Tactical Eyewear

Market Survey Report

May 2021

Homeland Security
Science and Technology

NUSTL®
NATIONAL URBAN SECURITY TECHNOLOGY LABORATORY

Approved for Public Release

SAVER-T-MSR-29

The *Tactical Eyewear Market Survey Report* was prepared by the National Urban Security Technology Laboratory for the U.S. Department of Homeland Security, Science and Technology Directorate. With subject matter input from the U.S. Army Combat Capabilities Development Command – Soldier Center (CCDC-SC). The work was performed under financial transaction FLTF-19-00074.

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. The National Urban Security Technology Laboratory (NUSTL) located within the DHS Science and Technology Directorate (S&T) manages the SAVER program, which 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 managed by the National Urban Security Technology Laboratory (NUSTL). NUSTL is responsible for all SAVER activities, including selecting and prioritizing program topics, developing SAVER knowledge products, coordinating with other organizations and ensuring flexibility and responsiveness to first responder requirements.

NUSTL provides expertise and analysis on a wide range of key subject areas, including chemical, biological, radiological, nuclear and explosive weapons detection; emergency response and recovery; and related equipment, instrumentation and technologies. In support of this tasking, NUSTL entered into an agreement with the Consumer Research Team, U.S. Army Combat Capabilities Development Command – Soldier Center (CCDC-SC) to assist with the conduct of a market survey of commercially available tactical eyewear products. This equipment falls under AEL reference number 01ZA-03-EYEP titled Protection, Eye.

For more information on NUSTL's SAVER program or to view additional reports on tactical eyewear and other technologies, visit www.dhs.gov/science-and-technology/SAVER.

U.S. Department of Homeland Security

SAVER

System Assessment and Validation for Emergency Responders

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EXECUTIVE SUMMARY

Tactical eyewear protects emergency responders from many dangers, including impact from blunt objects, airborne debris, bullet fragments, hazardous substances, and other causes of eye damage and irritation. Special lenses that protect against lasers and other hazardous light energy are available as well. This market survey report includes 26 tactical eyewear kits (15 spectacles and 11 goggles) that include frames, clear and sunglass lenses, and a carrying case. These products range in price from $60 to $450.

The tactical eyewear products identified in this report were specifically designed with emergency response in mind. All products provide impact protection (including against fragmentation), 99.9 percent UV protection, and high-quality optics, as verified via testing in accordance with the American National Standards Institute (ANSI) Z87.1 standard, titled "American National Standard for Occupational and Educational Personal Eye and Face Protection Devices." Furthermore, all products in this market survey are on the Authorized Protective Eyewear List (APEL)[i] maintained by the U.S. Military. [1] The APEL encompasses a series of commercial items that have undergone thorough and rigorous testing in both laboratory and field environments, the quality of which is monitored on a routine basis.

The tactical eyewear identified in this market survey report are available in a variety of costs, sizes, styles, and frame colors. Most products offer an optional prescription lens carrier that allows a prescription lens to fit beneath the protective lens. Though not listed on the APEL, many products have optional specialty lenses (e.g., colored, mirrored, polarized, or photochromatic) that may or may not meet the same level of protection as the clear and sunglass lenses that come standard.

Emergency responder agencies that are considering purchasing tactical eyewear should carefully research each product's overall capabilities and limitations in relation to their agency's operational needs.

[i] The APEL is a qualified list of eyewear products that are authorized for use by the U.S. Military. In addition to meeting the ANSI Z87.1 impact standard, they must meet military specifications for impact as well. APEL products are verified by independent laboratory testing. A brochure showing currently qualified products can be found at www.med.navy.mil/sites/nostra/PP_CombatEyeProtection/APEL%20Poster%202019_FINAL.pdf

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1.0 INTRODUCTION

Tactical Eyewear provides first responders protection against many common hazards encountered in the challenging environments in which they operate. Such hazards include blunt impacts, wind-blown dust and debris, bullet fragments, chemicals, biohazards, and harmful light radiation. A good quality set of tactical eyewear protects against a disabling eye injury while providing clear vision and the ability to adapt to different lighting conditions. To provide emergency responders with information on tactical eyewear, the System Assessment and Validation for Emergency Responders (SAVER) program conducted a market survey on commercially available tactical eyewear for emergency responders.

