



Summary

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 Directorate (S&T) of DHS, the SAVER Program conducts objective operational tests 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, and operationally oriented assessments and validations of emergency responder equipment;
- Providing information 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-saving 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?"

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Helmet-Mounted Lights (HMLs) Assessment Report

In order to provide emergency responders with information on currently available HML capabilities, limitations, and usability, Science Applications International Corporation conducted a comparative assessment of HMLs for the SAVER Program in June 2007. Detailed findings are provided in the complete Assessment Report on Helmet-Mounted Lights, which is available by request at <https://www.rkb.us/saver>.

Background

Emergency responders commonly use HMLs as hands-free primary and secondary light sources during firefighting and search and rescue operations—including collapsed structure and confined space rescue.

Assessment

A focus group consisting of seven emergency response practitioners from various regions of the country met in March 2007 to identify equipment selection criteria, evaluation criteria, and assessment scenarios. The focus group recommended that the upcoming assessment should focus on intrinsically safe HMLs specifically designed for search and rescue operations. Based on the focus group recommendations and market survey research, the following four HMLs were selected for assessment as representative of the current marketplace for search and rescue operations HML:

- Streamlight® Trident® Headlamp
- Petzl® Tikka® XP HAZLOC Headlamp
- Princeton Tec® Apex™ Headlamp
- Brunton® RL6 LED Headlamp.

Eight emergency response practitioners served as assessment evaluators. The assessment simulated search and rescue operations in subdued lighting conditions. Evaluators conducted four rotations (one for each HML being assessed). Each assessment rotation consisted of two stations: (1) a darkened maze and (2) a darkened building.

Assessment Results

Evaluators rated the HMLs based on the weighted evaluation criteria established by the HML focus group within the five SAVER categories. The SAVER category and composite scores are shown in table 1.



Helmet-Mounted Lights

Table 1. HMLs Assessment Results¹

System	Composite Score	Affordability (10% Weighting)	Capability (30% Weighting)	Deployability (15% Weighting)	Maintainability (20% Weighting)	Usability (25% Weighting)
Trident®	67.4	61	69	69	66	69
Tikka®	64.8	60	62	73	56	72
Apex®	61.9	61	67	61	49	68
RL6	61.8	55	62	67	54	68

Note:

¹ Scores contained in the complete assessment report may be listed in a different numerical scale. For the purposes of the SAVER Summary, SAVER category scores are normalized and rounded to the nearest whole number.

The following sections provide a brief summary of the evaluator comments and feedback on each HML. The helmet light models are listed by highest to lowest composite scores. The full report includes a breakdown of evaluator comments by individual criterion.

Trident

The Trident received the highest evaluator scores in the capability and maintainability categories. Evaluators stated that the combination of the Xenon bulb and light-emitting diode (LED) lamp provides adequate lighting, and they noted that the adjustable width Xenon beam was an especially helpful feature. They reported that the Trident appears to be durable and should be able to endure repetitive emergency responder use. They noted the Trident was able to withstand a drop test from head level with little damage.

Evaluators reported that the Trident is water resistant and appears to be sealed well enough for use in rain or other wet conditions but should not be immersed in water. They also stated that the Trident is lightweight and balances well on both the structural firefighting



Trident in Confined Space

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 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.

and Urban Search and Rescue (USAR) helmets. They stated that they barely noticed the weight of the light on the helmet. They noted that the light did not interfere with completing assessment tasks. Evaluators reported that the Trident's controls are easy to operate while wearing either firefighting gloves or search-and-rescue style gloves. They noted that the single control button is conveniently located on the top of the lamp, and the large button is easy to press.

The evaluators determined that there were a few drawbacks with the assessed Trident HML. Trident's three light modes are controlled by a single control button, but neither the light modes nor the beam width

	<p>↑ Pros</p>	<ul style="list-style-type: none"> • Easy-to-use on/off switch • Solid construction • Rubber helmet strap • Lightweight • Focusable Xenon beam • Good vertical adjustment • Useful dim/bright settings • Warranty • Price
	<p>↓ Cons</p>	<ul style="list-style-type: none"> • Tilting lamp head only tilts downward • Sequential modes • Requires two hands to focus the Xenon beam • Minimal instructions
<p>Trident</p>	<p>Composite Assessment Score: 67.4</p>	

settings are labeled on the unit. The single control button changes modes in an easy-to-follow sequence, but the user must turn off the light to begin the sequence again. Evaluators reported that the Trident’s tilting head’s inability to tilt upward hinders it from being positioned well for crawling through confined spaces.

Tikka


The Tikka received the highest evaluator scores in the deployability and usability categories. Evaluators reported that the Tikka is water resistant and is rated for use in Class 1, Division 2, Groups C and D hazardous locations. They also reported that the Tikka worked much better in confined spaces than in large rooms and long hallways. Evaluators reported that the Tikka is light and balances well on both structural firefighting and USAR helmets. They added that the Tikka works especially well with the structural firefighting helmets.



Tikka in Confined Space

Evaluators noted that the Tikka has a visual battery indicator but no audible low battery alarm. The helmet must be removed in order for the user to see the indicator, and the location of the indicator on the side of the headlamp made it difficult for others to read. As with the Trident, the Tikka’s tilting head only tilts downward and was not as effective when crawling.

