Homeland Security

# Summary

The U.S. Department of Homeland Security, Preparedness Directorate, Office of Grants and Training (G&T) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders in performing their duties. The mission of the SAVER Program is to

- Provide impartial, practitioner relevant, and operationally oriented assessments and validations of emergency responder equipment.
- Provide information that enables decision-makers and responders to better select, procure, use, and maintain emergency responder equipment.
- Assess and validate the performance of products within a system, as well as systems within systems.
- Provide information and feedback to the user community through a well-maintained, Web-based database.

The SAVER Program established and is supported by a network of technical agents who perform the actual 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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## Portable Cutting Torch Systems Assessment Report Summary

The objective of the cutting torch systems assessment project was to evaluate and assess the comparative parameters of the three most common torch systems utilized by the emergency-response community—exothermic torches, oxy-acetylene torches, and oxy-gasoline torches. Subject matter experts (SMEs) from the emergency-response community, who have extensive experience and training in cutting and burning applications, were used to evaluate and assess the selected systems (see figure 1). The assessment included torch system characteristics, customer service, operational performance based on field use by SMEs in simulated response scenarios, controlled tests, and after sale support by manufacturers and vendors.

The cutting torch systems assessment project provides the emergency response community with comparative information on the three most common torch systems used for the purposes of victim extrication, search operations, and removal of obstacles limiting access to areas of operation. The use of torch systems on varying materials were assessed. Torch systems are commonly used to cut a range

Figure 1. Tactical door entry with oxygen-acetylene torch.

of metallic materials, steel, manganese steel, armor plate, mild and hardened steel, as well as the newer technology composite steels. Additionally, the exothermic system can be made applicable to other materials such as concrete of varying aggregate composition. Other factors that were considered during this project are the amount of training and experience of the user, the availability of fuels to power the systems, portability through varying terrains, weather conditions, safety conditions, maintenance requirements, and adaptability to the situations.

Texas A&M Engineering, including Texas Engineering Extension Service (TEEX), Texas Engineering Experiment Station (TEES), and Texas Transportation Institute (TTI), with the support of the U.S. Department of Homeland Security, Preparedness Directorate, Office of Grants and Training (G&T), conducted comparative assessments on portable cutting torch systems from July 19 through July 21, 2005, at Disaster City on the TEEX Brayton Fire Training Field, College Station, Texas.

This is a summary of the contents of the Portable Cutting Torch Systems Assessment report. The report should be reviewed for the full discussion and recommendations. The complete report can be found on the SAVER Web site (https://saver.fema.gov).

| Oxygen-Acetylene and Oxygen-Gasoline Torches | Exothermic Torches |
|---|---|
| • Torch assembly<br>• Oxygen cylinder<br>• Oxygen regulator<br>• Oxygen hose<br>• Fuel cylinder<br>• Fuel regulator<br>• Fuel hose<br>• Cutting tips<br>• Spark striker | • Torch Assembly<br>• Oxygen cylinder<br>• Oxygen regulator<br>• Oxygen hose<br>• Rechargeable ignition system<br>• Igniter with cables<br>• Cutting rods<br>• Cutting tips |

Table 1. Components for oxygen-acetylene and oxygen-gasoline torches and exothermic torches.

# The Cutting Torch Systems

The cutting torch models that were included in the assessment were selected based on the primary criterion that the units are intended to be transported and used by one person. Three types of cutting torches representing six different manufacturers were assessed:

### *Exothermic*

- Arcair Slice Pak #63-991-002
- Broco PC/TACMOD1

### *Oxygen-acetylene*

- Harris Port-a-Torch #16601-200DLX
- Smith Tag-a-Long #TL-550
- Victor Portable Torch #0384-1412

### *Oxygen-gasoline*

- Petrogen Portable Cutting PCS #6000

Table 1 lists the components of the oxygen-acetylene and oxygen-gasoline torches and the exothermic torches.

# Exothermic Torches

Ratings expressed in Table 2 for the two exothermic cutting torches included in the assessment (see figure 2) show that although deployability was the only category in which the Broco rated higher than the Arcair, the overall ratings for the systems were relatively close. The Arcair's very low rating in the deployability category can be attributed to its larger size, greater weight, and requirement of two operators for deployment. Capability and usability are two categories where the ratings were close, with the Arcair ratings slightly exceeding the Broco ratings. Affordability and maintainability are the two categories in which the Arcair ratings were higher than the

Broco. The Broco's low rating in the affordability category can be attributed to its high purchase cost, almost double that of the Arcair.

Overall, both exothermic torches provided similar usability, but the Arcair system provided better cutting capability and maintainability while the Broco system was superior in deployability.

## Oxygen-Acetylene Torches

Ratings listed in Table 2 for the three oxygen-acetylene cutting torches indicate the Smith and Harris had the highest overall ratings followed by the Victor. Capability and usability are the two categories in which the Harris system ratings were higher than the other oxygen-acetylene cutting torches; however, all three oxygen-acetylene torches were closely rated in these two categories. All oxygen-acetylene cutting torches were very affordable. The purchase prices ranged from $310 to $540, with the Victor having the least expensive purchase price and the Smith having the most expensive purchase price. Deployability was a close category with all oxygen-acetylene torches faring quite well. Maintainability was the one category in which the ratings were not grouped together, with ratings for the Smith system higher than the other two oxygen-acetylene cutting torches.

