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U.S. Department of Homeland Security



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 (S&T) Directorate 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

Explosive Ordnance Disposal (EOD) Hook and Line Kits

(AEL reference number 02EX-02-TLRO)

In order to provide emergency responders with information on currently available EOD hook and line kit technologies, capabilities, and limitations, Science Applications International Corporation (SAIC) conducted a comparative assessment of EOD hook and line kits for law enforcement applications for the System Assessment and Validation for Emergency Responders (SAVER) Program in May 2010. Detailed findings are provided in the Assessment Report on Explosive Ordnance Disposal (EOD) Hook and Line Kits, which is available by request at <https://www.rkb.us/saver>.

Background

EOD hook and line kits are used by law enforcement officers and emergency responders, especially members of hazardous materials (HAZMAT) and tactical entry or special weapons and tactics (SWAT) teams who have been trained as bomb or hazardous device technicians. The kits are used to open doors in situations where an explosive device is thought to be present, to remove suspected explosive items from buildings, cars, etc., or to remove objects from areas where explosives are thought to be present while the operator remains a safe distance from the explosives.

Assessment

Prior to the assessment, a focus group of nine emergency response practitioners with backgrounds in EOD, law enforcement, and HAZMAT response was selected from different jurisdictions. The focus group's primary assignment was to develop EOD hook and line kit evaluation criteria; however, they were also tasked with recommending possible applications to be used in the assessment plan development. The group's final task was to recommend specific EOD hook and line kits that they considered potentially beneficial to the response disciplines for evaluation.

The focus group was presented with manufacturers' information on available EOD hook and line kits for possible assessment. Participants discussed the broad range of equipment configurations and the different features offered with each kit. The group's primary concerns for these types of tools and kits were the safety of responders, ease of operation, tool standardization, and tool versatility. Focus group participants discussed factors affecting the SAVER Program's equipment selection process and helped to streamline the selection process by recommending different EOD hook and line kits for the upcoming assessment.

Based on the focus group recommendations and market survey research, the following EOD hook and line kits were assessed:

- ICOR Technology, Inc. Ultimate Advanced Hook & Line
- Allen Vanguard HAL[®] GS-1

- NIC Instruments Limited Comprehensive Hook & Line Kit
- Quabbin, Inc. Dexter Hook & Line 18.

Eight emergency response practitioners were selected to serve as assessment evaluators. All evaluators had at least 7 years of combined experience in emergency response disciplines, had completed training, and were bomb technician or hazardous device technician certified.

Evaluators were tasked to participate in four stations: package removal from a building, package removal from a vehicle, dexterity exercises, and body relocation. 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 the operational objectives that might exist if a similar incident were to occur.

Assessment Results

Evaluators rated the EOD hook and line kits based on the evaluation criteria established by the hook and line kit 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

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.

scores indicate a higher rating by evaluators. To view how each EOD hook and line kit scored against each of the evaluation criteria assigned to the SAVER Program categories, see table 2. For a list of components included in the assessed kits, see table 3.

The following paragraphs provide a brief summary of evaluator comments and feedback on each EOD hook and line kit used during the assessment. The hook and line kits are listed from highest to lowest composite

Table 1. EOD Hook and Line Kit Assessment Results¹

Model	Composite Score	Affordability (15% Weighting)	Capability (30% Weighting)	Deployability (20% Weighting)	Maintainability (10% Weighting)	Usability (25% Weighting)
Ultimate Advanced Hook & Line	79	72	80	82	74	81
HAL® GS-1	73	63	73	81	70	76
Comprehensive Hook & Line Kit	69	60	71	79	62	67
Dexter Hook & Line 18	62	68	69	49	73	55

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.

score. The complete assessment report includes a breakdown of evaluator comments by individual criterion.