Evaluators reported that the Tikka was easy to attach to the structural firefighting and USAR helmets used

	<p>↑ Pros</p>	<ul style="list-style-type: none"> • Separate wide angle and spot settings • Boost mode • Positive lock on battery back • Waterproof to 1 meter • Battery light indicator • Separate buttons for different options
	<p>↓ Cons</p>	<ul style="list-style-type: none"> • Tilting lamp head only tilts downward • Controls on bottom of light and difficult to reach • Strap too small • Power cord too short • Durability • Warranty • Cost
<p>Tikka</p>	<p>Composite Assessment Score: 64.8</p>	

in the assessment. Most evaluators noted that accessory clips available from the manufacturer were needed to hold the light securely—especially on the USAR helmets. Evaluators reported that the Tikka received slight damage when it was drop tested from head level, but it continued to operate.

They also commented that the light’s sliding diffuser lens and tilting head mechanism appear susceptible to damage. The small control buttons were difficult to operate while wearing search-and-rescue style gloves and nearly impossible while wearing firefighting gloves. Evaluators were required to use two hands to adjust the tilting lamp head.


Apex


The Apex received the highest evaluator scores in the capability category. The Apex has a visual battery indicator but no audible low battery alarm. The Apex uses different lamp combinations to create narrow and wide beams, and the four smaller LED lamps also operate in a flash mode. Evaluators stated that neither beam width nor brightness settings are labeled on the light unit and the raised markings on the control buttons are difficult to feel while wearing gloves. The Apex’s tilting head also only tilts downward.



Apex

Evaluators reported that the Apex was easy to attach to the structural firefighting helmets but somewhat difficult to attach to the USAR helmets without using the accessory clips. The Apex was especially difficult to attach to helmets with goggle or visor-style eye

	<p>↑ Pros</p> <ul style="list-style-type: none"> • Lightweight • Small, low profile • Removable from harness • Diffuser • Instructions/detailed battery chart • Medium setting good at close range • Good in confined space • Battery light indicator • Warranty
<p>↓ Cons</p> <ul style="list-style-type: none"> • Tilting lamp head only tilts downward • Durability • Small buttons • Low settings too dim • Warranty • Minimal instructions 	
<p>Apex</p>	<p>Composite Assessment Score: 61.9</p>

	<p>↑ Pros</p> <ul style="list-style-type: none"> • Tilting lamp head tilts upward and downward • Red light works well for short distances in smoke • Good in confined space • Power button delay prevents accidental shutoff
<p>↓ Cons</p> <ul style="list-style-type: none"> • Battery compartments open easily when dropped or bumped • No wide-angle beam • Buttons are difficult to use while wearing gloves • Minimal instructions 	
<p>RL6</p>	<p>Composite Assessment Score: 61.8</p>

protection, and the light had a tendency to slip during assessment tasks if the clips were not also used with the firefighting helmet. Evaluators reported that the Apex’s casing cracked slightly when it was drop tested from head level, but the light continued to operate. Despite the damage, evaluators considered the light to be durable enough for most response operations.

Most evaluators agreed that the Apex is lightweight and balances well on both the structural firefighting and USAR helmets. However, two evaluators commented that the battery pack creates too much weight on the back of the helmets. They noted that the Apex’s control buttons are difficult to operate while wearing either firefighting or search-and-rescue style gloves. Evaluators stated that the tilting lamp head was easy to adjust with one hand.

RL6

Evaluators reported that the RL6 does not have a visual or an audible low battery indicator. However, the light automatically switches to a power-save mode when battery life reaches 15 percent. The RL6 has five white LEDs and one red night vision LED, which can be operated in five light modes. Evaluators pointed out that the user can adjust the RL6’s tilting head either up or down.



RL6

Evaluators noted that the RL6 can be easily attached to structural firefighting and USAR helmets, but doing so

requires the accessory clips to stay in place. They also indicated that the RL6 is a little more difficult to attach to helmets with goggles or visor-style eye protection. Evaluators reported that the RL6 was able to withstand drop test impact from head level with little damage to the headlamp and should be able to withstand repetitive use by emergency responders. However, the twin battery compartments on the back of the light harness do not lock securely, and the batteries come out of the compartment every time the light is dropped.

Evaluators reported that the twin battery packs on the strap cause helmets to feel heavy in the back and slightly uncomfortable. They also noted that the control buttons are easy to use with search-and-rescue style gloves but more difficult with firefighting gloves. They stated that the RL6 has no beam width adjustment control and the tilting lamp head is easy to adjust with one hand. The strap required little adjustment during the assessment, but evaluators reported that the RL6 strap is easier to adjust while wearing gloves than the other evaluated models.

Conclusion

The purpose of this comparative assessment was to evaluate the affordability, capability, deployability, maintainability, and usability of HMLs used in emergency response operations. The assessment was based on a scenario-driven exercise, which included common response tasks necessitating the use of HMLs. The evaluators were able to successfully complete the assessment tasks with all four of the assessed helmet light models.

An analysis of the evaluator comments and scores revealed these common conclusions concerning the assessed HMLs:

- HMLs provide responders adequate hands-free primary or secondary lighting for search and rescue operations.
- HMLs do not provide responders adequate primary lighting for search and rescue operations in environments that have heavy smoke or dust.
- HMLs that do not allow the lamp to be tilted upward can result in additional neck fatigue when used in confined spaces.
- The HML's cost is not a good indicator of its performance.



Helmet-Mounted Lights

QuickLook Snapshot²



Note:

² The SAVER QuickLook, available on the SAVER Web site, allows users to select the SAVER categories that are most important to their department and view results according to their specific needs.

All reports in this series, as well as reports on other technologies, are available on the SAVER Web site (<https://www.rkb.us/saver>).