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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 Directorate (S&T), the SAVER Program conducts unbiased 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 established and 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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# Summary

## Thermal Imaging Systems Assessment

*As a part of the System Assessment and Validation for Emergency Responders (SAVER) Program, Texas A&M Engineering, including Texas Engineering Extension Service (TEEX) and Texas Transportation Institute (TTI), conducted a comparative assessment of thermal imaging systems. The Thermal Imaging Systems Assessment Report is available by request at <https://www.rkb.us/saver>.*

### Background

Thermal imagers are used by emergency responders for a variety of applications. Commonly, these systems are used to assist firefighters in identifying hidden hotspots in firefighting, locate downed personnel in limited visibility conditions such as smoke-filled rooms, and in "overhaul" operations. The systems also have other applications, including locating hidden persons or other heat sources, in search and rescue and law enforcement applications, and industrial/hazardous materials scene assessment. This summary details the comparative assessment results in firefighting applications, while the full assessment report details results for firefighting, hazardous material (HAZMAT), and search applications.

### Assessment

Nine different microbolometer-type sensor thermal imaging systems that met selection criteria were included in the assessment. They were:

- FireFLIR® FF130 System by Aerion Technologies (*Aerion*)
- Argus™ 4 Thermal Imaging Camera by e2v (*Argus*)
- T3XT Thermal Imager by Bullard (*Bullard*)
- VIPER® Thermal Imaging System by Cairns Advanced Technologies (*Cairns*)
- K1000 Elite by ISG Thermal Systems USA (*ISG*)
- ISI 3500 Thermal Imaging Camera by International Safety Instruments (*ISI*)

- Evolution<sup>®</sup> 5000 Series Thermal Imaging Camera by MSA (*MSA*)
- Eagle Imager 1600 Color Thermal Camera by Scott Health and Safety (*Scott*)
- SearchTIC by SearchSystems (*SearchSystems*).

In the tests, fire services practitioner subject matter experts (SMEs) used the thermal imaging systems individually for HAZMAT applications (figure 1) and in bench tests for hot spot identification and sensitivity transition, and used the systems in teams for search and rescue and live fire scene scenarios.



**Figure 1. Assessment SMEs use thermal imagers to view product levels in petroleum storage tanks.**

## Assessment Results

The SMEs provided numeric ratings of the systems for capability, deployability, maintainability, and usability, and also provided verbal feedback after they used the systems in the different scenario applications. In addition, system cost, warranty, vendor service, and environmental durability were evaluated.

Thermal imaging system ratings for firefighting, search and rescue, and HAZMAT applications scenarios are discussed in separate chapters of the full report. The system rating summary is based on firefighting applications.

Table 1 lists the SAVER category and composite scores, on a 100-point scale (100 is best) for live fire applications.

The composite score of the thermal imaging systems for HAZMAT and search applications are contained in the full assessment report.

### *FireFLIR<sup>®</sup> FF130 System by Aerion Technologies*

In live fire applications, the *Aerion* system was the top favorite of the fire services practitioner SMEs for its capability and usability, and it scored in the top half of all assessment categories. SMEs commented about its image quality and ergonomics, noting that the unit is “firefighter friendly.” Shortcomings of the unit that were identified in the test were its larger size, making it comparatively more difficult to store on apparatus than some of the other units, and its heavier weight and lens/screen configuration, impacting their ability to use it for standing applications or where downward views are necessary, such as on stairs.

**Table 1. Firefighting Applications Composite Rating and Category Scores for Thermal Imaging System<sup>a</sup>**

<b>Thermal Imager</b>	<b>Composite Score</b>	<b>Affordability</b> (.05 Overall Weighting)	<b>Capability</b> (.25 Overall Weighting)	<b>Deployability</b> (.25 Overall Weighting)	<b>Maintainability</b> (.15 Overall Weighting)	<b>Usability</b> (.30 Overall Weighting)
Aerion	<b>88</b>	54	100	80	80	92
MSA	<b>80</b>	54	76	82	86	82
ISG	<b>76</b>	42	76	82	80	76
ISI	<b>74</b>	70	78	80	50	76
Argus	<b>72</b>	12	66	80	82	76
Bullard	<b>70</b>	32	78	70	66	74
Scott	<b>70</b>	100	66	68	72	70
Cairns	<b>56</b>	74	60	40	88	50
Search Systems	<b>56</b>	52	52	66	54	52

<sup>a</sup> Scores contained in the report may be listed in a different numerical scale. For the purposes of the SAVER Summary, listed SAVER category scores are unweighted and rounded to the nearest whole number using a 100-point scale.

***Evolution<sup>®</sup> 5000 Series Thermal Imaging Camera by MSA***

In live fire applications, the *MSA* system was one of the top scoring systems in deployability, maintainability, and usability, and scored in the top half of all assessment categories. Most fire services practitioner SME comments about the system’s image quality were positive, especially about the low sensitivity mode, and they liked the unit’s small size, their ability to carry the system with a tether, and easily obtain replacement batteries at stores such as Wal-Mart. System shortcomings were its small screen size and the bumper/support on the handle—the firefighters did not trust it to support their weight for crawling applications or thought it to be a snagging hazard.

