Homeland Security
Science and Technology

Summary

U.S. Department of Homeland Security
SAVER
System Assessment and Validation for Emergency Responders

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. SAVER provides information on equipment that falls within the categories listed in the DHS Authorized Equipment List (AEL).

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?"

For more information on this and other technologies, contact the SAVER Program Support Office.

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Mobile Radioactive Material Search Systems

(AEL reference number 15SC-00-PMON)

In order to provide emergency responders with information on currently available equipment capabilities, limitations, and usability, National Security Technologies, LLC, conducted a comparative assessment of mobile radioactive material search systems (or mobile search systems) for the System Assessment and Validation for Emergency Responders (SAVER) Program in March 2009. Detailed findings are provided in the complete Mobile Radioactive Material Search Systems Assessment Report, *which is available by request at https://www.rkb.us/saver.*

Background

Mobile search systems enable first responders to perform searches for lost or stolen radioactive material, as well as efficiently define the boundaries of predetermined exposure rate limits in a large area.

Mobile search systems can be divided into two groups: simple alarming systems and spectral systems. Simple alarming systems only verify the presence of radioactive material and alert the operator. Spectral systems not only alarm in the presence of radioactive material, but they can also identify the material and plot results on a map.

Assessment

A focus group of emergency response practitioners from various regions of the country met in December 2008 to identify equipment selection criteria, evaluation criteria, and assessment scenarios. Focus group-recommended selection criteria included systems priced under $100,000 and the exclusion of bulky systems designed for aerial platforms.

The focus group recommended the assessment be split into two distinct categories—simple alarming systems and spectral systems. Due to the disparate operational expectations of these systems, the criteria used to evaluate these systems differed.

Based on focus group recommendations and market survey research, the following three spectral systems were assessed:

- Thermo-Fisher Scientific Mobile Detection System (MDS)
- Bubble Technology Industries MOBILE SPEC
- ORTEC NaI-SS Radiation Search System V2.5.

Also included in the assessment were two simple alarming systems:

- Technical Associates Mobile Radiation Detector (MoRad)
- Laurus Systems Inc. EVA-1.

Eleven emergency responders from various backgrounds and jurisdictions served as assessment evaluators. Field exercises simulated real-life situations

in which mobile search systems may be deployed. A two-phased approach was used in the evaluation. Phase I focused on characteristics of the equipment that cannot be directly assessed, such as equipment costs and manufacturer's claims on temperature and humidity tolerances. Phase II consisted of participant operation of the systems in operationally relevant scenarios. Scenarios included a chokepoint scenario, an incident-driven scenario, and a search scenario.

Assessment Results

Evaluators rated the mobile search systems based on the evaluation criteria established by the focus group. Each recommended criterion was assigned to one of the five SAVER categories, and each criterion was then assigned a weight for its level of importance on a scale of 1 to 5, with 1 being somewhat important and 5 being of utmost importance. Once the criteria were weighted, the five SAVER Program categories were assigned a percentage value to represent the level of each category's importance relative to the other categories.

Tables 1 and 2 display the composite assessment scores, as well as the category scores for each product. Higher scores indicate better equipment performance. Table 3 includes manufacturer specifications for each product assessed under the spectral system category. Table 4 shows how each spectral system scored against each of the evaluation criteria assigned to the SAVER Program categories. Table 5 includes manufacturer specifications under the simple alarming system category. Table 6 provides criteria scores under the simple alarming system category.

The following paragraphs provide a brief summary of the evaluator comments and feedback on each system.

SAVER Program Category Definitions

Affordability: This category groups criteria related to life-cycle costs of a piece of equipment or system.

Capability: This category groups criteria related to the power, capacity, or features available for a piece of equipment or system to perform or assist the responder in performing one or more responder-relevant tasks.

Deployability: This category groups criteria related to the movement, installation, or implementation of a piece of equipment or system by responders at the site of its intended use.

Maintainability: This category groups criteria related to the maintenance and restoration of a piece of equipment or system to operational conditions by responders.

Usability: This category groups criteria related to the quality of the responders' experience with the operational employment of a piece of equipment or system. This includes the relative ease of use, efficiency, and overall satisfaction of the responders with the equipment or system.