This market survey report is based on information gathered between June 2020 and August 2020 from a search of vendor websites, internet research, industry publications, and existing government data. The scope of this report is eyewear with interchangeable lenses that appear on the U.S. Military's Authorized Protective Eyewear List (APEL) [1], which is maintained by the military. APEL products are rugged and have higher than normal impact ratings. Further, the scope of this report is limited to spectacles and goggles. Face shields, respirators, and other forms of protective eyewear are not included.

To ensure this report would cover a selection of robust eyewear suitable for use day or night under potentially harsh conditions, protective eyewear had to meet the following criteria for inclusion in this survey:

- Commercial availability
- Interchangeable lenses
- Fragmentation protection
- ANSI Z87.1 compliance
- Clear and sunglass configurations
- Inclusion on Authorized Protective Eyewear List (APEL)

2.0 OVERVIEW

Eye protection is essential for first responders to guard against disabling eye injury. First responders may encounter flying objects, blowing sand, fragmentation, dust and debris, chemicals, biohazards, UV radiation, and other hazards that could easily damage the eye. Eye injuries frequently cause pain and/or disruption of vision sufficient enough to interfere with a responder's ability to effectively conduct tasks and can compromise safety on the job. Most injuries of this nature can be prevented by wearing proper protective eyewear. Wearing a reliable tactical eyewear product significantly reduces the risk of injury while providing the clear vision needed to safely and effectively carry out field operations.

2.1 STANDARDS/REGULATIONS

The American National Standards Institute (ANSI) Z87.1 standard [2] sets forth criteria for the optical quality of eyewear as well as its protectiveness against three important hazards: impact, liquid splash exposures, and non-ionizing radiation, such as ultraviolet (UV) light. Safety glasses for many different industries are designed to meet this standard. Compliant products should prevent or minimize damage to the eye from airborne debris, fragments, and chemicals, all of which can cause permanent disruption of vision, up to and including blindness.

Given the unpredictable nature of first response environments, however, a higher level of protection may be desired. Products listed on the U.S. Military's Authorized Protective Eyewear List (APEL) exceed the requirements set by ANSI Z87.1. Spectacles and goggles on the APEL must meet military standard MIL-PRF-32432A [3]. APEL products must also be rugged, resistant to an extended temperature range, and undergo thorough and rigorous testing in both laboratory and field conditions. Their quality is monitored on a routine basis. Only spectacle and goggle configurations are covered by the APEL. For emergency responders requiring added facial protection, visors that meet MIL-DTL-43511D [4] are an alternative.

All products in this market survey report meet both the ANSI Z87.1 standard and are on the APEL. This ensures emergency responders a product with impact protection well above that specified by ANSI Z87.1.

It should be noted that all clear and sunglass lenses for products in this report meet the ANSI Z87.1 and APEL standards. Commercial specialty lenses, such as colored lenses and mirrored lenses, are not included on the APEL and may or may not meet the same level of protection. Should specialty lenses be desired, first responders should carefully review product specifications and performance for each specialty lens under consideration or contact the manufacturer to determine whether the products are compliant with these standards.

2.2 CURRENT TECHNOLOGIES IN PROTECTIVE EYEWEAR

2.2.1 BALLISTIC FRAGMENTATION/IMPACT PROTECTION

Impact protection is a key aspect of protective eyewear. Without proper protective eyewear, impacts to the eye can cause injuries ranging from temporary pain or discomfort to permanent loss of vision.

Projectiles, including fragments from bullet ricochets and explosions, rocks and other thrown objects, ejected shell casings, and spall can impact or penetrate the eye(s) with sufficient force to cause partial or complete vision loss. Minute particles, such as bits of metal or grains of sand, can be propelled with sufficient force to become embedded in the eyelids and damage the surface of the eye(s). Other contact injuries include abrasions or lacerations to the eye(s) from brush and other surrounding objects.

