



**Homeland
Security**

Science and Technology

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 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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Powered Air Purifying Respirators Assessment: Law Enforcement Applications

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 powered air purifying respirators (PAPRs) for law enforcement applications and provided findings in the Powered Air Purifying Respirators Assessment: Law Enforcement Applications Report.

Background

PAPRs are used to provide respiratory protection to emergency responders who are operating in atmospheric environments that are not oxygen deficient, but still require respiratory protection (figure 1). Examples include conditions with heavy or hazardous air particulates or where there are low and known levels of certain chemical or biological agents.



Figure 1. A law enforcement SME performs a simulated exercise while wearing a PAPR.

Assessment

Ten different “facepiece” PAPR systems were included in the assessment. They were:

Bullard PA-40 – Spectrum mask and standard belt (*Bullard PA-40*)

Draeger C420 – Panorama Nova EPDM SS Frame facemask (*Draeger C420*)

MSA MM2K – Ultraelite facepiece (*MSA MM2K*)

MSA 6HC – 3100 facepiece with rubber harness (*MSA 6HC*)

SEA Model SE400 AT-2 – with standard facepiece (*SEA AT-2*)

Scott C420 – with standard facepiece (*Scott C420*)

Scott Proflo 2 – with standard facepiece (*Scott Proflo 2*)

Scott Proflo 3 – with AV2000 facepiece (*Scott Proflo 3*)

Survivair Belt-Mounted Unit – belt-mounted blower assembly and battery kit with 4000 Series facepiece with 5-point headstrap (*Survivair Belt*)

Survivair Mask Mounted Unit – 4000 Series facepiece with 5-point headstrap, battery and blower assembly (mask-mounted) (*Survivair Mask*).

In the tests, law enforcement subject matter experts (SMEs) used the PAPRs in simulated response scenarios including tactical forced entry, tactical search, evidence collection, and downed officer rescue and evacuation (figures 2 to 5). The officers also used the PAPRs in a four-station tactical firing course including prone, standing, kneeling, and



Figure 2. Law enforcement SMEs prepare to breach a door while wearing PAPRs.



Figure 3. Law enforcement SMEs simulate evidence collection and documentation while wearing PAPRs.



Figure 4. Law enforcement SMEs simulate a tactical search while wearing PAPRs.



Figure 5. Law enforcement SMEs perform a simulated search for hidden contraband while wearing PAPRs.

running positions, as well as shotgun use. Tasks also included cleaning and rehabilitating the PAPR systems and changing mask sizes as needed. The SMEs provided numeric ratings of the systems for capability, deployability, maintainability, and usability criteria, and also provided written feedback after they used the systems in the different applications. Information about system cost, warranty, battery charging capability, ease of assembly, monitoring and notification devices, and maintenance/repair documentation were included in the assessment.

Assessment Results

The comparative assessment was conducted in a similar manner for each PAPR. This summary provides a snapshot of the comparative performance of 10 individual PAPRs that were identified as meeting assessment selection criteria and publicly procured.

Table 1 (following page) lists the overall and category scores for each PAPR system, on a 100-point scale (100 is best). For law enforcement applications, the *Scott Proflo 2*,

Draeger C420, and *MSA MM2K* PAPRs were rated highest, and the *SEA AT-2* and *Survivair Belt* PAPRs were rated lowest.

Scott Proflo 2

The *Scott Proflo 2* was the highest rated unit overall. Law enforcement SMEs had positive comments about the unit's light weight, its comfort, ease of assembly and good ventilation. One user cautioned that audio alarms are not suitable for tactical operations, and another user indicated that the indicator lights cannot be seen by a left-handed user.

Draeger C420

The *Draeger C420* rated in the top half of four of the five assessment categories, and it was also one of the most expensive. Law enforcement SMEs found the unit was lightweight, but that the power switch could accidentally be bumped, inadvertently shutting off power. Although the facepiece allowed for good communication and straps were made for easy adjustment, they noted that the unit's mask provided poor peripheral vision.

