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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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Summary

Underwater Body Bags

(AEL reference number 03WA-01-BAGB)

In order to provide emergency responders with information on currently available underwater body bags, Science Applications International Corporation (SAIC) conducted a comparative assessment of underwater body bags for the System Assessment and Validation for Emergency Responders (SAVER) Program in October 2010. Detailed findings are provided in the Underwater Body Bag Assessment Report, which is available by request at <https://www.rkb.us/SAVER>.

Background

Underwater body bags are used by dive personnel during water recovery operations. These bags can be used at various depths in fresh or salt water and may be deployed in clear or zero visibility conditions. Underwater body bags are available in a variety of construction types and materials with assorted styles and features.

Assessment

Prior to the assessment, a focus group of eight emergency response practitioners with backgrounds in public safety diving was selected from different jurisdictions. The group's primary assignment was to develop evaluation criteria; however, they were also tasked with recommending possible applications to be used in the development of the assessment plan.

The focus group was presented with manufacturer information on available underwater body bags for possible assessment. Focus group participants discussed factors affecting the SAVER Program's equipment selection process and helped to streamline the process by recommending different underwater body bags for assessment.

Based on the focus group recommendations, market research, and equipment availability, the following underwater body bags were assessed:

- BBSDW-85 Water Recovery Mesh Bag, Centennial Products Inc.;
- BBENV-WTR01-75 Water Recovery Pouch, Medical Products Limited Inc.;
- EmP-100 Deep Sea Mesh 6-Handle Emergency Pouch, Peerless Plastics Inc.; and
- KS/WRP400 Water Retrieval Pouch, Knight Systems Inc.

Eight emergency response practitioners were selected to serve as assessment evaluators. All evaluators were required to have at least 5 years of public safety diving experience.

Evaluators were tasked to conduct various tasks simulating victim recovery operations. Specifically, these tasks included recovering adult- and child-size mannequins and simulated human remains, as well as lifting and transferring underwater body bags from the water to a vessel and from the vessel to the

shore. The assessment environment and activities performed were replicable should there be a need to repeat an identical or similar assessment in the future. The activities performed in this assessment were consistent with operational objectives that might exist if similar incidents were to occur.

Assessment Results

Evaluators rated the underwater body bags 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 Program 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 underwater body bag scored against each of the evaluation criteria assigned to the SAVER Program categories, see table 2. For equipment specifications, see table 3.

The following paragraphs provide a brief summary of evaluator feedback on each underwater body bag used during the assessment. The underwater body bags are listed from highest to lowest composite score. The complete assessment report includes a breakdown of evaluator comments by individual criterion.

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.

Centennial Products

Evaluators agreed that the Centennial Products underwater body bag was constructed with good quality materials, drained liquid well, and provided good filtering for retention of possible evidence. They also noted that the size of the bag is adequate for routine body recovery operations and will open

Table 1. Underwater Body Bags Assessment Results¹

Product	Composite Score	Affordability (5% Weighting)	Capability (35% Weighting)	Deployability (20% Weighting)	Maintainability (10% Weighting)	Usability (30% Weighting)
Centennial Products BBSDW-85 Water Recovery Mesh Bag	74	85	79	72	52	76
Medical Products Limited BBENV-WTR01-75 Water Recovery Pouch	74	70	83	68	57	73
Peerless Plastics EmP-100 Deep Sea Mesh 6-Handle Emergency Pouch	64	40	64	68	36	74
Knight Systems KS/WRP400 Water Retrieval Pouch	48	45	51	55	40	44

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	<ul style="list-style-type: none"> • Contrasting colors of handles and bag • Handle length and width • Long handles on each end • Perimeter-style opening • Cost versus quality • Durable shell material • Durable handle material • Identification kit • Color visibility
	↓ Cons	<ul style="list-style-type: none"> • Limited stitching on handle attachment • Narrow zipper edge • Small zipper pull • No contrasting color on zipper pull
Centennial Products	Composite Assessment Score: 74	

180 degrees, allowing recovery personnel to easily open the bag as much as necessary for each situation. The bag features 10 handles that are adequately sized with good length and width for a comfortable grip while performing tasks. The handles appeared to be durable and designed to withstand the weight of a body during routine operations. Evaluators also felt that this bag is reasonably priced and the cost is a good value based on its quality.

