System Assessment and Validation for Emergency Responders (SAVER)

Hearing Protection with Integrated Radio Communications Market Survey Report

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System Assessment and Validation for Emergency Responders

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FOREWORD

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 assessments and validations on commercially available equipment and systems and develops knowledge products that provide relevant equipment information to the emergency responder community. The SAVER Program mission includes:

- Conducting impartial, practitioner-relevant, operationally oriented assessments and validations of emergency response equipment
- Providing information, in the form of knowledge products, that enables decision-makers and responders to better select, procure, use, and maintain emergency response equipment.

SAVER Program knowledge products provide information on equipment that falls under the categories listed in the DHS Authorized Equipment List (AEL), focusing primarily on two main questions for the responder community: "What equipment is available?" and "How does it perform?" These knowledge products are shared nationally with the responder community, providing a life- 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. As a SAVER Program Technical Agent, the Oak Ridge National Laboratory (ORNL) has been tasked to provide expertise and analysis on radio communications. In support of this tasking, ORNL developed this report to provide emergency responders with information gathered during a market survey of commercially available Hearing Protection with Integrated Radio Communications, which fall under AEL reference number 01ZA-04-HEAR titled *Hearing, Protection*.

For more information on the SAVER Program or to view additional reports on hearing protection with integrated radio communications or other technologies, visit https://www.dhs.gov/science-and-technology/saver.

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1. INTRODUCTION

Hearing protection with integrated radio communications refers to tactical headsets that are designed to fit under, or attach to, a ballistic helmet. They combine electronic hearing protection, radio communication, and the ability to maintain peripheral hearing in a tactical environment. To provide emergency responders with information on hearing protection with integrated radio communications, the System Assessment and Validation for Emergency Responders (SAVER) Program conducted a market survey with an emphasis on headsets used by special weapons and tactics (SWAT) personnel.

This market survey report is based on information gathered from September 2015 to March 2016 from vendors, Internet research, industry publications, an emergency responder focus group, and a government-issued Request for Information that was posted on the Federal Business Opportunities website. Both inner and outer ear headsets were considered. For inclusion in this report, the hearing protection with integrated radio communications had to meet the following criteria:

- Hardwired with cable running from push-to-talk button to radio (no wireless communications)
- All communication capabilities are duplex
- Not integrated with a helmet
- Inner ear products must have electronic noise suppression
- User-replaceable batteries
- If equipped with a behind-the-head strap, the headset should have an over-the-head strap too.

Due diligence was performed to develop a report that is representative of products in the marketplace.

2. HEARING PROTECTION WITH INTEGRATED RADIO COMMUNICATIONS OVERVIEW

Electronic hearing protection amplifies nonhazardous ambient sounds and allows the user to carry on a conversation while also protecting the user from loud noises, which can damage hearing. Integrated radio communication allows the user to covertly receive and transmit information when the electronic hearing protection system is connected to a portable radio.

2.1 Capability

Radio communications are required to offer both clear transmission from the microphone and clear reception through the ear cup. The headset offers decibel (dB) reduction where it safely reduces the hazardous ambient sounds while simultaneously providing the user with continuous situational awareness. Optimally, the decibel reduction capability should lower sporadic noise (e.g., gunshot) to a safe level without cutting out all sound completely. Maximum noise protection specification is rated using either the Noise Reduction Rating (NRR) system or the Single Number Rating (SNR) system, and ranged from 18 to 29 dBs. The higher the number, the

greater the capacity to reduce noise. Because electronic circuitry radiates undesirable radio frequency interference (RFI), inner ear configurations, which are more easily affected by RFI, should offer electronic noise suppression to absorb or minimize the RFI. Duplex communication, or two-way communication, is essential. Full duplex, where the users can communicate with each other simultaneously, is preferred over half-duplex, where the communication is not simultaneous.

