

System Assessment and Validation for Emergency Responders (SAVER)

Handheld Image Intensifiers Focus Group Report

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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 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 mission includes:

- Conducting impartial, practitioner-relevant, operationally oriented assessments and validations of emergency responder equipment; and
- Providing information, in the form of knowledge products, that enables decision-makers and responders to better select, procure, use, and maintain emergency responder 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 Space and Naval Warfare Systems Center (SPAWARSYSCEN) Atlantic has been tasked to provide expertise and analysis on key subject areas, including communications, sensors, security, weapon detection, and surveillance, among others. In support of this tasking, SPAWARSYSCEN Atlantic will conduct an assessment of handheld image intensifiers to provide emergency responders with reference information on currently available technologies. Handheld image intensifiers fall under AEL reference number 03OE-02-TILA titled Optics, Thermal Imaging and/or Light Amplification and AEL reference number 04MD-01-LAMP titled Equipment, Light Amplification. As part of the project, assessment recommendations were gathered from a focus group and are highlighted in this report.

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 handheld image intensifiers or other technologies.

POINTS OF CONTACT

SAVER Program

U.S. Department of Homeland Security

Science and Technology Directorate

OTE Stop 0215

245 Murray Lane

Washington, DC 20528-0215

E-mail: saver@hq.dhs.gov

Website: <https://www.rkb.us/saver>

Space and Naval Warfare Systems Center Atlantic

Advanced Technology and Assessments Branch

P.O. Box 190022

North Charleston, SC 29419-9022

E-mail: ssc_lant_saver_program.fcm@navy.mil

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1. INTRODUCTION

Handheld image intensifiers increase the intensity of available light to provide imaging in poorly lit situations. They are widely used by emergency responders in nighttime surveillance, search and rescue, and covert operations. The System Assessment and Validation for Emergency Responders (SAVER) Program plans to use the recommendations presented in this report to conduct an assessment of handheld image intensifiers. The results of the assessment will provide emergency responders information that will assist them in making informed selection and procurement decisions. This SAVER assessment will be conducted by law enforcement personnel.

In support of the assessment, a focus group met in April 2013 with the primary objectives of recommending evaluation criteria, product selection criteria, products, and scenarios for the assessment. Eight emergency responders from various jurisdictions participated in the focus group. The participants, law enforcement personnel with at least 2 years of experience using handheld image intensifiers, are listed in Table 1-1. The participants' experience with handheld image intensifiers, combined with their experience in law enforcement, facilitated meaningful and productive discussions.

All of the participants acknowledged they did not have an employment or financial relationship that could create a potential conflict of interest with the work to be performed by the SAVER Program. Participants signed a nondisclosure agreement and a conflict of interest statement.

Table 1-1. Focus Group Participants

Participant	Years of Experience	State
Police Department—Technology Unit Lieutenant	20+	TX
Police Department—Patrol Officer/SWAT Team	16-20	AZ
Sheriff's Department—Special Enforcement Detail Deputy	16-20	CA
Sheriff's Office—Detective, Metro SWAT	16-20	SC
Police Department—Surveillance Special Agent	16-20	VA
Police Department—Patrol Officer/Sniper Team Leader	16-20	WA
Sheriff's Department—Assistant Range Master/Armorer	11-15	CA
Police Department—Patrol Officer	6-10	WA

2. FOCUS GROUP METHODOLOGY

The focus group opened with an overview of the SAVER Program, the handheld image intensifiers project, and the focus group goals and objectives. Once the background material was covered, a facilitator led focus group discussions on four sets of recommendations:

- Evaluation criteria recommendations—General criteria that are important to consider when making acquisition or operational decisions;
- Assessment scenario recommendations—Scenarios in which the products should be assessed to evaluate their performance;

- Product selection criteria recommendations—Criteria that identify specifications, attributes, or characteristics a product should possess to be considered for the assessment; and
- Product recommendations—Products and vendors that are relevant to the emergency responder community and should be candidates for inclusion in the assessment.

Figure 2-1 highlights the process followed to gather these recommendations.