The ANSI Z87.1 standard sets forth minimum requirements for impact protection. Products that meet this standard must be laboratory tested and should bear the marking "Z87" or "Z87+" to indicate a high-velocity impact rating. Products listed on the APEL offer fragmentation protection that exceeds the requirements set by ANSI Z87.1. These standards specify tests that subject eyewear to small metal fragment simulating projectiles travelling much faster and with more impact energy than that required by the Z87+ rating.

2.2.2 OPTICAL QUALITY

A high-quality optical lens helps first responders to see fine features and distant objects clearly. Protective eyewear curves around the face to provide frontal and periphery protection; because of that curvature, the lenses are optically corrected to prevent distortion. Wearing poor quality lenses can lead to symptoms, such as eye strain, headaches, dizziness, and nausea, even when the optical imprecision is not obvious to the unaided eye. Operator performance can be affected as a result.

Products with the Z87 marking have been tested to ensure they provide high-resolution vision that is free from distortion and other harmful effects of poor lens quality.

2.2.3 ULTRAVIOLET AND HAZARDOUS LIGHT PROTECTION

Excessive exposure to ultraviolet (UV) light from the sun and other sources can cause damage to the eyes over time, leading to conditions such as cataracts. UV light exposure can be exacerbated by highly reflective surfaces, such as light-colored sand and snow. For this reason, the ANSI Z87.1 specifies a UV scale that begins at U1 protection, which blocks 99.9% of harmful UV energies, and goes up to U6, which blocks 99.99%. Clear lenses for protective eyewear must have at least U1 protection, while sunglass lenses will normally have a higher rating.

Exposure to lasers and other hazardous light sources is also a concern for some emergency responders. Hazardous light sources, such as lasers, operate at different wavelengths, emitting different "colors" of light, some visible to the eye, others not. To protect the eye, eyewear lenses must be designed for the particular laser(s) or other hazardous light source(s) expected to be encountered.

It is important to note that light protective lenses DO NOT provide protection against *all* lasers or hazardous light sources. Responders should also be aware that trade-offs associated with removing certain colors of light include changes in color perception and increased difficulty seeing in very dark conditions.

Laser lens manufacturers specify the amount of laser light blocked by the optical density of the lens. A lens with an optical density of 0 blocks no laser light, while a lens with optical density of 6 blocks 99.9999% of laser light. Table 2-1 lists the respective percentages of light transmittance and blocked laser light for each optical density.

Table 2-1 Optical Density and Transmitted Light

Optical Density	Light Transmittance (%)	Blocked Laser Light (%)
0	100	0
1	10	90
2	1	99
2.5	0.3	99.7
3	0.1	99.9
4	0.01	99.99
5	0.001	99.999
6	0.0001	99.9999

2.2.4 VISION CORRECTION

Some protective eyewear designs are compatible with a prescription lens carrier (PLC) that may be installed behind the primary protective lens for individuals requiring corrective lenses. The PLC can be fitted with prescription lenses specific to the wearer's needs, allowing optimal vision for performing job related duties. Various companies offer their own PLC designs, which wearers may have filled with their individual prescriptions by an optometrist, then mounted into their eyewear using a special nosepiece or adapter. Some PLCs, such as the Universal Prescription Lens Carrier (UPLC) used by the U.S. military, are compatible across designs from more than one manufacturer, provided that those manufacturers have designed an appropriate nosepiece or adapter to mount the UPLC into their prescription-compatible eyewear products. Many products on the military's APEL are UPLC compatible.

Figure 2-1 Blade style spectacle with prescription lens carrier installed
Image courtesy of Revision Military Inc.