2.2 Deployability

Accessories may include alternate microphone control options to configure for either right- or left-handed users. The option of a throat microphone versus a boom microphone is available on some outer ear configurations, allowing for the use of a mask. A mask microphone may also be an option when the user is required to wear a face mask. Some of the headsets offer a microphone-mounted lip light for viewing of critical material in low lighting and waterproof microphones. Mounting options (e.g., rail system mounts, proprietary, or standard mounting options) are a consideration depending on the use of a helmet. Users need the option of having a headset that can be mounted to the helmet via a rail system but also have the option of being able to easily remove the helmet. When equipped with a behind-the-head (BTH) strap, an over-the-head (OTH) strap is also preferred to ensure a snug but comfortable fit. Dual push-to-talk (PTT) functionality may be an option, allowing dual transmission when two radios are in use. A remote PTT is a device that can be worn on the hand giving more efficient accessibility depending on user's positioning. Most headsets offer varying lengths of radio cable to adjust for height of the users and the addition of outerwear. Additional options may include various subdued headset and ear cup colors, depending on the mission requirements or personal preference. An option to consider is the adaptability of the headset to a variety of radios; some models function with only one model of radio.

2.3 Usability

Headsets can become uncomfortable after extended periods of use. In addition, the use of other equipment such as safety glasses, air purifying respirators, and helmets may affect comfort as well. The weight and fit of the headset plays considerably into the comfort. Vendor-provided information listed weights varying from 8.32 to 38.4 ounces, not including the radio. As discussed in Section 2.2, effective mounting to the helmet, and the combination of BTH and OTH straps can support comfort. Optimally, the straps are adjustable. Gel or memory foam ear cup seals provide greater comfort with the outer ear configuration. For the inner ear configuration, shells that are ear impressions are preferred for comfort, but the user may prefer the foam tips, which generally expand using body heat and are available in multiple sizes. Controls (e.g., PTT switch and radio volume) must be easily located and easily manipulated while wearing gloves but also configured so as to eliminate accidental transmissions. Microphones and controls can be configured for left- or right-handed use and are flexible so as to adjust for the addition of other equipment.

The option of outer versus inner ear configuration is not only a user preference but also plays into the comfort of the user. The more traditional outer ear configuration uses the ear cup and a boom microphone. The inner ear configuration uses a foam tip or shell that is inserted in the ear and a cable retainer that fits over the ear to ensure the ear piece stays in place. Most inner ear configurations now use bone conduction, which captures the vibration from the jaw bone,

eliminating the need for a boom microphone. The bone conduction technology enhances the clarity of the transmission. The ergonomics of the inner ear piece also enhances reception. In addition, this configuration fits more efficiently under a mask. There are advantages of the inner ear over the outer ear; the inner ear is lighter in weight and has better efficiency at protection from hazardous ambient sounds. The primary disadvantage is comfort; some users are sensitive to having a bud in their ear. In addition, if the inner ear configuration does not use bone conduction, the clarity is not as effective. For those users that prefer the advantages of the outer ear configuration, but also want to take advantage of the inner ear configuration, there are hybrid models that use a combination.

2.4 Maintainability

The headsets are generally powered on readily available AAA batteries, although there are some models that power off the radio. There are a few models that use AA or lithium-ion batteries, some of these requiring order from the vendor. For those that use batteries, accessibility to the battery compartment is integral to use in the field. Extended runtime is crucial when in the field. Runtime can vary from 100 to 600 hours on battery power.

Product support is essential to the user. The headsets generally come with a 1-year warranty and training, along with technical support on a Monday through Friday basis during and after the warranty period.

2.5 Applications

This SAVER project focused on hearing protection with integrated radio communications for SWAT applications, such as:

- Entry and breaching
    - Routine
    - Explosive
- Mobile operations
    - Dignitary protection
    - Vehicle assaults
    - Vehicle take-downs
- Sniping
    - Field operations
    - Confined space
- Tracking
- Training operations
    - Indoor range
    - Confined space
    - Open space (e.g., outdoor range)

3. PRODUCT INFORMATION–VENDOR PROVIDED

This section provides information on six headsets that range in price from $579 to $2,620; the radio is sold separately. Table 3-1 provides general product specifications, and the following sections provide product-specific information. Product information presented in this section was obtained from information obtained through the Request for Information. The information has not been independently verified by the SAVER Program. Clarification on certain specifications in Table 3-1 is provided below, listed in column order:

MSRP refers to the manufacturer's suggested retail price with standard accessories.