Ultimate Advanced Hook & Line

The Ultimate Advanced Hook & Line received a composite score of 79. Evaluators reported that it is the least expensive kit, yet many of the components are favored over those in other assessed kits. They stated that the heavy-duty clamp works well for a variety of tasks. Evaluators liked the fact that the corkscrew ground anchor provides a strong anchor and does not require the use of a hammer. They noted that because the friction lock on the extension pole remains secure and does not twist, it provides smooth maneuvering and removal of suspect packages. Evaluators reported that features, including the interchangeable tips on the clamps, the positive lock

on the vise grips, as well as the versatility of the suction cups, increase the capabilities of this kit. Evaluators favored the highly visible red color of the components, making them easy to see, especially when the user is wearing a bomb suit. They reported that the two different rope colors are easy to distinguish and simplify tasks. Additionally, evaluators noted that the relatively lightweight wheeled carrying case provides a stable platform and allows the case to be freestanding in the vertical position.

Evaluators also reported a few disadvantages they observed when using the Ultimate Advanced Hook & Line. They stated that they had difficulty adjusting the door jamb extension pole, and the release cylinder jammed on the breakaway pulley and slipped on the rope. Evaluators noted that they were unable to use both hands on the small handle of the heavy-duty clamp, and suggested that a longer handle would provide more torque. Although the kit provides two lines, only one line puller is provided, according to the evaluators. They also stated that the line frayed and appeared to be deficient in quality.

HAL GS-1

The HAL GS-1 received a composite score of 73. Evaluators agreed that the HAL GS-1 carrying case offers a good layout with contrasting component colors for easy identification and access. They stated that the adhesive anchor pads provide strong adhesion and the locks on the extension pole are easy to operate. Evaluators favored features such as the two-hand line pull handle, which provides plenty of room for a good grasp and also holds the pitons in place for hammering. They reported that the endless loops and soft ground anchor provide additional capabilities.

Evaluators agreed, however, that this kit is the most expensive of the four assessed kits and includes only one reel and line. They described the design of the reel as poor because it is not stable, has no guide to control line spooling and tangling, and is not equipped with a braking mechanism to control the speed of the spool. Evaluators stated that the modular clamp tips repeatedly come off when put under stress and the breakaway pulleys are constructed poorly, failing multiple times during the assessment. They noted that several times the suction cups did not provide sufficient hold, especially when used on smooth surfaces. Evaluators indicated that the pulley release cone is attached to the line and is not adjustable, and

	 Pros	<ul style="list-style-type: none"> • Red component color provided visibility while in bomb suit • Stable platform provided by case wheel position • Freestanding case capability due to wheel position • Light wheeled case • Heavy-duty clamp • Interchangeable tips on clamps • Positive lock on the vise grip component • Multidirectional release of breakaway pulleys • Reel guide and reel design • Two different rope colors • Multiple angle configurations for suction cups • Twisting prevented due to friction lock on extension pole • Good anchor point provided by ground corkscrew; no hammer required • Strong anchor points • Least expensive kit
	 Cons	<ul style="list-style-type: none"> • Small handle on heavy duty clamp, could only use one hand to tighten • Jamming of release cylinder on side of the breakaway pulley; slippage on rope • Two lines but only one rope puller • Poor quality rope (frayed) • Door jamb extension pole not easily adjustable
Ultimate Advanced Hook & Line	Composite Assessment Score: 79	

	 Pros <ul style="list-style-type: none"> • Useful kit layout • Contrasting colors for components • Lightweight, durable case with handles on both ends • Two-hand rope pull handle; also doubles as a piton holder when hammering • Very good bonding on adhesive pads • Easy-to-operate locks on extension pole • Red metal door jamb brace unique to this kit • Multiple carabiner styles • Endless loops in kit • Soft ground anchor
	 Cons <ul style="list-style-type: none"> • Modular clamp tips repeatedly came off • Poor construction of breakaway pulleys • Breakaway cone is permanently attached to the line • Only one line • Poor reel design • Suction cup failures • Not all carabiners fit adhesive anchor points • Most expensive kit
HAL® GS-1	Composite Assessment Score: 73

the adhesive anchor points do not allow all of the carabiners to connect to the attachment point, limiting their capabilities.

