the vendor's facility. The vendor provides options for training, trade-ins, and vendor-provided disposal.

3.8 ORTEC®, Detective-200

COST: $95,000 for single unit; $380,000 for 4-unit turnkey system with computer and software
GSA SCHEDULE: Not currently, but may be available in the future
WARRANTY: 1 year

The Detective-200 is part of the ORTEC Detective product family and is specifically designed for standoff detection with higher sensitivity and more ruggedness than other Detective models. It contains an HPGe detector for gamma detection and spectral analysis, a G-M tube for increased dose-rate range, and an optional helium-3 or lithium-6 neutron detector. The Detective-200 can be used to search, locate, and identify nuclear threat sources. It can also be used as a choke point monitor, a wide-area search system, a maritime search system, or as a nuclide identifier.

Detective-200
Courtesy of Ortec

As an option, a turnkey system can be supplied with a Chevrolet Tahoe or a Chevrolet Suburban with built-in racks for as many as eight Detective-200s. Because of its modular design, multiple Detective-200s can be combined in many different configurations and can be deployed in many types of vehicles such as minivans, panel trucks, boats, and aircraft. As many as 16 units can be combined. When the Detective-200s are supplied without a vehicle, detector mounts can be provided for standard U.S. vehicles such as the Tahoe or Suburban. These systems can also be mounted in a vehicle using the standard transportation cases as the mounting device. For instance, a system with four Detective-200s can be installed in a Suburban and be operational in approximately 15 minutes. Each unit comes with a built-in removable 120-degree collimator to reduce background interference in the field of view. Custom collimation can also be deployed, allowing the system to be aimed at various angles once a nuclear threat has been detected.

The HPGe detector in the Detective-200 must be cooled down to cryogenic temperatures before use. The initial cool-down time is approximately 8 hours. Once cooled, ORTEC recommends that the system remain powered and cold so that it is ready for immediate deployment. If the detectors lose power, they have features that allow them to be cooled from any temperature, thus avoiding a traditional thermal recycle. Since HPGe detectors are operated at cryogenic

temperatures, they are not subject to temperature drift issues that affect other types of detectors as the ambient temperature changes during the day. The Detective-200 is factory calibrated and uses the naturally occurring potassium-40 peak for gain stabilization and to ensure the state of health of the instrument. A calibration check and energy alignment procedure is provided, but the need for it would be rare since the system maintains its own calibration and state of health.

The Detective-200 can be operated via an on-board LCD touch screen or via remote PC-based software. Various modes of operation include Identify, Search, SNM Search, Monitor, LCX (Expert Mode), Spectrum Display (for both real-time and recalled data), Background, and Status. The remote PC-based software integrates multiple Detective-200s into a composite system. Controls include Start Search, End Search, Stand-in, Background, Review Data, and Send Data to Reachback. The system automatically stores the time, date, and GPS location along with spectral data. The Detective-200s have on-board WiFi that allows them to communicate wirelessly to the computer. Once the data is in the local computer, a variety of options are available to transfer data to other locations. These include Wi-Fi, cell modem, and satellite phone. The Detective-Remote software application is capable of sending an alarm response to a remote phone, PDA, or annunciation device.

The Detective-200 can be powered with a 10 to 17 volt DC source and requires 5 amps during cool-down and 2 amps in normal use. An internal battery is provided which will power the unit for approximately 3 hours without charging. This can be extended with an external battery pack. The Detective-200 is normally powered from the 12-volt cigarette lighter on a vehicle or from a DC power supply, and the internal battery handles short-term power outages. The operating temperature specification is 14°F to 122°F. The Detective-200 case has an IP67 rating and is shock-resistant and designed to float in water. The system has been designed for military applications, to operate in extreme environments, and to pass the RFI requirement of ANSI 42.34. The connectors have been designed to meet IP67 requirements.

The maintenance contract or an extended warranty is configurable and payable in advance for up to 5 years. The price of the extended standard warranty is approximately eight percent of the list price of the Detective-200. Pricing will vary depending on the number of years in the contract. Training is customized based on the specific user requirements. Repairs can be made on-site or at the vendor's facility. Trade-ins and vendor-provided disposal are available.

3.9 Proportional Technologies, Inc., Straw Standoff Neutron Detector

COST: $15,000 - $48,500 depending upon model
GSA SCHEDULE: No
WARRANTY: 2 years

The Straw Standoff Neutron Detector consists of a number of individually sealed boron-coated straw (BCS) detectors, embedded in an HDPE moderator block. There are four models available, and the number of detectors and their size vary by model. The moderator/detector assembly is housed inside a sealed aluminum case that also contains a preamplifier, shaper,

Straw Standoff Neutron Detector
Courtesy of Proportional Technologies, Inc.

discriminator, and high-voltage power supply. Output connectors are located at the end face of the housing. The system also includes a separate electronics box that provides an electrical power interface and connection to a PC using an Ethernet cable. Separate transistor-transistor logic (TTL) and analog outputs are also provided. A Windows-based software package presents a user interface for basic controls, displays a live count rate and alarm status, and can identify fission sources by use of advanced functions for coincidence/multiplicity counting. The software package is included, but the user must provide the PC.