Ear Piece refers to the inner or outer ear configuration of the headset.

Power refers to the type of batteries required.

Runtime refers to battery runtime.

Configuration refers to the possibility of configuring the boom microphone for left- or right-handed use.

Temperature refers to the manufacturer-recommended operating temperature range.

Hearing Protection refers to the maximum noise protection specification (used NRR unless noted otherwise).

Table 3-1. Product Comparison Matrix – Vendor Provided

Vendor	Product	MSRP	Ear Piece	Power	Runtime	Configuration	Temperature	Hearing Protecion
3M™	Peltor™ COMTAC Series	$640 and up	Outer	AAA	400 hrs	✓	-40°C to +55°C	20 to 23 dB
	Peltor™ OraTac	$579	Inner	AAA	400 hrs	✓	-32°C to +55°C	25 dB SNR
	Peltor™ Lite-Com Pro II	$774	Outer	Lithium -ion	18 hrs	N/A	-20°C to +50°C	24 to 25 dB
Honeywell	QuietPRO QP400	$2,175 to $2,620	Inner	CR123	NP	✓	-30°C to +55°C	29 dB
Tactical Command Industries (TCI)[1]	Liberator II™	$835	Outer	AAA	600 hrs	✓	-55°C to +85°C	22 dB
	Liberator III™	$1,250	Outer	AAA	600 hrs	✓	-55°C to +85°C	22 dB

Notes:
✓–meets the requirement
dB-decibel
N/A—not applicable
NP–information not provided
SNR-Single Number Rating

Information presented in the table is based on data gathered from response to the Request for Information during March 2016.

[1] Operated under The Safariland Group.

3.1 3M™ Peltor™ COMTAC Series

The COMTAC Series costs begin at $640, which includes: the headset and the microphone mounting post (microphone not included). Preassembled kits vary in price dependent upon the model and accessories and include the headset, PTT adaptor, accessory bag, batteries, and gel ear cup seals. All headsets come with a 1-year warranty.

The COMTAC III weighs 17.6 ounces without the batteries. The COMTAC Series offers gel ear cup seals for improved comfort, ambidextrous boom microphone location, increased electronic noise suppression, and salt water resistance. The headsets operate on two AAA batteries for up to 400 hours in a -40°C to 55°C environment. The maximum noise protection specification is 20 to 23 dB (NRR).

Technical support is available Monday through Friday, 8:00 a.m. to 4:30 p.m. CST, via phone support. Training is available through the suppliers.

Peltor™ COMTAC III

Image courtesy of 3M

3.2 3M™ Peltor™ OraTac

The OraTac costs $579, which includes: the headset, two pair of eartips, two AAA batteries, and a cable clip. All headsets come with a 1-year warranty.

The OraTac weighs 8.29 ounces. This headset incorporates an inner ear microphone, eliminating the need for a boom microphone. The headset operates on two AAA batteries for up to 400 hours in a -32°C to 55°C environment. The maximum noise protection specification is 25 dB (SNR).

Technical support is available Monday through Friday, 8:00 a.m. to 4:30 p.m. CST, via phone support. Training is available through the suppliers.

Peltor™ OraTac

Image courtesy of 3M

3.3 3M™ Peltor™ Lite-Com Pro II

The Lite-Com Pro II costs $774, which includes: the headset as shown and a 1-year warranty.

The Lite-Com Pro II weighs 38.4 ounces and offers both PTT and Hands-Free Voice Activated transmit functions in addition to three strap style options: OTH, neckband, and hard hat mountable. The headset operates on a rechargeable lithium-ion battery for 18 hours in a -20°C to 50°C environment. The maximum noise protection specification is 24 to 25 dB (NRR).