Comprehensive Hook & Line Kit

The Comprehensive Hook & Line Kit received a composite score of 69. Evaluators reported that the Comprehensive Hook & Line Kit carrying case provides good organization of the components with foam inserts and pouches for short lines and hooks. They stated that the case protects the components by keeping them secure in their designated compartments. Evaluators agreed that the small clamps are strong and the reels are sturdy. Other favored features included the cone-shaped sled, gated eye hooks on the pulleys, and a wide strap. Evaluators added that the large handle on the reel provides a good grip, especially when in the bomb suit.

Evaluators agreed that there are several disadvantages to this kit and features that they did not prefer. They stated that the case is not stable when being pulled and

	 Pros <ul style="list-style-type: none"> • Good organization in case; components secured in compartments; pouches for short lines and hooks • Strong small clamps • Gated eye hooks on pulleys • Sturdy reels • Large reel handle provides a good grip • Two different color ropes • Cone-shaped sled • Wide strap
	 Cons <ul style="list-style-type: none"> • No color coding; difficult to distinguish components in low light • Case unable to stand on end; not stable when walking • No positive locking mechanism on vise grips • Poorly designed breakaway pulleys, not durable; inconsistent in functioning properly • Unable to lock reel wind handle in place • Short grip on rope pull handle • Adhesive pads not durable, substandard • Inability to separate the suction cups • Difficult collapse of telescoping pole • Improper functioning of telescopic pole attachment used for delivery of treble and pronged hooks • Difficult to apply tension to door jamb brace once in place; collar lock poorly designed • Inadequate number and style of carabiners • Ends of steel cable unable to accommodate carabiners • Tips not compatible with tools of other kits
Comprehensive Hook & Line Kit	Composite Assessment Score: 69

it does not stand on its end. Evaluators noted that the vise grips do not have a positive locking mechanism and the line pull handle has a short grip. They noted that the telescopic pole attachment does not function properly when used for delivery of the treble and pronged hooks; they also reported trouble collapsing the pole. Evaluators commented that the adhesive pads bent and are not durable. They also stated that they had difficulty separating the suction cups and applying tension once the door jamb brace was in place. Evaluators agreed that the breakaway pulleys

do not always function properly, are poorly designed, and are not durable. Lastly, they stated that the reel winding handle will not lock into place and allows the line to unwind.

Dexter Hook & Line 18

The Dexter hook & Line 18 received a composite score of 62. Evaluators agreed that the Dexter Hook & Line 18 provides more components than the other assessed kits, including high-quality lines and stable reels with a brake that is easy to operate while in a bomb suit. They preferred the positive lock on the cable lines and stated that the door jamb brace is very strong and works extremely well. They reported that the two mirrors (one small, handheld, lighted mirror and one larger mirror that can be attached to the

sectional pole) provide additional capabilities and are favored kit components. Evaluators stated that the suction cups perform very well and the adhesive pads are designed with a large surface area for extra adhesion. They agreed that the backpack carrying case would be good for SWAT operations because it would easily contain a smaller quantity of specific components.

Evaluators reported, however, that the backpack is very heavy, difficult to carry, and cannot be worn on the back when in a bomb suit. They stated that the backpack has too many compartments with no intrinsic system of organization. Evaluators explained that the components' black color makes them even more difficult to be identified and located in the black backpack. Evaluators agreed the lines being the same color present problems and limit the kit's versatility. The reels are not equipped with a line guide to help respool the lines neatly and they do not have a friction brake for additional control, according to evaluators. They also stated that utilization of the pulleys requires additional carabiners that can be attached to them. Evaluators noted that the short ropes have attached carabiners that are not always necessary and limit their use. Finally, they reported that the shock-corded, collapsible, sectional pole is difficult to maneuver and manipulate, and the unused sections hinder the user during response operations.