The following models are available:

Number of detectors	Detector diameter (mm)	Detector length (inches)	System weight (pounds)	Case size (inches)	Price ($)
30	15	36	85	12 x 5 x 40	15,150
196	4	12	24	6 x 5 x 15	23,500
234	4	39	62	6 x 6 x 43	45,150
309	4	39	84	6 x 8 x 43	48,500

The cases can be mounted in any desired orientation in any suitable vehicle. It is recommended that the detector case be mounted with its long axis horizontal. Detector calibration is not normally required. A neutron-emitting check source can be used to verify proper calibration. The charge gain for all detection zones displayed by the system software should agree within 3 percent.

The user interface displays the count rate in each of four detection zones in which straw detectors are distributed. Typically, the zones located closer to the detector side facing the source will record higher count rates. The main display screen shows total counts, time elapsed, average count rate, count rate averaged over the last 2 seconds, alarm indication, and the current values of system settings. Additional screens display counts distributed among different detector zones, time distribution of events (Rossi-alpha distribution), neutron die-away time, fission coincidence rate, random coincidence rate, multiplicity distribution, and other advanced functions. The system alarm goes off when the dynamic count rate exceeds the alarm threshold. The latter is automatically calculated based on the current settings of background rate, integration time, and false alarm probability. Data can be saved on the hard drive of a connected personal computer and recalled as needed. There is no capability to collect position data.

The enclosure is rated IP66 and can be supplied with submersible seals as an option. The operating temperature range is -40°F to 140°F. The detectors require a power input of +5 volts DC at 0.5 amps and -5 volts DC at 0.5 amps. An adaptor is provided to convert a 12-volt DC vehicle battery to the required voltages. Several battery options are available, including a large capacity battery that can provide power for months. The system can tolerate shock and vibration associated with operation aboard a moving vehicle. The system connects to the electronics box with gold-pin radio frequency (RF) connectors. Other connectors include Bayonet Neill–Concelman (BNC), Ethernet, and a sealed-panel power connector that meets IP68 and National Electrical Manufacturer's Association (NEMA) 250 specifications. The system housing acts as an RF shield. The external electronics box and cables are also shielded.

Maintenance contracts are not currently available. Training is included in the system price. Repairs can be made on-site or at the vendor's facility. Vendor-provided disposal is an option.

3.10 Radiation Solutions, Inc., RS-500 Digital Airborne Gamma-Ray Spectrometer

COST: Information not available
GSA SCHEDULE: Information not available
WARRANTY: Information not available

The RS-500 Digital Airborne Gamma-Ray Spectrometer detects and measures low-level radiation from naturally occurring and man-made sources. It can be used to scan for radiation while flying in urban or remote areas in all types of weather. The system contains five NaI(Tl) detectors, with four facing the ground and one facing upwards. Each detector crystal has a 4-liter volume. Spectral data from each detector is rendered linear by the use of an analog-to-digital converter and a digital signal processor. This allows an unlimited number of detectors to be summed without distortion. No radiation sources are required for system setup or system performance validation. Each NaI(Tl) detector is individually gain stabilized using multiple peaks from natural isotopes present in the background radiation. This effectively eliminates the need for any pre-stabilization with external sources. The operating temperature range of the system is -22°F to 113°F.

The RS-500 comes with RadAssist software which allows the user to monitor data and system performance on a computer running Windows XP. RadAssist provides a variety of displays for system setup and performance monitoring. Minimal user interaction is required. A standard data acquisition system can be used instead of RadAssist to eliminate the need for an external computer.

The preceding information was compiled from publicly available vendor information.

3.11 Radiation Solutions, Inc., RS-700 Mobile Radiation Monitoring System

COST: Information not available
GSA SCHEDULE: Information not available
WARRANTY: Information not available

The RS-700 Mobile Radiation Monitoring System is a self-contained gamma and neutron radiation detection and monitoring system that can be used in land vehicles, helicopters, unmanned aerial vehicles, or at a fixed location. The detector case is a roof-top carrier that can be configured with either one or two 4-liter NaI(Tl) gamma detectors and a helium-3 tube array for neutron detection. Spectral data from each gamma detector is rendered linear by use of an analog-to-digital converter and a digital signal processor. This allows an unlimited number of detectors to be summed without distortion. Additional gamma detectors can be purchased. A built-in GPS receiver provides location data for each measurement. The operating temperature range of the system is -22°F to 113°F.