Technical support is available Monday through Friday, 8:00 a.m. to 4:30 p.m. CST, via phone support. Training is available through the suppliers.

Lite-Com Pro II

Image courtesy of 3M

3.4 Honeywell QuietPRO QP400

The QuietPRO QP400 costs $2,175 to $2,620, depending on the radio cable requirement. This price includes: the control unit, the headset, one pair of ear tips, and batteries. This includes a 1-year warranty.

The QuietPRO QP400 weighs 25.6 ounces. This headset is an inner ear configuration and operates on two CR123 batteries in a -30°C to 55°C environment. The maximum noise protection specification is 29 dB (NRR).

Technical support is available via phone Monday through Friday, 8:00 a.m. to 6:30 p.m. EST, with an engineer assigned specifically to the QuietPRO. Training is available in person, online, or through instructional videos.

QuietPRO QP400

Image courtesy of Honeywell

3.5 TCI Liberator II™

The Liberator II™ costs $835, which includes all components needed to operate the headset. This includes a 1-year warranty with additional support beyond the initial warranty with charges for parts and labor beyond normal wear.

Liberator II™

Image courtesy of TCI

The Liberator II™ weighs 19.4 ounces. The headset has an ambidextrous boom microphone configuration and operates on two AAA batteries for 600 hours in an -55°C to 85°C environment. The maximum noise protection specification is 22 dB (NRR).

Technical support is available Monday through Friday, 6:00 a.m. to 4:00 p.m. PST, via phone. Training is available to include system set up, usage, and maintenance. In addition, assistance is available in basic tactical communications techniques and procedures.

3.6 TCI Liberator III™

The Liberator III™ costs $1,250, which includes all components needed to operate the headset. This includes a 1-year warranty with additional support beyond the initial warranty with charges for parts and labor beyond normal wear. This model is an upgrade from Model II listed above, as it includes connections for an additional radio.

Liberator III™

Image courtesy of TCI

The Liberator III™ weighs 22 ounces. The headset has an ambidextrous boom microphone configuration and operates on two AAA batteries for 600 hours in an -55°C to 85°C environment. The maximum noise protection specification is 22 dB (NRR).

Technical support is available Monday through Friday, 6:00 a.m. to 4:00 p.m. PST, via phone. Training is available to include system set up, usage, and maintenance. In addition, assistance is available in basic tactical communications techniques and procedures.

4. PRODUCT INFORMATION–RESEARCHED

This section provides general product specifications on 12 headsets that range in price from $375 to $1,885 and include the headset only; the radio is sold separately. Specifications presented in Table 4-1 were obtained from Internet and industry publication research. The information has not been independently verified by the SAVER Program. Clarification on certain specifications in Table 4-1 is provided below, listed in column order:

MSRP refers to the manufacturer's suggested retail price without accessories.

Ear Piece refers to the inner or outer ear configuration of the headset.

Suppression refers to the capability of electronic noise suppression.

Power refers to the type of batteries required.

Runtime refers to battery runtime.

Configuration refers to the possibility of configuring the boom microphone for left- or right-handed use.

Temperature refers to the manufacturer-recommended operating temperature range.

Hearing Protection refers to the maximum noise protection specification (used NRR).

Options refers to the availability of different configurations.

Table 4-1. Product Comparison Matrix – Researched

Vendor	Product	MSRP	Ear Piece	Suppression	Power	Runtime	Configuration	Temperature	Hearing Protection	Options
Atlantic Signal	COMTAC Hybrid IV	$625	Inner and outer	✓	AAA	500 hrs	✓	-4°C to +55°C	18 dB	Dual or single downlead
	Enforcer	$750	Inner[2]	✓[3]	Runs on radio	N/A	✓	NP	Dependent on ear bud	Multiple configurations
	MH180S	$405 to $495	Inner[4]	✓[5]	Runs on radio	N/A	✓	NP	Dependent on ear bud	Multiple configurations
FireCom	Direct Wire	$375	Outer	✓	Runs on radio	N/A	✓	-40°C to +70°C	24 dB	Upgraded models
Mine Safety Appliances (MSA)	Supreme® Pro X Headset	$800 to $1,400	Outer	NP	AAA	600 hrs	✓	N/A	18 to 19 dB	Multiple configurations
Phonak Communications AG	Primero DPC+	$1,025	Inner	NP	AAA	200 hrs	N/A	-20°C to +60°C	27 dB	Multiple EarJack™ options
Sonetics	APX373	$745 to $894	Outer	✓	3.7V Litrhium -ion	44 hrs	✓	-30°C to +60°C	20dB	Some updgrades