## Oxygen-Gasoline Torches

The Petrogen, the only oxygen-gasoline cutting torch, was one of the most expensive in the assessment. The Petrogen's overall rating fell between the exothermic and oxygen-acetylene torches, with the oxygen-acetylene torches scoring higher. However, it should be noted that

Figure 2. Exothermic cutting torch on rubble.

| Portable Cutting Torch | Overall | Affordability Score | Capability Score | Deployability Score | Maintainability Score | Usability Score |
|---|---|---|---|---|---|---|
| Smith | 3.31 | 4.49 | 2.87 | 3.81 | 3.13 | 3.02 |
| Harris | 3.28 | 4.68 | 2.97 | 3.90 | 1.97 | 3.26 |
| Victor | 3.13 | 4.83 | 2.70 | 3.89 | 1.90 | 2.95 |
| Petrogen | 3.07 | 2.53 | 2.13 | 4.12 | 3.54 | 3.44 |
| Arcair | 3.02 | 2.76 | 3.73 | 1.43 | 2.93 | 3.58 |
| Broco | 2.96 | 0.53 | 3.64 | 3.25 | 1.77 | 3.56 |

Table 2. Portable cutting torch systems assessment results. Note: rated on a 0 (lowest) to 5 (highest) scale.

the Petrogen was the top performer of all cutting torches in the maintainability and usability categories. Ratings for the Petrogen are listed in Table 2.

## Overall Cutting Torch Systems Results

Table 2 lists portable cutting torch systems ratings, on a 0 (lowest) to 5 (highest) scale. These ratings are for the assessments conducted by Texas A&M Engineering, using category weightings that were based on information reported by Subject Matter Experts in a focus group. Ratings for all cutting torches indicate the Smith and Harris had the highest overall ratings followed by the Victor, the Petrogen and lastly the exothermic cutting torches, the Arcair and the Broco, respectively.

Affordability was dominated by the oxygen-acetylene torches, which had purchase prices ranging from $310 to $540 (the Victor had the least expensive purchase price). The exothermic and oxygen-gasoline cutting torches comprised the most expensive group of torches, with a purchase price range of $1,680 to $3,150 (the Broco had the highest purchase price of all the cutting torches).

Capability and usability category ratings clustered around cutting torch category types, with the exothermic cutting torches leading, followed by the oxygen-acetylene cutting torches, and lastly the oxygen-gasoline cutting torch. Deployability was a close category with all cutting torches, except the Arcair. The Arcair's very low rating in this category can be attributed to its larger size, greater weight, and requirement of two operators for deployment. The Petrogen, which ranked fourth overall of torches tested, ranked highest in deployability and maintainability.

## Conclusion

The full cutting torch systems assessment report can be found on the SAVER Web site along with other TAMU reports dealing with the cutting torch assessment project. The QuickLook chart for the cutting torch assessment is also available on the SAVER Web site (see figure 3). The QuickLook chart offers responders a mechanism to select equipment items based on characteristics that are of most importance to their department. Using the QuickLook chart, responders can emphasize and de-emphasize five categories to fully refine their search for equipment items.

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Opinions or points of view expressed in this document are those of the authors and do not necessarily represent the view or official position of the U.S. Government.

For more information on the cutting torch assessment project, please see the SAVER Web site or contact the SAVER Program Support Office.

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| Product | COMPOSITE | AFFORDABILITY | CAPABILITY | DEPLOYABILITY | MAINTAINABILITY | USABILITY | Features |
|---|---|---|---|---|---|---|---|
| Specs RKB<br>Smith<br>Tag-a-Long | ½ | 1½ | | | | | • Weight (lbs)*: 37.5<br>• Dimensions: 13.5"W X 9"D X 24"H<br>• System Size (cu ft): 1.69<br>* *Weight listed includes full fuel and oxygen cylinders (accurate to pound).* |
| Specs RKB<br>Harris<br>Port-a-Torch | ½ | 1½ | | 1½ | | ½ | • Weight (lbs)*: 36.0<br>• Dimensions: 13"W X 9"W X 24"H<br>• System Size (cu ft): 1.63<br>* *Weight listed includes full fuel and oxygen cylinders (accurate to pound).* |
| Specs RKB<br>Petrogen<br>Portable Cutting PCS | 1½ | 1½ | | 1½ | 1½ | 1½ | • Weight (lbs)*: 39.5<br>• Dimensions: 14.5"W X 9"D X 24.5"H<br>• System Size (cu ft): 1.85<br>* *Weight listed includes full fuel and oxygen cylinders (accurate to pound).* |
| Specs RKB<br>Arcair<br>Slice Pak | 1½ | 1½ | 1½ | 1½ | 1½ | 1½ | • Weight (lbs)*: 66.5<br>• Dimensions: 15.5"W X 8"D X 28"H<br>• System Size (cu ft): 2.00<br>* *Weight listed includes full fuel and oxygen cylinders (accurate to pound).* |
| Specs RKB<br>Victor<br>Portable Torch | 1½ | 1½ | 1½ | 1½ | 1½ | 1½ | • Weight (lbs)*: 34.5<br>• Dimensions: 13"W X 9"D X 24"H<br>• System Size (cu ft): 1.63<br>* *Weight listed includes full fuel and oxygen cylinders (accurate to pound).* |
| Specs RKB<br>Broco<br>Broco | 1½ | 1½ | 1½ | 1½ | 1½ | 1½ | • Weight (lbs)*: 40.0<br>• Dimensions: 11"W X 12.5" D X 24.5" H<br>• System Size (cu ft): 1.95<br>* *Weight listed includes full fuel and oxygen cylinders (accurate to pound).* |

Figure 3. The SAVER Quicklook chart is available on the SAVER Web site.