The RS-700 system performs gain stabilization using multiple peaks from the naturally occurring isotopes of uranium-238, thorium-232, and potassium-40. Algorithms using the spectral signatures of these isotopes achieve spectral stabilization regardless of the number of detectors in the system.

The RS-700 can operate in an unattended standalone configuration with the data recorded internally. It can also be controlled and monitored in real time when connected to a computer running the included RadAssist program. RadAssist is a suite of utilities running under Windows XP that provides alarm capability, radioisotope identification, mapping displays with selectable data overlays, contour plots, navigation tracks with breadcrumb trails, and chart displays with selectable items. The program can be operated in real-time or playback mode.

The preceding information was compiled from publicly available vendor information.

3.12 Thermo Fisher Scientific, Inc., Matrix Mobile ARIS

COST: Information not available
GSA SCHEDULE: Information not available
WARRANTY: Information not available

The Matrix Mobile ARIS is an integrated system for radiation survey, patrol, and radioisotope identification that can be mounted in an SUV, boat, or other vehicle. The system combines the patented technologies of Natural Background Rejection (NBR), the Advanced Radioisotope Identification System (ARIS), and Viewpoint software. Operators can survey an area, determine the background radiation contour correlated with GPS position, and save the data for comparison with readings taken during periodic patrols. When patrolling, the system uses GPS to compare gamma and neutron levels at each location with the stored survey contour. When an alarm occurs, ARIS is initiated. Each identified radioisotope is linked with stored isotope information profiles.

Mobile Matrix ARIS
Courtesy of Thermo Fisher Scientific, Inc.

The Matrix Mobile ARIS contains two 7-liter gamma probes that use NBR technology to suppress signals from naturally occurring radioactive materials and enhance sensitivity to artificial sources of concern. Left- and right-side gamma probes allow sources to be localized. A neutron probe is also included. When an alarm occurs, Viewpoint notifies the operator with a popup dialog box, plays a sound file, identifies the alarm source, and indicates the location of the source. All alarm levels are user selectable. Viewpoint software runs on a rugged laptop computer.

The vendor's RadReachback™ system can be integrated into the Mobile Matrix ARIS. This system provides continuous, real-time data communications with a command center or analysis facility. RadReachback can be implemented in a variety of ways, including satellite transmitters, cell modems, and wireless mesh networking.

The preceding information was compiled from publicly available vendor information.

4. VENDOR CONTACT INFORMATION

Additional information on the products included in this market survey report can be obtained from the vendors of SRDs.

Table 4-1. Vendor Contact Information

Company	Product	Address/Phone Number	E-Mail/Website
Bubble Technology Industries, Inc.	FlexSpec Mobile	31278 Highway 17 P.O. Box 100 Chalk River, Ontario, Canada K0J 1J0 (613) 589-2456	sales@bubbletech.ca www.bubbletech.ca
FLIR Radiation, Inc.	iFind Compton Camera 442	100 Midland Road Oak Ridge, TN 37830 (865) 220-8700	www.flir.com
Innovative American Technology, Inc.	Mobile Radiation Verification System (MRVS) Rapid Deployment Radiation Verification System (RD-RVS)	6601 Lyons Road Suite L3 Coconut Creek, FL 33073 (561) 866-7532	www.ia-tec.com
Mirion Technologies, Inc.	SPIR-Ident Mobile Monitoring System	5000 Highlands Parkway Suite 150 Smyrna, GA 30127 (770) 432-2744	www.mirion.com
Nucsafe, Inc.	ARDIMS Aerial Pod System Guardian Predator Portable Radiation Detection Kit	601 Oak Ridge Turnpike Oak Ridge, TN 37830 (865) 220-5050	sales@nucsafe.com www.nucsafe.com
ORTEC®	Detective-200	801 S. Illinois Avenue Oak Ridge, TN 37601 (865) 482-4411	www.ortec-online.com
Proportional Technologies, Inc.	Straw Standoff Neutron Detector	8022 El Rio Street Houston, TX 77054 (713) 747-7324	www.proportionaltech.com
Radiation Solutions, Inc.	RS-500 Digital Airborne Gamma-Ray Spectrometer RS-700 Mobile Radiation Monitoring System	386 Watline Avenue Mississauga, Ontario, Canada L4Z 1 X2 (905) 890-1111	sales@radiationsolutions.ca www.radiationsolutions.ca
Thermo Fisher Scientific, Inc.	Matrix Mobile ARIS	81 Wyman Street Waltham, MA 02454 1-800-274-4212	www.thermoscientific.com

5. SUMMARY

SRDs are important devices that can detect and identify threatening radiation sources such as SNM that can be used in a nuclear weapon. The SRD systems described in this market survey report are COTS products that are designed to be mounted in vehicles, to detect radiation sources from an appropriate standoff distance, to determine the direction of radiation sources, and to distinguish threats from normally occurring radiation. They can be used in a wide variety of applications and in different environments, including land, sea, and air. Important capabilities in

an SRD system include gamma detection, neutron detection, source localization, radioisotope identification, and other system software.