2.2.5 ELECTRONIC FEATURES

Manufacturers are increasingly incorporating electronic features into their protective eyewear. Some products, particularly goggles, offer heated lenses or incorporate small fans to reduce the incidence of lens fogging. Other products offer lenses that transition from clear to sunglass and vice versa at the push of a button. These products require batteries to operate. Often the batteries are rechargeable, offering a convenient means to replenish power and maintain performance.

2.3 EYEWEAR FORMATS

Both spectacle and goggle protective eyewear configurations are addressed in this market survey. Spectacles are common eyeglass configurations with temple arms that rest on the ears to keep the eyewear in place. Spectacles inherently offer added ventilation for minimal fogging and are comfortable and lightweight. There are two main designs for tactical eyewear spectacles. The blade spectacle has a single piece lens that can be swapped out for another lens type in one maneuver. Dual-lens spectacles have frames that contain separate lenses for each eye. Though dual lenses will take longer to swap out, they often provide a closer fit than single lens designs and thereby a better interface with optical aids such as binoculars,

Goggles have a thick strap and are designed to seal around the eyes when fastened about the head. Goggles are used mainly when additional protection is required, for example, from blowing sand, dust, and debris. Due to reduced air flow around the eyes, goggles are typically more prone to lens fogging than spectacles.

3.0 PRODUCT INFORMATION: SPECTACLES

This market survey report provides information on 15 spectacles that meet the criteria for inclusion discussed in Section 1.0. These items come in a kit with a frame, clear and sunglass lenses, a carrying case, and may also contain cleaning materials. Kit prices range from $60 to $249. It should be noted that most vendors also offer individual eyewear assemblies (frame with single lens installed) for sale at a lower price. All spectacles feature impact-resistant lens technology, are less than or equal to 1.6 ounces in weight, and meet the ANSI Z87.1 and APEL standards for impact resistance and optical quality. The eyewear featured in this market survey have many common features, including impact protection and protection from harmful UV radiation from the sun. None of the spectacles were specifically designed for cold weather.

These products are listed in alphabetical order by manufacturer in Table 3-1. Product data was obtained directly from the manufacturer or distributor or their respective websites. The information obtained has not been independently validated by SAVER. Product features in Table 3-1 are defined as follows:

Manufacturer indicates the maker of the product.

Product indicates the name of the product.

Kit cost indicates the price of a kit containing a spectacles frame, clear and sunglass lenses, and a carrying case. The price is rounded to the nearest U.S. dollar.

Discount indicates whether a discount is offered to government agencies, law enforcement, or the military.

Warranty indicates the period of time over which the vendor guarantees to repair or replace a defective product.

Prescription correction indicates whether the product has an available option to purchase a prescription lens carrier that fits beneath the protective lenses.

Electronic features indicate the type of battery-powered electronic features (e.g., fans, heated lenses, transition lenses), if any, that are included with the product.

Laser lenses indicates whether the product has laser protection lenses available as an optional purchase.

Specialty lenses indicates whether the product has colored, mirrored, polarized, or photochromatic lenses available.

Sizes indicates the number of sizes available for purchase.

Frame colors indicates the colors of frames available for purchase.

Table 3-1 Spectacles Product Comparison Matrix

Manufacturer	Product	Kit Cost	Discount	Warranty	Prescription Correction	Electronic Features	Laser Lenses	Specialty Lenses	Sizes	Frame Colors
e-Tint	CTRL® MS1	$249	Yes	Limited 6 months	Yes	Tran	No	No	2	Black
Eye Safety Systems	Crossblade	$115	No	5 years	Yes	None	Yes	Yes	2	Black, Tan
Eye Safety Systems	Crossbow	$115	No	5 years	Yes	None	Yes	Yes	1	Black, Tan
Eye Safety Systems	Rollbar	$120	No	5 years	No	None	No	Yes	1	Black, Tan
Honeywell	UVEX Genesis	$60	No	Limited 1 year	Yes	None	No	Yes	1	Black, Blue, Earth, Patriot
Honeywell	UVEX XC	$60	No	Limited 1 year	Yes	None	No	Yes	1	Black
Oakley	M-Frame Alpha	$90	No	2 years	No	None	No	Yes	1	Black, Tan
Oakley	M-Frame 2.0	$115	No	2 years	No	None	No	Yes	1	Black
Oakley	M-Frame 3.0	$125	No	2 years	No	None	Yes	Yes	1	Black, Tan
Revision	Sawfly	$89	Yes	3 years	Yes	None	No	Yes	3	Black, Tan, Green
Revision	ShadowStrike	$114	Yes	3 years	No	None	No	Yes	1	Black, Tan, Grey
Revision	StingerHawk	$105	Yes	3 years	Yes	None	Yes	Yes	2	Black
Smith Optics	Aegis Arc	$80	No	Lifetime	Yes	None	Yes	Yes	2	Black, Tan
Wiley-X	Valor	$95	No	Lifetime	No	None	No	Yes	1	Black, Kryptek Typhon
Wiley-X	Vapor	$105	No	Lifetime	Yes	None	No	Yes	1	Black, Tan

