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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Imaging Sonar Systems

(AEL reference number 03WA-02-SONR)

In order to provide emergency responders with information on currently available imaging sonar systems, the Space and Naval Warfare Systems Center (SPAWARSYSCEN) Atlantic conducted a comparative assessment of imaging sonar systems for the System Assessment and Validation for Emergency Responders (SAVER) Program in July 2010. Detailed findings are provided in the Imaging Sonar Systems Assessment Report*, which is available by request at https://www.rkb.us/SAVER.*

Background

Imaging sonar is a high-frequency, narrow field of view, underwater sonar that produces video-like acoustic imagery that is used to detect and identify submerged objects of interest, even in low- to no-visibility conditions. Imaging sonar systems can be hull-, tripod-, or pole-mounted; attached to a remotely operated underwater vehicle (ROV); or hand-carried by a diver.

Emergency responders may use imaging sonar systems to:

- Inspect ship hulls or the individual pilings of piers and bridges;
- Direct divers to an area of interest;
- Track divers underwater;
- Inspect an object or area of interest before deploying divers; and
- Search for underwater obstructions ahead of a vessel.

Assessment

Prior to the assessment, eight emergency responders were chosen from various jurisdictions to participate in a focus group. Participants possessed strong backgrounds in underwater search and recovery, law enforcement, marine services, firefighting, and emergency services. The group's primary objectives were to recommend evaluation criteria, product selection criteria, vendors, and possible scenarios for the assessment.

Based on focus group recommendations, market research, and system availability, the following imaging sonar systems were assessed:

- BlueView Technologies Inc., P900-130;
- Sound Metrics Corp., DIDSON™ Diver-Held; and
- Subsea Technologies Inc., Tritech Gemini 720i.

Four responders served as evaluators for this assessment. All evaluators had at least six years of experience in emergency response disciplines including emergency services, marine patrol, and underwater search and recovery.

Evaluators were tasked to participate in two phases of the assessment: the operational assessment and the specification assessment. During the operational assessment, evaluators assessed the systems based on hands-on experience with the systems during three segments: system setup, system

operation, and post operation. During the specification assessment, evaluators assessed the systems based on vendor-provided information and specifications.

Assessment Results

Evaluators rated the imaging sonar systems based on the evaluation criteria established by the focus group. Each criterion was assigned to one of the five SAVER categories, and then assigned a weight for its level of importance. Once the criteria were weighted, the five SAVER categories were assigned a percentage value to represent the level of each category's importance relative to the other categories.

Table 1 displays the composite assessment scores as well as the category scores for each product. Higher scores indicate a higher rating by evaluators. To view how each imaging sonar system scored against the evaluation criteria assigned to the SAVER categories, see table 2. For product specifications, see table 3.

The following paragraphs provide a brief summary of evaluator comments and feedback on each imaging sonar system used during the assessment. The systems are listed from highest to lowest composite score. The complete assessment report includes a breakdown of evaluator comments by SAVER category.

Sound Metrics Corp., DIDSON Diver-Held

The DIDSON Diver-Held received a composite score of 76. The system includes a mask-mounted display, a battery for diver-held operation, a 100-foot cable, telephone and e-mail technical support, and a user guide. The range for detection and identification of the targets met evaluator expectations, and targets could be detected and a clear image viewed at various distances. The ability to change to a higher frequency also allowed for much clearer images and made for better target identification. Both the automatic gain setting and the manual gain were easy to use and worked well, and the software was easy to use following familiarization training. In addition, using the range scale tool, capturing still images, and adjusting the color palette were easy for the user when not performing other functions. The refresh rate met

SAVER 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 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. Imaging Sonar System Assessment Results[1]

System	Composite Score	Affordability (20% Weighting)	Capability (27% Weighting)	Deployability (13% Weighting)	Maintainability (5% Weighting)	Usability (35% Weighting)
Sound Metrics Corp., DIDSON™ Diver-Held	**76**	60	82	80	74	80
Subsea Technologies Inc., Tritech Gemini 720i	**74**	66	76	70	84	78
BlueView Technologies Inc., P900-130	**66**	60	74	72	66	62

Note:

[1] Scores contained in the assessment report are displayed differently. For the purposes of the SAVER Summary, all SAVER category scores are normalized using a 100-point scale.

	Pros	• Multiple mounting options • Well-engineered pan/tilt • Multiple power options • Resolution for identification • Auto adjust frequency
	Cons	• High initial cost • Expensive long-term maintenance and extended warranty costs • Portability • Complex maintenance
Sound Metrics Corp., DIDSON™ Diver-Held	**Composite Assessment Score: 76**	

expectations, and the system produced real-time imaging as the sonar moved. The system has multiple mounting options, and the power requirements exceeded expectations and should cover common power sources. The neutral buoyancy of the sonar head and the ability to take a snapshot without stopping the recording were preferred features, as was the ability to capture global positioning system (GPS) information for evidentiary purposes.