Information presented in the table is based on data gathered through research September 2015 to March 2016.

[2] Can use bone conduction
[3] Dependent upon ear bud chosen
[4] With bone conduction only
[5] Dependent upon ear bud chosen

Vendor	Product	MSRP	Ear Piece	Suppression	Power	Runtime	Configuration	Temperature	Hearing Protection	Options
TCI	Liberator II™ Headset	$695 to $950	Outer	✓	AAA	600 hrs	✓	-31°C to +63°C	21 to 29 dB	Multiple configurations
	Liberator III™ Basic Suite	$1,150 to $1,850	Outer	✓	AAA	600 hrs	✓	-31°C to +63°C	NP	Multiple configurations
	Liberator III™ ITJCS	$1,150 to $1,850	Outer	✓	AAA	600 hrs	✓	-31°C to 63°C	NP	Throat mic
Television Equipment Associates Inc. (TEA)	Invisio® X5 Headet/X50 Controller	$1,885	Inner[6]	✓	AA	100 hrs	N/A	-31°C to +63°C	29 dB	Multiple connections
3M™	Peltor™ COMTAC III Advanced Communication Headset (ACH)	$832 to $889	Outer	✓	AAA	500 hrs	✓	-32°C to +49°C	23dB (headband) 22dB (neckband)	Handsfree option

Notes:
dB-decibel
NP—information not provided
N/A—not applicable
TCI- Tactical Command Industries

Information presented in the table is based on data gathered through research September 2015 to March 2016.

[6] With bone conduction only.

5. VENDOR CONTACT INFORMATION

Additional information on the hearing protection with integrated radio communications included in this market survey report can be obtained from the vendors listed in Table 5-1.

Table 5-1. Vendor Contact Information

Vendor	Phone Number	Website/E-Mail Address
Atlantic Signal	(800) 850-8512	support@atlanticsignal.com
FireCom	(800) 833-4558 x 103	soneticsweb@gmail.com
Honeywell Safety Products	(800) 430-5490	www.honeywellsafety.com
MSA	None provided	fire.cs@msanet.com
PSD Peltor™ Communications	None provided	occsafety@mmm.com
Phonak Communications AG	+41 266729672[7]	www.phonak-communications.com
TEA	(706) 846-3515	www.teaheadsets.com
3M Company	(800) 243-4630	http://solutions.3m.com/wps/portal/3M/en_U
The Safariland Group (TCI)	(909) 773-1314	www.safariland.com

6. SUMMARY

This market survey report provides information on 16 different hearing protection with integrated radio communications headsets. The products differ in cost, power source and duration, operating temperature range, hearing protection, and available accessories. While the outer ear configuration was more prevalent, there were several that were available as inner ear, and one headset offered both configurations. Most headsets operate on standard AA or AAA batteries with a general runtime of 500 hours, but there are a few that operate on lithium-ion batteries, and some offer the option of operating on the radio. Half of the headsets have a manufacturer-recommended operating temperature range of -30°C to +60°C, with most falling within that range. The maximum noise protection specifications generally fall within 21 to 29 dB (NRR). More specific information on accessories and the affiliated costs can be obtained from the vendors.

Emergency responder agencies that consider purchasing hearing protection with integrated radio communications should carefully research each product's overall capabilities and limitations in relation to their agency's operational needs.

[7] This is the corporate line; there are domestic distributors.