Abbreviations:
Tran - Transition lenses

3.1 E-TINT, CTRL MS1

Key features of the e-Tint CTRL® MS1 spectacle:

- Anti-glare lenses standard
- Anti-fog coating on lens interiors to minimize fogging during rigorous activity
- Electronic transition lenses powered by a 70-hour, rechargeable lithium ion battery. Tint (clear to sunglass) is controlled either automatically (based on ambient light conditions) or by the user, at the push of a button
- Military version of the kit includes a transition lens and a clear lens (non-transitioning) to optimize transmittance during night-time operations, both of which are impact resistant
- Two sizes available: regular and large/wide
- Frames available only in black
- UPLC-compatible nosepiece available, which can be filled with a prescription by an optometrist
- Six-month limited warranty
- 15% discount available to government agencies, first responders, and former first responders

Figure 3-1 CTRL MS1
Image courtesy of e-Tint

3.2 EYE SAFETY SYSTEMS CROSSBLADE

Key features of the ESS CrossBlade spectacle:

- Anti-fog coating minimizes fogging during rigorous activity
- Lenses available in clear, sunglass, polarized sunglass, and photochromic, as well as colors such as yellow, bronze, copper, smoke gray, and mirrored blue
- Optional LPL-5 laser protective lens blocks 532 nm wavelengths (green lasers) with an optical density of 2.5
- Locking clip secures interchangeable lenses in the frame
- Frames available in matte black and “terrain tan”
- Two available sizes: regular and “naro” (small)
- Prescription nosepiece and proprietary lens carrier available for both sizes
- UPLC-compatible prescription nosepiece available
- Five-year warranty against craftsmanship defects

Figure 3-2 CrossBlade
Image courtesy of Eye Safety Systems

3.3 EYE SAFETY SYSTEMS CROSSBOW

Key features of the ESS CrossBow spectacle:

- Anti-fog coating minimizes fogging during rigorous activity
- Anti-scratch coating on lens exteriors
- Lenses available in clear, sunglass, polarized sunglass, photochromic, and colors such as yellow, bronze, copper, smoke gray, and mirrored blue
- Optional LPL-B laser protective lens blocks 1,064 nm wavelengths (infrared lasers) with an optical density (OD) of 5 and 820-1,090 nm wavelengths (multi-band infrared) with an OD of 4
- Locking clip secures interchangeable lenses in frame
- Frames available in black, matte black, and "terrain tan"
- One size fits all design
- Prescription nosepiece and proprietary lens carrier available
- UPLC-compatible prescription nosepiece available
- Five-year warranty against craftsmanship defects

Figure 3-3 CrossBow
Image courtesy of Eye Safety Systems

3.4 EYE SAFETY SYSTEMS ROLLBAR

Key features of the ESS Rollbar spectacle:

- Thick frame dual-lens design for high stability
- Anti-fog coating minimizes fogging during rigorous activity
- Outer anti-scratch coating
- Lenses available in clear, sunglass, polarized sunglass, mirrored, as well as colors such as yellow, mirrored copper, mirrored gray, and polarized mirrored gray
- Easy lens swapping via lens gate mechanism that uses lever to release or lock lenses in place
- Frames available in black and "terrain tan"
- One size fits all design
- Five-year warranty against craftsmanship defects