Some disadvantages to the DIDSON Diver-Held were noted. The sonar head was larger and heavier than expected. The pole mount, while well-engineered with pan/tilt capabilities, was difficult to mount to the patrol boat by one person; it also was difficult to assemble and the screws used to secure the sonar head could be easily dropped. The system was not easily portable, as moving the system from one location to another requires two trips for one person or one trip for a two-person team. Though the technical manual was clear and understandable, maintenance seems complex because it requires the user to replace the focus pin and fluid in the front lens. The system's initial cost was considered to be high, and instructor-led training is an additional cost. The cost of the extended warranty was also viewed as high.

Subsea Technologies Inc., Tritech Gemini 720i

The Tritech Gemini 720i received a composite score of 74. The system includes telephone and e-mail technical support, one day of basic sonar training, and a user guide. The compact, lightweight system was portable and easy to set up and repackage for storage by one person. The software was intuitive with user-friendly features, and users can take a snapshot without stopping the recording. The graphical user interface was easy to use; the starting and stopping of

	Pros	• Portability • Multiple power options • Range zoom feature • 24/7 technical support • Reliable, user-friendly software • Easy setup and use • Little maintenance required
	Cons	• No GPS or character generator • Lack of mounting options • Single frequency • No extended warranty
Subsea Technologies Inc., Tritech Gemini 720i	**Composite Assessment Score: 74**	

recording and the capturing of still images were also easy for the user. The range zoom feature was considered a benefit for the detection of targets, the range for detection of targets exceeded expectations, and the range for identification of targets met expectations. The refresh rate also met expectations, and the system produced real-time imaging as the sonar head was manually panned right and left. The system cost was considered reasonable, and the after-hours technical support was viewed favorably. The technical manual provided clear and understandable maintenance and repair instructions.

Some disadvantages to the Tritech Gemini 720i were noted. While the manual sonar gain controls were easy to use, the system does not have an automatic sonar gain control. In addition, target identification may have been easier if the system had the option to adjust to a higher frequency. Evaluators also felt that the vendor should provide the bracket required to mount the sonar head. The system only records in audio video interleave, AVI format, and the system does not feature a character generator for evidence tagging or allow for GPS input. Power requirements, though versatile, do not include a 12 volts direct current (VDC) primary power option or a battery pack for diver-held operations. While the system cost was viewed as reasonable, evaluators indicated that an extended warranty should be available.

BlueView Technologies Inc., P900-130

The P900-130 imaging sonar system received a composite score of 66. The system includes a 25-foot cable, telephone and e-mail technical support, and a user guide. The system components were large enough to manipulate, but not too heavy or bulky,

	Pros	• Multiple mounting options • Portability • Ability to change color scheme and units • Little maintenance required
	Cons	• Poor software interface • Poor image quality • Limited standard power options • Expensive extended warranty cost • Single frequency
BlueView Technologies Inc., P900-130	**Composite Assessment Score: 66**	

which contributed to its portability. The ability to adjust the color scheme was a preferred feature, as was the range scale tool. The automatic and manual sonar gain controls were easy to use, and the refresh rate and recording formats met expectations. The variety of mounting options for the system was favorable, but evaluators felt they should be included in the system cost. The technical manual provided clear and understandable maintenance and repair instructions.

Some disadvantages of the P900-130 were noted. The mounting screws and wrenches for attaching the sonar head to the pole mount did not meet expectations and could easily be lost. While the detection range was assessed as sufficient for most applications, target identification was difficult. Evaluators felt that target identification may have been easier if the system had the option to adjust to a higher frequency. In addition, image quality was not as clear as expected. The software interface lacks a hot keys menu for the pan and tilt mechanism, and the system does not have a character generator for evidence tagging. Also, the time/date stamp functions were not user-friendly. Starting and stopping the recording and capturing still images were easy, but the live sonar feed stops until the still image is labeled. The direct current (DC) power option is not included with system cost, and evaluators felt the system's primary power source should be 12 VDC. The system cost should include training, and the cost of the extended warranty was considered high.

Conclusion

Evaluators observed advantages and disadvantages of the assessed systems and noted that the most important features of an imaging sonar system are clear, identifiable images, and a user-friendly interface.

The evaluators considered the depth ratings of all three systems to be more than adequate for most applications. The evaluators found decontaminating all three systems, which consisted of breaking down the components, rinsing with fresh water, and drying prior to repacking, to be simple. The evaluators also considered the availability of customer-site training offered by all three vendors to be beneficial and important to agencies with large dive teams. The evaluators indicated that training in the environment where the system will be used is important. The evaluators commented that all three systems should have an initial warranty period longer than one year. Lastly, the evaluators would prefer all three systems to have wider operating temperature ranges for use in extremely hot and cold waters.