Table 1. Spectral Systems Assessment Results[1]

Spectral System	Composite Score	Affordability (16% Weighting)	Capability (26% Weighting)	Deployability (16% Weighting)	Maintainability (21% Weighting)	Usability (21% Weighting)
MDS	**88**	86	88	92	80	96
MOBILE SPEC	**86**	84	86	86	86	84
NaI-SS	**80**	74	94	84	76	72

Table 2. Simple Alarming Systems Assessment Results[1]

Simple Alarming System	Composite Score	Affordability (20% Weighting)	Capability (15% Weighting)	Deployability (25% Weighting)	Maintainability (20% Weighting)	Usability (20% Weighting)
MoRad	**64**	62	66	68	68	58
EVA-1	**62**	60	30	68	60	72

Note:

[1] Scores contained in the assessment report may be displayed differently. For the purposes of the SAVER Summary, all SAVER category scores are normalized using a 100-point scale and rounded to the nearest whole number.

The systems are listed from the highest to lowest composite score, starting with spectral systems. The complete assessment report includes a breakdown of evaluator comments by individual criterion.

Spectral Systems

MDS

The Thermo-Fisher Scientific MDS received the highest composite score and scored highest in the usability, affordability, and deployability categories. Assessors commented that it was easy to use after minimal training and appreciated its small size. The GPS and mapping functions of the system were considered a plus. Assessors felt troubleshooting on the system could be easily done. The evaluators were complimentary of the intuitive software, and found the alarm to be loud and distinctive. The system was found to be affordable.

The evaluators found that the system only provides rate-of-activity measurements. The system does not have spectral capability and it does not identify radionuclides, which the evaluators considered an important capability in a comprehensive system.

Pros	• Intuitive menu options • Easy setup • Reasonable price • Distinctive alarm • Sturdy storage case
Cons	• No nuclide identification
MDS	**Composite Assessment Score: 88**

MOBILE SPEC

The Bubble Technology Industries MOBILE SPEC received the second highest composite score and scored highest in the maintainability category.

Pros	• Rugged detector system • Useful touch screen • Nuclide identification options • Easy to source check and calibrate
Cons	• Maps do not track current position • No confidence levels on nuclide identification
MOBILE SPEC	**Composite Assessment Score: 86**

Evaluators noted the system's rugged construction and commented that with a few minor changes, the MOBILE SPEC could have been their favorite. Evaluators agreed that the system was easy to source check and calibrate. They noted the MOBILE SPEC touch screen lent to the system's ease of use.

Evaluators noted that the mapping features of the MOBILE SPEC were not as sophisticated as they would like. The evaluators would also have preferred a confidence level given to each of the nuclides reported.

NaI-SS

The ORTEC NaI-SS received the third highest composite score and scored highest in the capability category. The evaluators greatly enjoyed the waterfall display, spectroscopy options, and large detector volume. The system received the highest capability score due in part to the mapping capabilities and the sophisticated nuclide identification software. The detectors were very sensitive and the alarms could be easily adjusted.

Evaluators agreed the cost of maintenance on the NaI-SS was too high and troubleshooting would take more expertise than most first responders with operational training possess. The evaluators also felt the system was out of their price range.

Pros	• Excellent nuclide identification capability • User-friendly waterfall display available • Rugged storage case
Cons	• Price • Use of system not intuitive • System too sophisticated • Maintenance costs potentially high
NaI-SS	**Composite Assessment Score: 80**

Simple Alarming Systems

MoRad

The Technical Associates MoRad received the highest composite score and scored highest in the affordability, maintainability, and capability categories. Assessors liked the user interface and ruggedness of the detector. The evaluators also liked that the MoRad can operate using rechargeable batteries. The evaluators felt they could source check the instrument easily.

One issue found by the evaluators was that the system would have to be calibrated by an outside entity. Another area in which the MoRad scored poorly was the high maintenance costs for the system.

	Pros	• Can operate using rechargeable batteries • Simple software user interface • Easy to source check
	Cons	• Difficult calibration procedure • Probes not secured • Maintenance costs potentially high • Voltage control knobs too frail
MoRad	**Composite Assessment Score: 64**	

EVA-1

The Laurus Systems Inc. EVA-1 received the second highest composite score and scored highest in the deployability category. Assessors agreed that the highlight of the system was its ease of use. The system was also small, lightweight, and water-resistant.

	Pros	• Small and lightweight • Water resistant • Easy to use buttons • Easy to install • Easy to source check
	Cons	• 8-second response time • Manufacturer preset exposure rate for alarm too high • Exposure rate for alarm not user adjustable • No calibration procedure
EVA-1	**Composite Assessment Score: 62**	

The drawbacks found by the evaluators included a slow response time. The system takes 8 seconds to respond in an elevated radiation field. Evaluators also determined that the manufacturer preset exposure rate for alarm was set too high. There is also no calibration procedure.