MSA MM2K

The *MSA MM2K* was the highest rated mask-mounted blower assembly in the test set, and scored in the top half of four of the five assessment categories. It was the most affordable unit in the test set. Law enforcement SMEs found the unit to be small, lightweight, and simple to use. Most comments about the blower assembly indicated it was noisy, and several users indicated that downward head motions would be a problem given the blower assembly/canister location. Some difficulty in adjusting the straps was noted.

Table 1. Composite and SAVER Category Ratings for P APR Law Enforcement Applications

P APR System	Composite Score	Capability (.30 overall weighting)	Usability (.40 overall weighting)	Deployability (.20 overall weighting)	Affordability (.05 overall weighting)	Maintainability (.05 overall weighting)
Scott Proflo 2	78	88	78	62	80	68
Draeger C420	76	90	66	78	66	74
MSA MM2K	76	84	66	76	94	78
Scott Proflo 3	76	92	74	50	82	74
Scott C420	70	84	66	60	78	62
Bullard PA-40	68	90	60	44	90	68
Survivair Mask	60	56	56	64	88	62
MSA 6HC	58	92	40	40	80	62
Survivair Belt	56	50	58	50	84	68
SEA AT-2	52	56	58	40	46	56

Scott Proflo 3

The *Scott Proflo 3* system is similar to the *Scott Proflo 2*, except the *Proflo 2* holds two filter canisters, and the *Proflo 3* holds three. Law enforcement SMEs commented that the unit is a little too large and bulky for tactical applications, but it was easy to assemble and use. The inability to change batteries quickly drew some concern although one user liked that they were integrated with the power unit. Some users also indicated communication problems with the unit’s mask, and another commented that the indicator lights cannot be seen when the system is used left-handed.

Scott C420

The *Scott C420* scored in the middle of the test set, and the law enforcement SMEs found the unit to be lightweight, low profile, and easy to

use. Although users commented that the mask was comfortable, they indicated that communication with the unit could be a problem.

Bullard PA-40

The *Bullard PA-40* was one of the higher rated systems for affordability and capability, but among the lowest for deployability. The law enforcement SMEs felt that the unit was “an overall average unit” with a comfortable belt and mask. They also commented that the hose length was too short, and that the unit’s white nose piece reflected light onto the mask. They also indicated that the unit was too bulky, and they had difficulty accessing the power switch.

Survivair Mask

The law enforcement SMEs commented that the *Survivair Mask* PAPR moved a lot of air, perhaps too much, as two SMEs commented about drying contacts. Several comments were made about problems with the unit's mask in that it was not comfortable or stiff, and some sealing problems were noted. SMEs found the mask-mounted blower assembly was noisy and it drew mixed comments on its balance—some users found that the unit was nose-heavy.

MSA 6HC

Although the *MSA 6HC* had one of the higher air flow rates of the units in the test set, it received the lowest overall ratings from law enforcement SMEs for deployability and usability in field applications. They noted particular difficulties with adjusting and maintaining unit position with the belt, that the unit was too heavy, and that the hose length was too short. They also commented about difficulties accessing the power switch and changing the battery.

Survivair Belt

The *Survivair Belt* system drew mixed comments from the law enforcement SMEs about the belt and clasp, distribution of multiple components on the belt, mask comfort and fit, weight, and unit construction quality. One user indicated the nose piece reflects light onto the mask.

SEA AT-2

The *SEA AT-2* PAPR scored in the lower half of the test set for all five assessment categories. Law enforcement SMEs found the unit to be large and bulky, and they had difficulty accessing the power switch. Comments about the unit's microphone system were favorable, as were comments about its belt. The SMEs also indicated that the unit

was difficult to assemble and that the alignment of the hose on the facepiece made looking down difficult.

Conclusion

The PAPR law enforcement composite scoring is the combined result of the PAPR test criteria scores and weights. For law enforcement applications, the *Scott Proflo 2*, *Draeger C420*, and *MSA MM2K* PAPRs scored highest, and the *SEA AT-2* and *Survivair Belt* PAPRs scored lowest.

SMEs noted some difficulty in sighting a target when wearing a PAPR. SMEs concluded that practice would be necessary before using a shotgun and wearing a PAPR at the same time.

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