Evaluators observed that the zipper has a very narrow amount of material sewn to the shell; the narrow seam may be prone to tearing without additional reinforcement. They also noted that the zipper pulls are small and difficult to grip, especially with gloves, and that the zipper and pull are both black with no color contrast, making it difficult to differentiate between the two.

Medical Products Limited

Evaluators commented that the Medical Products underwater body bag is made with durable materials, drains well, and is capable of filtering and retaining possible evidence. This bag is sufficiently sized for routine body recovery operations and can open 180 degrees. The handles are adequately sized for a comfortable grip and capable of withstanding the weight of an adult-size body during routine operations. Buoyant, fluorescent orange float handles attached to the zipper pulls were particularly favored by evaluators; this design makes it easier for users to locate the zipper pulls. The contrast of the yellow bag, black handles, and zipper with orange pulls

	↑ Pros	<ul style="list-style-type: none"> • Contrasting color of zipper float handle • Handle length and width • Perimeter-style opening • Cost versus quality • Durable shell material • Stitching reinforcement on handles • Buoyant float handle on zipper
	↓ Cons	<ul style="list-style-type: none"> • Limited stitching on zipper • Narrow zipper edge • Small zipper pull
Medical Products Limited	Composite Assessment Score: 74	

enhances bag visibility. Evaluators also felt the cost of the bag is reasonable and relative to the quality.

Evaluators observed that the bag has a minimal amount of stitching on the seam that connects the zipper and a limited area available on the edges of the zipper; they suggested that a larger area would provide more material to sew to the zipper, increasing the strength of the seam. They also noted that the handle material is flat, which can make it difficult to open the handle, and that the small zipper pulls are difficult to grasp.

Peerless Plastics

Evaluators noted that the Peerless Plastics material is durable, pliable, and resistant to tears and cuts. The metal rivet attached through the handle and materials provides additional strength to the handle and absorbs a great deal of stress during lifting. The bag was easy to position underwater and remained in place during recovery operations. The bag size is adequate for most normal recoveries and was capable of supporting the weight of the adult-size mannequin with ease. The contrasting color of the yellow bag and white zipper was preferred; the yellow provided good visibility and the contrasting white made it easier to identify the zipper.

Evaluators observed that the seam around the perimeter had only single stitching; they were concerned that some seam stitching failed while lifting the bag into the vessel. They indicated that the center-style opening may hinder users from effectively placing adult-size bodies in the bag during some recovery operations and were concerned that the side handles do not provide adequate weight

	 Pros	<ul style="list-style-type: none"> • Contrasting colors of zipper and bag • Small mesh holes • Metal rivet for reinforcement
	 Cons	<ul style="list-style-type: none"> • Single-stitch perimeter • Small zipper pull • Center-style opening • Narrow handle opening • Handle width • Number of handles • Handle placement • Cost versus quality
Peerless Plastics	Composite Assessment Score: 64	

distribution and balance when carrying or lifting. The narrow handles placed undue pressure on the palms and fingers and were also slightly difficult to fit on a gloved hand.

Knight Systems

Evaluators commented that the Knight Systems underwater body bag is designed with two types of materials; the top of the bag is vinyl-coated polyester fabric, which shields contents from onlookers, and the bottom of the bag is vinyl-coated polyester mesh, which drains liquid and filters debris. The quantity and location of the handles was considered adequate and the zipper style was a good feature due to the large size of the teeth. The white bag color provides good visibility, and the contrasting black color of the zipper aids users in locating the zipper.