Conclusion

Evaluators were able to successfully complete the assessment tasks with all four of the assessed EOD hook and line kits. They observed advantages and disadvantages of the assessed kits, but noted that their results are unique to the configurations used for this assessment. Evaluators noted that a hammer or mallet is necessary for many of the required tasks they perform with this type of kit and suggested that they be included with each kit. Analysis of evaluator comments and scores revealed the following common observations concerning the assessed EOD hook and line kits:

- Evaluators placed a high value on EOD hook and line kits with well-made and high-quality materials. The rigors of EOD bomb mitigation tasks require durable components that can withstand repeated use.
- Evaluators expressed a strong preference for EOD hook and line kits that include a wide variety of tools that are versatile and

	 Pros	<ul style="list-style-type: none"> • Backpack case good for special weapons and tactics team (SWAT) operations • Stable reels with easy-to-operate brake • High quality lines • Positive lock on cable lines • Strong suction cups • Large surface area on adhesive pads • Strong door jamb brace; worked well • Two mirrors: small, lighted, handheld; larger mirror with pole attachment • More components than in other kits
	 Cons	<ul style="list-style-type: none"> • Difficult to distinguish black components in black backpack • Too many compartments in backpack; difficult to locate components in bag; no intrinsic organization • No hard case provided; difficult to carry heavy backpack; straps unable to fit over bomb suit • Additional carabiners needed on pulleys for attachment • No line guide on reels • No friction brake on reel • Same color for both lines • Limited uses for short ropes with attached carabiners • Shock-corded, collapsible pole difficult to maneuver/manipulate; unused sections got in the way
Dexter Hook & Line 18	Composite Assessment Score: 62	

interoperable. They preferred to have different sized carabiners that are easy to open and close.

- They agreed that continual use of a kit demands a case that is durable and protects its components from damage. Backpacks, according to evaluators, are good for short-term tasks requiring only a few tools.
- Evaluators preferred EOD hook and line kits with well-organized cases. Technicians must be able to quickly and easily access components; cases that provide a place for every tool allow users to easily identify each tool. Evaluators expressed a strong preference for cases equipped with easy-to-grip handles on both ends for easy deployment and wide wheel bases that prevent the case from tipping to one side when it is being rolled. In addition, some evaluators suggested an inner cover or sleeve to prevent components from falling out of their slots when the case is opened.
- Evaluators preferred kit components that are brightly colored and easily identified in the carrying case or bag, and can be easily seen while wearing a bomb suit or in low light conditions.
- Evaluators preferred pliers that are designed with locking mechanisms to enhance ease of use, speed of task completion, and user safety.
- Evaluators placed a high value on heavy-duty clamps that can hold a lot of weight; have self-gripping or alligator-type jaws; will attach to a variety of object sizes; are reversible; have attachment holes for lines and other tools; and are spring-loaded.
- Evaluators preferred features that include pulleys and snatch blocks that break away in both directions and that open for easy line insertion. Some pulleys are side loading and open to allow the bomb technician to place the line in the pulley and lock the gate. Some snatch block pulleys lock shut and will not open during use, while others will open automatically when used with a release or jammer cleat. Pulleys with side openings allow for changing the direction of the pull and for lifting suspect objects.
- Evaluators preferred sturdy reels with stable bases that do not easily tip over, are not too heavy, have locking/braking mechanisms, and provide a guide for rewinding lines. They also

agreed that the use of two reels with durable, color-coded lines that do not stretch enhance their abilities.

- Evaluators expressed a strong preference for EOD hook and line kits with rope handles that can be easily grasped with two hands. They agreed it is essential that the rope does not slip from the technician's hands while being pulled, and it is equally important for the technician to maintain a firm grip during rigging and removal tasks. Some rope handles are equipped with cleats to hold the line securely; the cleats will tighten the technician's grip on the line when the line is pulled.
- Evaluators commented that features such as suction cups that provide a strong suction on a variety of smooth surfaces improve the speed and efficiency of rigging tasks.
- Evaluators placed a high value on adjustable and telescopic poles that hold weight easily and do not slip. They also preferred poles with hook attachments on the ends to attach a line or hook to suspect objects.
- Evaluators preferred hooks with durable spring gates, triple barb hooks (used to attach a line to an object that must be manipulated), and hooks with mounts for pole ends.
- Evaluators expressed a strong preference for pitons that will not bend and are equipped with rings or eye hooks, slings to tighten around suspect objects or victims, door wedges that can be placed in various positions to hold a door open, and adhesive pads equipped with eyes and protective backing that can be easily removed, especially when wearing a bomb suit.