Emergency responder agencies should carefully consider each system's overall capabilities and limitations in relation to their jurisdiction's operational needs when purchasing an imaging sonar system.

All reports in this series, as well as reports on other technologies, are available in the SAVER section of the Responder Knowledge Base Web site at https://www.rkb.us/SAVER.

Table 2. Imaging Sonar System Criteria Ratings[1]

KEY Least Favorable → Most Favorable			
○ ◔ ◑ ◕ ●	**Sound Metrics Corp., DIDSON Diver-Held**	**Subsea Technologies Inc., Tritech Gemini 720i**	**BlueView Technologies Inc., P900-130**
Affordability			
Initial Cost	◑	◕	◑
Warranty	◑	◑	◑
Maintenance Cost	◑	◑	◑
Capability			
Depth Rating	◕	◕	◕
Refresh Rate	◕	◕	◑
Recording	◕	◕	◕
Distance Between Head and Controls	●	◕	◕
Operating Temperature	◕	◑	◕
Storage Temperature	◕	◕	◑
Distance Between Operating Systems	◕	◑	◕
Deployability			
Multiple Mounting Options	◕	◔	◕
Portability	◑	●	◕
Power Requirements	●	◕	◑
Buoyancy	●	◕	◕
Easy to Assemble	◕	●	◕
System Check	◕	◕	◕
Maintainability			
Technical Support	◑	◕	◑
Technical Manual	◕	◕	◕
Decontamination	●	●	◕
Usability			
Image Quality	●	◕	◔
Range	◕	◕	◔
Detection Speed Limit	◑	◑	◑
Intuitive Software	◕	●	◕
Software Features	◕	●	◕
Training	◕	◕	◕
Adjustable Frequency Range	◕	◑	◔
Sonar Gain Control	◕	◕	◕
User Guide	◕	◕	◕
Identification Speed Limit	◕	◑	◑
Size	◕	●	◕

Note:

[1] Averaged criteria ratings for each product that was assessed are graphically represented by colored and shaded circles. Highest ratings are represented by full green circles.

Table 3. Imaging Sonar System Specifications

Specifications	Sound Metrics Corp., DIDSON™ Diver-Held	Subsea Technologies Inc., Tritech Gemini 720i	BlueView Technologies Inc., P900-130
System Cost	$85,000	$29,280	$29,950
Training Cost	Vendor Site: $750 per day Customer Site: $750 per day, plus travel expenses Training DVD: $15	Vendor Site: First day free of charge, $800 per additional day Customer Site: First day free of charge, $800 per additional day, plus expenses, plus 15 percent	Vendor Site: $800 per day Customer Site: $800 per day, plus travel expenses
Extended Warranty Cost (beyond included 12-month warranty)	$5,000 per year	Extended warranty not available	$2,995 per year
Out-of-warranty Labor Cost	$95 per hour	$100 per hour	$136.50 per hour
Technical Support (7 days/week)	8:30 a.m. to 11:30 p.m. Pacific After-hours support is not available	8:00 a.m. to 5:00 p.m. Central After-hours support available at no cost	8:00 a.m. to 8:00 p.m. Pacific After-hours support is available with advanced scheduling at no cost
Operating Frequency	1,100 kilohertz 1,800 kilohertz	720 kilohertz	900 kilohertz
Depth Rating	300 feet	984 feet	3,280 feet
Mounting Options	Pole, tripod, diver-held	Custom fabrication by user required	Pole, ROV, hull, tripod, diver-held
Power Requirements	24 VDC at 30 watts Self-contained battery for diver-held operation	120 VAC 18-75 VDC at 35 watts	100-250 VAC at 50-60 hertz Optional DC: Requires third party 800-watt inverter 12-48 VDC at 15 watts
Operating Temperature Range (Sonar Head)	32 to 104°F	32 to 95°F	32 to 104°F
Storage Temperature Range (Sonar Head)	-40 to 140°F	-4 to 122°F	Not available
Distance Between Head and Topside Controls	600 feet	328 feet for Ethernet 3,280 feet for very high bit-rate digital subscriber line, which requires use of a $1,600 adapter	200 feet for Ethernet (distance can be extended by using a $4,500 extender kit)
Distance Between Operating Systems	3 feet	Not available	No minimum required when synchronized
Buoyancy (Sonar Head)	Neutral	Negative	Negative

Notes:

DC = direct current
F = Fahrenheit
ROV = remotely operated underwater vehicle
VAC = volts alternating current
VDC = volts direct current