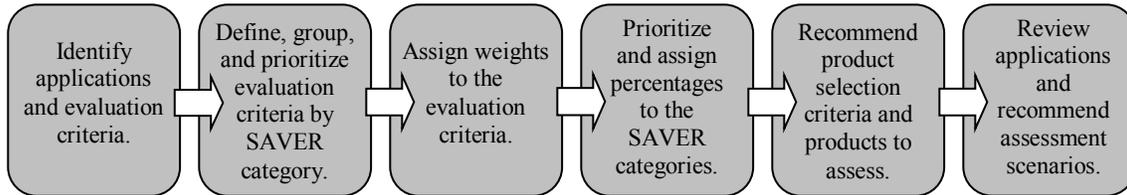


Figure 2-1. Focus Group Process

Focus group participants first identified applications in which handheld image intensifiers are commonly used. Next, the focus group participants identified and defined evaluation criteria, which were then grouped and prioritized in the following SAVER categories: Affordability, Capability, Deployability, Maintainability, and Usability. The SAVER categories are defined as:

- Affordability—Groups criteria related to life-cycle costs of a piece of equipment or system;
- Capability—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—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—Groups criteria related to the maintenance and restoration of a piece of equipment or system to operational condition by responders; and
- Usability—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.

Once the evaluation criteria were prioritized within the SAVER categories, focus group participants assigned a weight for each criterion’s level of importance on a scale of 1 to 5, with 1 being somewhat important and 5 being of utmost importance. Table 2-1 highlights the evaluation criteria weighting scale.

Table 2-1. Evaluation Criteria Weighting Scale

Weight	Definition
5	Utmost importance <i>“I would never consider purchasing a product that does not meet my expectations of this criterion or does not have this feature.”</i>
4	Extremely important <i>“I would be hesitant to purchase a product that does not meet my expectations of this criterion or does not have this feature.”</i>
3	Very important <i>“Meeting my expectations of this criterion or having this feature would strongly influence my decision to purchase this product.”</i>
2	Important <i>“Meeting my expectations of this criterion or having this feature would slightly influence my decision to purchase this product.”</i>
1	Somewhat important <i>“Other things being equal, meeting my expectations of this criterion or having this feature may influence my decision to purchase this product.”</i>

After the evaluation criteria were assigned a weight, the focus group participants recommended whether the criteria should be assessed operationally or according to vendor-provided specifications. Next, considering the evaluation criteria in each category, the focus group participants ranked the SAVER categories in order of importance. Based on the ranking, a percentage was assigned to each category to represent its level of importance.

Next, the focus group participants identified product selection criteria. The focus group also identified products that should be considered for the assessment. Lastly, the focus group participants reviewed the applications identified at the beginning of the focus group session and recommended scenarios for the assessment.

3. EVALUATION CRITERIA RECOMMENDATIONS

The focus group identified 18 evaluation criteria and concluded that Usability was the most important SAVER category, followed by the Capability, Maintainability, Affordability, and Deployability categories, respectively. Table 3-1 presents the category weights, the evaluation criteria, and the evaluation criteria weights.

Table 3-1. Evaluation Criteria

SAVER CATEGORIES				
Usability	Capability	Maintainability	Affordability	Deployability
Overall Weight 40%	Overall Weight 32%	Overall Weight 15%	Overall Weight 8%	Overall Weight 5%
Evaluation Criteria				
Image Quality Weight: 5	Infrared Illuminator Weight: 4	Battery Type Weight: 4	Warranty Weight: 3	User Manual Weight: 2
Image Adjustment Weight: 4	Versatility Weight: 4	Maintenance Weight: 4		
Handheld Operation Weight: 4	Battery Runtime Weight: 3	Technical Support Weight: 2		
Tube Protection Weight: 3	Field of View Weight: 3			
Durability Weight: 3				
Depth Perception Weight: 3				
Coverttness Weight: 3				
Eye Relief Weight: 3				
Indicators Weight: 2				

3.1 Usability

Nine Usability criteria were identified and defined by the focus group.

Image quality refers to the device providing a clear, sharp image with minimal defects and distortion such as blooming, shadowing, and haloing as well as automatically adjusting for different lighting conditions. The focus group noted that image quality impacts the user's ability to detect and recognize objects of interest.