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. EOD Hook and Line Kit Ratings Chart¹

KEY					
Least Favorable	➔	Most Favorable			
					
		Ultimate Advanced Hook & Line	HAL® GS-1	Comprehensive Hook & Line Kit	Dexter Hook & Line 18
Assessment Criteria					
Affordability					
Equipment costs					
Replacement part costs					
Training					
Capability					
Component quality					
Versatility					
Strength					
Deployability					
Mobility					
Storage					
Maintainability					
Warranty					
Replacement part availability					
Cleaning and maintenance					
Usability					
Ease of use					
Weight					
Component accountability					

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. EOD Hook and Line Kit Components

Product	Components	
Ultimate Advanced Hook & Line	<ul style="list-style-type: none"> • Reels (2) • Lines (2) • Hooks (9) • Pulleys/Snatch blocks (7) • Carabiners (8) • D-rings/Snaps/Shackles (3) • Adhesive anchor pads (10) • Grips/Clamps/Forceps (7) 	<ul style="list-style-type: none"> • Telescopic pole (1) • Suction cups (2) • Cords, straps, slings, ropes (14) • Pitons with eyehooks (6) • Sledge or skid pan (1) • Hard carrying case (1) • User/Instruction manual (1) <p>Other components include line pull handle; rope lock assemblies; replaceable tips for spike; split finger, needle nose, and rubber bumper clamps; two doorway braces; corkscrew ground anchor; pocket mirror with pole attachment; multifunction tool; eyescrews; door wedge; and doorstops.</p>
HAL® GS-1	<ul style="list-style-type: none"> • Reel (1) • Line (1) • Hooks (10) • Pulleys/Snatch blocks (4) • Carabiners/D-rings (6) • Adhesive anchor pads (5) • Grips/Clamps (1) 	<ul style="list-style-type: none"> • Collapsible pole (1) • Suction cups (2) • Cords, straps, slings, ropes (2) • Pitons (6) • Sledge or skid pad (0) • Hard carrying case (1) • User/Instruction manual (1) <p>Other components include line pull handle; needle nose, wide, and serrated clamp tips; door wedge with eyehook; and a doorstop.</p>
Comprehensive Hook & Line Kit	<ul style="list-style-type: none"> • Reels (2) • Lines (2) • Hooks (9) • Pulleys/Snatch blocks (7) • Carabiners/D-rings (4) • Adhesive anchor pads (10) • Grips/Clamps (6) 	<ul style="list-style-type: none"> • Telescopic pole (1) • Double suction cup (1) • Cords, straps, slings, ropes (7) • Pitons (4) • Sledge or skid pan (1) • Hard carrying case (1) • User/Instruction manual (1) <p>Other components include line pull handle, snatch block releases, hook mounts for pole, two doorway braces, pocket search mirror, rope eyes, self-locking forceps, pocket tool, door wedges, and doorstops.</p>
Dexter Hook & Line 18	<ul style="list-style-type: none"> • Reels (2) • Lines (2) • Hooks (14) • Pulleys/Snatch blocks (7) • Carabiners/D-rings (10) • Adhesive anchor pads (10) • Grips/Clamps/Pliers (12) 	<ul style="list-style-type: none"> • Sectional pole (1) • Suction cups with bridge (2) • Cords, straps, slings, ropes (14) • Pitons (8) • Sledge or skid pad (1) • Backpack carrying case (1) • User/Instruction manual (1) <p>Other components include line pull handle, rigging rope, two mirrors (one with handle, one with pole attachment), pocket tool, door wedges with eyehooks, and doorstops.</p>