***K1000 Elite by ISG Thermal Systems USA***

In live fire applications, the *ISG* unit scored in the top half of the systems in capability, deployability, maintainability, and usability. The fire services practitioner SMEs found that it had a good image quality for fire applications, handled well for most firefighters, and had a good storage system, but they noted difficulties changing the battery in the hot zone, and it was one of the more expensive systems in the test set.

***ISI 3500 Thermal Imaging Camera by International Safety Instruments***

In live fire applications, the *ISI* unit scored in the top half of the test set in affordability, capability, deployability, and usability. The

fire services practitioner SMEs observed a good image quality and that the system was easy to use, but comments about the sensitivity mode transition were mixed and they indicated battery-changing difficulties. The system also had the lowest maintainability scoring of the test set, with a lower warranty rating. SMEs also noted that the system failed to start on four of six attempts after simulated frigid weather conditions.

### **Argus™ 4 Thermal Imaging Camera by e2v**

In live fire applications, the *Argus* system scored in the top half for deployability, maintainability, and usability, but it was in the bottom half for capability. The fire services practitioner SMEs found it well-balanced, and it had the highest warranty rating of the test set. The SMEs, however, had mixed comments about the image quality and sensitivity transitions and found that the remote control was not well suited for fire scene applications (figure 2), although they liked the dual temperature readout (graph and numbers) and the ability to take pictures with



**Figure 2. Assessment SMEs prepare to use the Argus thermal imager for a woodland search.**

the unit. It was also the most expensive unit in the test set.

### **T3XT Thermal Imager by Bullard**

In live fire applications, the *Bullard* system was rated comparatively higher by the fire services practitioner SMEs for capability, in particular for its image quality in low sensitivity mode and sensitivity transition.

They also commented favorably about its ergonomics and the ability to store the unit on an engine. The system tied for the highest vendor support rating. The SMEs, however, had difficulties using the temperature indicator bar to discern smaller temperature changes, had problems operating the power switch, and they indicated that the screen tended to get water on it, resulting in image distortions. They also expressed concerns that the unit was originally delivered with a cardboard box as a “carrying case,” and suggested a Pelican-type case should be specified with the unit.

### **Eagle Imager 1600 Color Thermal Camera by Scott Health and Safety**

The *Scott* system was the most affordable of the test set, but in live fire applications it scored in the lower half of the test set for capability, deployability, maintainability, and usability. The fire services practitioner SMEs indicated a good image quality in high sensitivity mode; they liked the ability of the storage case to be decontaminated, and the ease of changing the battery. The fire services practitioner SMEs, however, experienced problems with the sensitivity mode transitioning, felt the unit was too large, and had concerns about the unit’s integrity, in particular for the battery cover and wiring durability. The system also had the lowest warranty rating and vendor support rating, primarily due to challenges in contacting the

vendor representative once it was identified that the system would be purchased.

### ***VIPER® Thermal Imaging System by Cairns Advanced Technologies***

In live fire applications, the *Cairns* system scored highest in maintainability and second highest for affordability, but it scored among the lowest in the test set for capability, deployability, and usability. The fire services practitioner SMEs commented that it had a good low sensitivity mode image, and they liked the rotating head of the camera. It also tied for the highest vendor support rating. The SMEs, however, had problems with high sensitivity mode image, frequent sensitivity transitioning, and image “freezing.” The unit was also large and heavy, making apparatus installation and carrying the unit on a fire scene difficult. In addition, the power button location was not intuitive and the comparatively longer (~30 seconds) system start time caused them to wonder if the system was even turned on.

### ***SearchTIC by SearchSystems***

The fire services practitioner SMEs commented that although the *SearchSystems* unit does not appear to be intended for firefighting applications but rather search and rescue applications (in which it tied for the lowest score), they wanted to identify how it would function in the rugged conditions of a fire scene. In live fire applications, the unit scored in the bottom half of all assessment categories and scored among the lowest in capability, deployability, maintainability, and usability. SMEs were able to use the unit for hotspot identification, but found that it had image ghosting problems at the live fire scene.

They also commented that the unit was too large and heavy; they were not able to use the unit for crawling applications, and they

experienced difficulty operating the power button and changing the battery while wearing firefighting gloves. The system also failed to start on four of six attempts after simulated frigid weather conditions.

### **Conclusion**

The evaluators’ comments and evaluation indicate that each system demonstrated strengths and weaknesses for firefighting applications. The evaluators’ observations on thermal imaging systems contained in the full report should provide local jurisdictions a helpful resource for the selection of thermal imaging equipment that best meets their specific needs in firefighting, search, and HAZMAT applications.

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