Figure 3-4 Rollbar
Image courtesy of Eye Safety Systems

3.5 HONEYWELL UVEX GENESIS

Key features of the Honeywell UVEX Genesis spectacle:

Figure 3-5 UVEX Genesis
Image courtesy of Honeywell

- Multiple anti-fog coating options
- Multiple anti-scratch coatings available
- Ratcheting hinge on temple arms adjusts lens tilt
- Lenses available in clear, sunglass, mirrored, and colors such as amber, gray, vermillion, and blue
- Frames come in black, “vapor blue,” “earth,” and “patriot” (red, white, blue)
- One size fits all design
- Telescoping feature adjusts temple arm length
- Proprietary prescription lens carrier and nosepiece available
- One-year limited warranty against material and manufacturing defects

3.6 HONEYWELL UVEX GENESIS XC

The UVEX Genesis XC spectacle has the same features as the UVEX Genesis plus these additional key features:

Figure 3-6 UVEX Genesis XC
Image courtesy of Honeywell

- Extended wrap-around lens provides 20% extra cheek and side coverage
- Additional lens tint options: ultra-dark, 50% gray, silver mirror, and green (in addition to tints available for UVEX Genesis, as above)
- Frames come in back only

3.7 OAKLEY M-FRAME ALPHA

Key features of the Oakley M-Frame Alpha spectacle:

Figure 3-7 M-Frame Alpha
Image courtesy of Oakley

- Inner anti-fog and outer anti-scratch coatings
- Lenses available in clear, sunglass, and color options including two rose-colored tints, one grey variation designed to provide high contrast for bright-light conditions (PRIZM Grey, 19% light transmission) and a rose color designed to provide high contrast for medium-light conditions (PRIZM TR22, 19% light transmission)
- Frames available in matte black and “terrain tan”
- One size fits all design
- Two-year warranty against material and workmanship-related breakage

3.8 OAKLEY SI BALLISTIC M-FRAME 2.0

Key features of the Oakley Ballistic M-Frame 2.0 spectacle:

- Inner anti-fog and outer anti-scratch coatings
- Lenses available in clear, sunglass, and three other tints that appear to be various shades of reddish gray (see vendor website to view color)
- Locking clip secures interchangeable lenses in the frame
- Frames available in matte black only
- One size fits all design
- Slim temple arms for comfort and compatibility with headgear and hearing protection
- Two-year warranty against material and workmanship-related breakage

Figure 3-8 SI Ballistic M-Frame 2.0
Image courtesy of Oakley

3.9 OAKLEY SI BALLISTIC M-FRAME 3.0

Key features of the Oakley M-Frame 3.0 spectacle:

- Inner anti-fog and outer anti-scratch coatings
- Lenses available in clear, sunglass, and seven other tints, including a rose color designed to provide high contrast for medium-light conditions (PRIZM TR22, 19% light transmission), and a lighter variation designed to provide high contrast for low-light conditions (PRIZM TR45, 44% light transmission) (see vendor website to view colors)
- Limited selection of laser lenses also available (contact the vendor for more information)
- Locking clip secures interchangeable lenses in the frame
- Frames available in matte black and “terrain tan”
- One size fits all design
- Ultra-slim temple arms for comfort and compatibility with headgear and hearing protection
- Two-year warranty against material and workmanship-related breakage

Figure 3-9 SI Ballistic M-Frame 3.0
Image courtesy of Oakley

3.10 REVISION SAWFLY

Key features of the Revision Sawfly spectacle:

- Inner anti-fog and outer anti-scratch coatings
- Lenses available in clear, sunglass, polarized sunglass, photochromic, and colors including yellow, vermillion, mocha, and smoke
- Frames available in black, “foliage green,” and tan
- Spectacles come in three sizes: small, regular, and large
- Included spectacle nosepiece is compatible with the UPLC, which can be filled with a prescription from an optometrist
- Slim temple arms for comfort and compatibility with headgear and hearing protection
- Three-year warranty against material and workmanship defects
- 30% discount is offered to the military and law enforcement

Figure 3-10 Sawfly
Image courtesy of Revision

3.11 REVISION SHADOWSTRIKE

Key features of the Revision ShadowStrike spectacle:

- Low-profile dual-lens design has a tight curvature for a wide field of view
- Inner anti-fog and outer anti-scratch coatings
- Lenses available in clear, sunglass, polarized sunglass, mirrored, photochromic, and smoke-colored tint
- Frames available in black, gray, and tan
- One size fits all design
- Three-year warranty against material and workmanship defects
- 30% discount is offered to the military and law enforcement

Figure 3-11 ShadowStrike
Image courtesy of Revision

3.12 REVISION STINGERHAWK

Key features of the Revision StingerHawk spectacle:

Figure 3-12 StingerHawk
Image courtesy of Revision

- Low-profile dual-lens design has a tight curvature for a wide field of view
- Occumax Plus anti-fog coating on interior of lens
- Anti-scratch coatings on lens exteriors
- Selection of laser lenses available for the StingerHawk as optional purchases:
    - E2-5 lens blocks near infrared lasers with 1,064 nm wavelengths with optical density (OD) of 5 and 820-880 nm with OD of 4
    - GF-8 lens blocks green lasers (532 nm) with OD of 2.5 and near infrared lasers with 808 nm wavelengths with OD of 2
    - FT-2 lens blocks violet lasers (405 nm) with OD of 4, blue lasers (445 nm) with OD of 4, and green lasers (532 nm) with OD of 4
    - V6-10 lens blocks ruby lasers (694 nm) with OD of 4 and near infrared lasers with 1,064 nm wavelengths with OD of 4
    - C5-6-10 lens blocks violet lasers (405 nm) with OD of 5, blue lasers (445 nm) with OD of 5, green lasers (532 nm) with OD of 4, ruby lasers (694 nm) with OD of 6, and near infrared lasers with 1,064 nm wavelengths with OD of 5
    - GI-19 lens blocks violet lasers (405 nm) with OD of 5, blue lasers (445 nm) with OD of 4, green lasers (532 nm) with OD of 4, and near infrared lasers with 800-820 nm wavelengths with OD of 4, 820-900 nm wavelengths with OD of 5, and 1,064 nm wavelengths with OD of 6
- Laser and polarized lenses available by special order
- Frames available in black only
- Two sizes available: regular and large
- Prescription nosepiece compatible with the UPLC available
- Slim temple arms for comfort and compatibility with headgear and hearing protection
- Three-year warranty against material and workmanship defects
- 30% discount is offered to the military and law enforcement

3.13 SMITH OPTICS AEGIS ARC

Key features of the Smith Optics Aegis Arc spectacle:

- Inner anti-fog and outer anti-scratch coatings
- Lenses available in clear, sunglass, and colors such as yellow and red
- Laser protective lenses available (Contact the vendor for more information.)
- Locking levers on either side of the spectacle secure lenses in place
- Frames available in black or tan
- Two sizes available: small/compact and regular
- Two options for vision correction: proprietary lens carrier and mounting kit or UPLC mounting kit; either carrier can be filled with prescription lenses by an optometrist
- Lifetime warranty against manufacturing defects

Figure 3-13 Aegis Arc
Image courtesy of Smith Optics

3.14 WILEY-X VALOR

Key features of the Wiley X Valor spectacle:

- Dual-lens design provides stability and wide field of view
- Inner anti-fog and outer anti-scratch coatings
- Lenses available in clear, sunglass, polarized sunglass, and light rust tint
- Frames available in black or Kryptek® Typhon™
- One size fits all design
- Lifetime warranty against manufacturing defects