Evaluators expressed concern about the durability of the bag. While the bag maintained its integrity underwater, the seams and handles failed when lifting the bag, and in some instances, evaluators could not complete the assessment tasks and had to use a backup bag. The top material of the bag is slick and difficult to manipulate underwater, and evaluators had some concerns with the envelope-style opening of the bag. The vinyl handles are wide, but the gripping area is small and does not easily accommodate a gloved hand. The handles were also slightly uncomfortable because they did not conform to the hand when gripped. Evaluators stated that the white color of the bag does not contrast with the white handles, making the handles harder to distinguish, and the black color of the zipper pulls make them difficult to locate.

	 Pros	<ul style="list-style-type: none"> • Contrasting colors of zipper and bag • Large zipper teeth • Large zipper pull
	 Cons	<ul style="list-style-type: none"> • Handles stretched • Handles difficult to open • Handle quality, construction • Heat seal in lieu of stitching • No bag/handle color contrast • Envelope-style opening • Difficult-to-locate zipper pulls • Some positive buoyancy • Shell design caused drag when ascending • Cost versus quality
Knight Systems	Composite Assessment Score: 48	

Conclusion

Evaluators successfully completed the assessment with the Centennial Products, Medical Products Limited, and Peerless Plastics bags. A backup Knight Systems bag was required to complete some tasks. While advantages and disadvantages were observed, evaluators noted that their results were unique to this assessment. Analysis of evaluator comments and scores revealed the following common observations concerning the assessed underwater body bags:

- Evaluators placed a high value on underwater body bags that are well-made and constructed with quality materials. They stated it is imperative that the bags are durable enough to withstand the stress of lifting a victim while remaining tear resistant.
- Evaluators preferred underwater body bags with a sufficient number of handles strategically located to provide the responder with a variety of options to improve leverage or weight balance. They emphasized a preference for strong, comfortable handles that remain securely attached to the bag when stress is applied during lifting or pulling.
- Evaluators favored underwater body bags with perimeter-style openings. They explained that placement of the victim is less difficult when a bag opens up 180 degrees.
- Evaluators placed a high value on underwater body bags that drain quickly and easily and have an efficient filtering system to capture any potential evidence for investigations or criminal court cases.

- Evaluators expressed a strong preference for underwater body bags with strong, reliable zippers that work smoothly and easily. Other preferences included dual zipper pulls that are easy to locate and are large enough to grasp, especially while wearing dive gloves.
- Evaluators favored bright colors that are easy to identify, as well as contrasting colors for the

handles, zipper, and pull. Being able to distinguish the different features enhances visibility and is an added value to the user.

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

Table 2. Underwater Body Bag Ratings Chart¹

KEY					
Least Favorable	Most Favorable				
					
		Centennial Products	Medical Products Limited	Peerless Plastics	Knight Systems
Assessment Criteria					
Affordability					
Initial Cost					
Capability					
Bag Construction					
Bag Size					
Style of Opening					
Handle Construction					
Color					
Deployability					
Underwater Deployment					
Ease of Carry					
Maintainability					
Storage Requirements					
Cleaning Requirements					
Repairability					
Usability					
Buoyancy					
Easy to Access Handles/Pulls					
Durability					
Weight Distribution					

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. Underwater Body Bags Specifications

Specifications	Centennial Products	Medical Products Limited	Peerless Plastics	Knight Systems
Length	96 inches	94 inches	90 inches	90 inches
Width	38 inches	36 inches	36 inches	36 inches
Girth	72 inches	72 inches	N/A	70 inches
Weight Capacity	450 pounds	450 pounds	400 pounds	N/A
Opening Style	Perimeter	Perimeter	Center	Envelope
Number of Handles	10	10	6	8
Color	Orange	Yellow	Yellow	White
Shelf Life	10 years	5 years	N/A	10 years
Cost	\$36.18	\$48.89	\$93.95	\$46.50

Note:

N/A = Information not available