Image adjustment refers to how well image quality can be improved by manually adjusting gain and focus.

Handheld operation refers to how easily the device can be held and carried (i.e., inclusion of a lanyard or hand strap attachment point). Handheld operation also refers to the ease of activation and adjusting controls such as focus, gain, diopter, and/or infrared (IR) illuminator with or without gloves. The focus group noted that controls should be readily accessible and the device should be useable ambidextrously.

Tube protection refers to the ability to remain operational or recover quickly when compensating for lighting conditions to protect the tube(s). The focus group noted that when a bright light is present, some tubes shut off while others may flicker or dim.

Durability refers to the overall ruggedness of the device, including the sturdiness of its buttons/controls. Durability also includes the device's water resistance, Ingress Protection (IP) rating, and shock resistance.

Depth perception refers to the image characteristics that enable the user to estimate distances and three-dimensional (3-D) relationships between objects and subjects in the field of view.

Covertiness refers to factors that contribute to the user's ability to use the device without being detected. The focus group noted that the device should have a black or camouflage casing, operate quietly, and restrict light escaping from the eyepiece.

Eye relief refers to the optimal distance between the eye and the eyepiece of the device to ensure maximum view of the exit pupil. The focus group noted that a longer eye relief is preferred.

Indicators refers to the location and appearance of a low battery indicator and/or an IR illuminator "on/off" indicator. The focus group noted the importance of indicators not interfering with the field of view or covertness of the device.

3.2 Capability

Four Capability criteria were identified and defined by the focus group.

Infrared illuminator refers to how well the device's IR light illuminates a target, as well as the ability to adjust the beam width.

Versatility refers to the device mounting options (e.g., head, helmet, weapon, tripod). Versatility also includes the ability to use a camera, sacrificial lenses, and magnified lenses with the device.

Battery runtime refers to the length of time the device can operate before the batteries require replacement.

Field of view refers to the area that is viewed through the device at a given distance.

3.3 Maintainability

Three Maintainability criteria were identified and defined by the focus group.

Battery type refers to the size and type of batteries required to power the device, including if they are readily available.

Maintenance refers to whether required maintenance and/or repairs can be performed by the user or if the device must be sent to the vendor for service. Maintenance also includes the ease of cleaning the device and its lenses as well as replacing batteries.

Technical support refers to the duration of technical support included with purchase and the availability, responsiveness, and technical knowledge of technical support.

3.4 Affordability

One Affordability criteria was identified and defined by the focus group.

Warranty refers to the duration and coverage of the warranty included with purchase.

3.5 Deployability

One Deployability criteria was identified and defined by the focus group.

User manual refers to the included user manual having instructions and diagrams that are easy to understand. The focus group noted that the manual should include a parts list, contact information, care and maintenance instructions, indicator translations, and a quick-start reference guide.

4. EVALUATION CRITERIA ASSESSMENT RECOMMENDATIONS

The focus group provided recommendations on whether the evaluation criteria should be assessed operationally or according to vendor-provided specifications. In an operational assessment, evaluators assess criteria based on their hands-on experience using the product. In a specification assessment, evaluators assess criteria based on product information provided by the vendor. Table 4-1 presents the focus group's assessment recommendations for the evaluation criteria.

Table 4-1. Evaluation Criteria Assessment Recommendations

Category	Criteria	Operational	Specification
Usability	Image Quality	✓	
	Image Adjustment	✓	
	Handheld Operation	✓	
	Tube Protection	✓	✓
	Durability	✓	✓
	Depth Perception	✓	
	Covertness	✓	
	Eye Relief	✓	
	Indicators	✓	✓
Capability	Infrared Illuminator	✓	
	Versatility	✓	✓
	Battery Runtime		✓
	Field of View	✓	
Maintainability	Battery Type		✓
	Maintenance	✓	✓
	Technical Support	✓	✓
Affordability	Warranty		✓
Deployability	User Manual	✓	

The focus group recommended the specification table in the assessment report present information on the criteria assessed, as well as the following information: manufacturer's suggested retail price (MSRP), resolution, dimensions, weight, operating and storage temperature ranges, tube generation, and tube life.