This market survey report includes twelve SRD systems ranging in price from $15,150 to $1,200,000. Eleven of the systems perform gamma detection and radioisotope identification. These systems contain different numbers, sizes, and types of gamma detectors. Most systems can be configured according to the customer's needs by adding additional detectors or changing the type of detectors. Detection sensitivity and the ability to detect a threat depend upon the number of detectors, their size, and their resolution. Neutron detection is also available in eleven of the SRD systems, either as a standard feature or as an option. A wide range of neutron detector types and sizes are available. In most products, the system can be configured to the user's need for neutron detection. The SRD systems use a variety of methods for localizing a source. These include right- and left-side detectors, multiple detection zones, collimation, and audible finder mode. One system uses source imaging to determine the precise location of the source. System software should enhance detection capability by identifying radioisotopes and communicating radiation alarms to the operator. In addition, it should tie the system together into an effective and cohesive unit with intuitive displays and user controls. The SRD systems described in this report contain a wide variety of software features including GPS mapping, remote paging, check source test routines, and utilities for transmitting data to another location.

APPENDIX A. REQUEST FOR INFORMATION

U. S. Department of Homeland Security
National Urban Security Technology Laboratory
201 Varick Street, New York, NY 10014-7447

Homeland Security

Document Type: Special Notice

Title: Market Survey – Standoff Radiation Detectors

Posted Date: February 20, 2013

Contracting Office Address:

Office of the Chief Procurement Officer
Washington, District of Columbia 20528
United States

Description:

Request for Information (RFI) – STANDOFF RADIATION DETECTORS

DUE: March 8, 2013

I. BACKGROUND AND OBJECTIVES

The U.S. Department of Homeland Security, National Urban Security Technology Laboratory (NUSTL), a SAVER Technical Agent, is seeking information on commercially available standoff radiation detectors (SRDs). A radiation detection system can be considered an SRD if it is larger than a personal or handheld radiation detector, can determine the direction of radiation sources, can distinguish threats from background and normally occurring radiation, is or can be mounted in a vehicle, and can detect radioactive sources from a standoff distance that depends upon the application.

The U.S. Department of Homeland Security (DHS) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders making procurement decisions. Located within the Science and Technology Directorate (S&T) of DHS, the SAVER Program conducts objective assessments and validations on commercial equipment and systems, and provides those results along with other relevant equipment information to the emergency response community in an operationally useful form. Information provided by the SAVER Program will be shared nationally with the responder community, providing a life- and cost-saving asset to DHS, as well as to Federal, state, and local responders. For more information on the SAVER Program, visit the SAVER website at https://www.rkb.us/saver.

SAVER provides information on equipment that falls within the categories listed in the DHS Authorized Equipment List (AEL). The AEL item numbers for the subject equipment is

07RD-04-SGND. The target audience for this information is public safety providers and their purchasing agents.

II. SUBMISSION OF INFORMATION

Respondents are required to complete a written Product Summary Questionnaire for each product. The questionnaire may be obtained via email from the technical point of contact, [redacted]. The Product Summary Questionnaire includes questions seeking the following specific information:

1. Company's name
2. Company's address
3. Point(s) of contact (name, title, e-mail, and phone number)
4. Business type and size (manufacturer or distributor, small or large business)
5. Product name, type, description, and specifications
6. Cost information (purchase price and General Services Administration [GSA] schedule information).

All information received will be treated as public knowledge and may be used in SAVER Program documentation; therefore, vendors should not submit proprietary information in response to this RFI.

Responses to this *Request for Information* must be submitted to [redacted] not later than 4:00 PM EST, March 8, 2013. All technical comments, inquiries and responses should be directed to [redacted]; all non-technical questions should be directed to [redacted], DHS Contracting Officer, via email at [redacted].

III. OTHER

The submitted information will be evaluated for inclusion in SAVER projects and reports. Determination as to an individual product's suitability will be made by NUSTL based on the objectives of this request. Therefore, requests for feedback should not be made through the Federal Business Opportunities posting agency. Vendors may be contacted following submission for more detailed product information. Vendor provided information may be reformatted for publication in SAVER Program documents.

This RFI is for information gathering and planning purposes only, and should not be construed as a Request for Proposal (RFP) or solicitation of an offer. The Government does not intend to award a contract on the basis of this RFI or otherwise pay for the information solicited. Submission of vendor information constitutes consent to publication of that information in SAVER Program documentation.