Conclusion

The purpose of the report is to provide the results of a comparative assessment of the affordability, maintainability, usability, capability, and deployability of selected commercially available mobile search systems used in emergency response operations. The assessment was based on carrying out scenario-driven exercises simulating environments that would require the use of mobile search systems, and reviewing manufacturer specifications. Evaluators were able to successfully complete the assessment tasks using each of the assessed mobile search systems.

The evaluators felt that, for the purpose of searching for radioactive material from a vehicle, a spectral system would be most useful. They realized the potential for using simple alarming systems in agencies whose primary mission is not radiation-related. These systems, however, would need to have reasonable response times and sensitivity to low-level radiation exposure while being easy to operate.

For additional information on the assessment and to access other reports in the series, visit the SAVER Web site (https://www.rkb.us/saver).

Table 3. Spectral System Manufacturer Specifications

Specifications				
		MDS	**MOBILE SPEC**	**NaI-SS**
Cost[1]	Base	$44,636.00	$46,975.00	$78,000.00
	Neutron detector	$11,068.00	$25,250.00	Base cost includes neutron detector
Weight (approx.)		33 lb	55 lb	110 lb
Detector Types	Gamma	5 liter scintillator	4"×4"×16" NaI	4"×4"×16" NaI
	Neutron	He^3 tube for neutron	2"×2" scintillator and He^3 tube for neutron	He^3 tube for neutron
Battery Type and Life	Type	12 VDC	12 to 32 VDC	None
	Life	8 hours	>12 hours	NA

Note:

1 Unit price as of June 2008.

Table 4. SAVER Evaluation Criteria Scores – Spectral Systems

KEY Least Favorable → Most Favorable ○ ◔ ◑ ◕ ●	 MDS	 MOBILE SPEC	 NaI-SS
Assessment Criteria			
Affordability			
Training Costs	●	◕	◕
Device Costs	●	◕	◕
Maintenance and Calibration Costs	◕	◕	◕
Capability			
Alarms Appropriately	●	◕	●
Nuclide Identification	◑	◕	●
Sensitivity	●	●	●
Adjustable Alarm Settings	●	◕	◕
GPS/Mapping	●	◕	●
Neutron Detection	●	●	●
Deployability			
Ease of Installation	●	◕	◕
Ruggedness	●	◕	◕
Size/Location	◕	◕	◑
Flexible Power Source	●	◕	◕
Temperature/Humidity	●	◕	●
Water Resistance	●	●	●
Maintainability			
Ease of Calibration	◕	●	◕
Ease of Source Checking	●	●	●
Software Requirements	◕	◕	◑
Ease of Troubleshooting	◕	◕	◕
Usability			
User-friendliness	●	◕	◕
Buttons/Switches	●	◕	◕
Dedicated Vehicle	●	●	◑
Distinctive/Obvious Alarms	●	◕	◑

Table 5. Simple Alarming System Manufacturer Specifications

Specifications		
	MoRad	**EVA-1**
Cost[1]	$8,330.00[2]	$960.26
Weight (approx.)	20 lb	1 lb
Detector Types	Geiger Mueller Tube, NaI, and He^3	Cadmium Telluride
Required Voltage	12 VDC	12 to 32 VDC

Notes:

[1] Unit price as of June 2008. [2] Price includes 3 probes.

Table 6. SAVER Evaluation Criteria Scores – Simple Alarming Systems

KEY		
Least Favorable → Most Favorable	**MoRad**	**EVA-1**
Assessment Criteria		
Affordability		
Maintenance and Calibration Costs	◑	◕
Device Costs	◕	◔
Capability		
Alarms Appropriately	◑	○
Adjustable Alarm Setting	◑	◔
Sensitivity	◕	○
Deployability		
Ruggedness	◔	◑
Size/Location	◑	◕
Water Resistance	◕	◕
Ease of Installation	◑	◕
Flexible Power Source	◕	◕
Temperature	◕	◕
Maintainability		
Ease of Source Checking	◕	◑
Ease of Troubleshooting	◑	◑
Ease of Calibration	◑	◑
Usability		
User-friendliness	◑	◑
Buttons/Switches	◑	◕
Distinctive/Obvious Alarms	◑	◕