5. ASSESSMENT SCENARIO RECOMMENDATIONS

The focus group identified surveillance, as well as search and rescue, as the applications in which they use handheld image intensifiers. Based on these applications, the focus group recommended three scenarios in which products could be assessed using the evaluation criteria recommended for an operational assessment (Table 4-1).

5.1 Setup Scenario

During the setup scenario, evaluators should review the user manual, install the batteries, and familiarize themselves with the device's indicators. Evaluators should also inspect the device for a lanyard, hand strap attachment points, and mounting options. Lastly, evaluators should call technical support to assess responsiveness and technical knowledge.

5.2 Search and Rescue Scenario

During the search and rescue scenario, evaluators should use the devices with IR illumination to conduct a search for an individual in a dark field. With the IR illuminator on, evaluators should begin the search 20 yards from the individual, moving closer to the individual and making device adjustments as necessary. Evaluators should assess depth perception, image quality, and image adjustment during these activities. Once identified, the individual should walk to a predetermined location where two cones or objects are set up at a specific distance apart from each other. The individual should walk back and forth between the cones to allow evaluators to assess field of view. Next, evaluators should follow the individual to a street with street lights. The individual should stop 50 feet from the evaluators, and evaluators should walk towards the individual until they are within arm's reach. This will allow the evaluators to assess depth perception in various lighting conditions while also assessing the device's tube protection features.

5.3 Surveillance Scenario

During the surveillance scenario, evaluators should monitor an individual at nighttime. From approximately 40 yards away, evaluators should utilize the device with the IR illuminator off in order to detect and recognize 3-D targets, including an individual entering and exiting a building while holding objects such as a cellular phone and an umbrella. Evaluators and the individual should stand in various lighting conditions (e.g., complete darkness, disparate lighting) to determine the effect on image quality. The individual should then enter the building, and evaluators should follow, using the device while navigating hallways and opening doors. Throughout these activities, evaluators should adjust gain and focus as necessary to improve image quality, as well as assess eye relief and handheld operation. Next, evaluators should assess IR illumination by observing and adjusting the beam width of the IR illuminator in a large room with as little ambient light as possible. Evaluators should then observe a facilitator using the device in various lighting conditions and at various distances to assess covertness. At the end of this scenario, evaluators should clean the device and its lenses and assess the overall ruggedness of the device.

6. PRODUCT SELECTION RECOMMENDATIONS

The focus group identified nine product selection criteria that may be used to select products for the handheld image intensifiers assessment. Table 6-1 presents the product selection criteria in priority order.

Table 6-1. Product Selection Criteria

Product Selection Criteria	Description
Magnification	Magnification of 1x
Built-In Infrared (IR) Illuminator	IR illuminator built-in the device
Tube Protection	Tube protection feature(s)
Manual Gain/Focus Adjustment	Manual gain/focus adjustment feature
Size	7 inches in length or less
Water Resistance	Water resistant
Battery Runtime	20-hour battery runtime with the IR illuminator off
Accessories	Eye cup and lens cover included
Warranty	3-year warranty

The focus group participants recommended products listed in Table 6-2 be considered for assessment.

Table 6-2. Product Recommendations

Vendor	Product/Series
B.E. Meyers & Company Inc.	OWL® Series
Night Vision Depot	BNVD-SG
Tactical Night Vision Company Inc.	Product not specified
Various vendors	PVS-14

7. FUTURE ACTIONS

The focus group recommendations will be used to guide the development of the upcoming SAVER assessment. Once the assessment is complete, the results will be available through the SAVER section of the Responder Knowledge Base (RKB) website, <https://www.rkb.us/saver>.

8. ACKNOWLEDGEMENTS

The SAVER Program thanks the focus group participants for their valuable time and expertise. Their insights and recommendations will guide the planning and execution of the handheld image intensifiers assessment, as well as future SAVER projects. Appreciation is also extended to the home jurisdictions of the participants for allowing them to participate in the focus group.