Figure 3-14 Valor
Image courtesy of Wiley-X

3.15 WILEY-X VAPOR

Key features of the Wiley-X Valor spectacle:

- Adjustable nosepiece accommodates any face/nose bridge
- Inner anti-fog and outer anti-scratch coatings
- Lenses available in clear, sunglass, and light rust tint
- Frames come in black or tan
- One size fits all design
- Nosepiece compatible with the UPLC available
- Lifetime warranty against manufacturing defects

Figure 3-15 Vapor
Image courtesy of Wiley-X

4.0 PRODUCT INFORMATION: GOGGLES

This market survey report provides information on 11 goggles that meet the criteria for inclusion discussed in Section 1.0. These items come in a kit with a frame, clear and sunglass lenses, a carrying case, and may also contain cleaning materials. Kit prices range for $80 to $450. Note that most vendors also offer individual eyewear assemblies (frame with single lens installed) for sale at a lower price.

The eyewear featured in this market survey have many common features, including protection from harmful UV radiation from the sun. All goggles feature impact-resistant technology, are one size fits all, and are less than or equal to five ounces in weight. Product data was obtained directly from the manufacturer or distributor, or their respective websites. The information obtained has not been independently validated by the SAVER program.

Products are listed in Table 4-1 in alphabetical order by manufacturer. Product features in Table 4-1 are defined as follows:

Manufacturer indicates the maker of the product.

Product indicates the name of the goggles.

Kit Cost indicates the price of a kit containing a goggles frame, clear and sunglass lenses, and a carrying case. The price is rounded to the nearest U.S. dollar.

Discount indicates whether a discount is offered to government agencies, law enforcement, or the military.

Warranty indicates the period of time over which the vendor guarantees to repair or replace a defective product.

Prescription Correction indicates whether the product has an available prescription lens carrier that fits beneath the protective lenses.

Electronic Features indicates the type of battery-powered electronic features (e.g., fans, heated lenses, transition lenses), if any, included with the product.

Laser Lenses indicates whether the product has laser protection lenses available as an optional purchase.

Specialty Lenses indicates whether the product has colored, mirrored, polarized, or photochromatic lenses available.

Cold Weather indicates whether the product was designed for use in cold weather.

Frame Colors indicates the colors of frames available for purchase.

Table 4-1 Goggles Product Information

Manufacturer	Product	Kit Cost	Discount	Warranty	Prescription Correction	Electronic Features	Laser Lenses	Specialty Lenses	Cold Weather	Frame Colors
Abom	HEET	$450	No	Limited 1 year	Yes	Heat	No	Yes	Yes	Black
e-Tint	CTRL MG1	$249	Yes	Limited 6 months	Yes	Tran	No	No	No	Tan
Eye Safety Systems	Influx	$120	No	5 years	Yes	None	Yes	Yes	No	Black, Tan, Green, Gray, White
Honeywell	Uvex XMF	$113	No	Limited 1 year	Yes	None	No	No	No	Black, Tan, Foliage Green
Oakley	SI Ballistic 2.0	$120	No	Limited lifetime	Yes	None	No	Yes	No	Black, Tan
Revision	Desert Locust	$99	Yes	3 years	Yes	None	No	Yes	No	Black, Tan, Green
Revision	SnowHawk	$139	Yes	3 years	Yes	None	No	Yes	Yes	Black, Tan, White
Smith Optics	Outside the Wire	$80	No	Limited lifetime	Yes	None	No	Yes	No	Black, Tan, Green
Wiley-X	Nerve	$100	No	Limited lifetime	No	None	No	No	No	Black, Tan
Wiley-X	Spear	$110	Yes	Limited lifetime	Yes	None	No	Yes	No	Black, Tan
Wiley-X	Spear Thermal	$110	Yes	Limited lifetime	Yes	None	No	Yes	Yes	Black, Tan

Abbreviations:
Tran - Transition lenses
Heat – Heated lenses for defogging

4.1 ABOM HEET

Key features of the Abom HEET goggle:

Figure 4-1 HEET
Image courtesy of Abom

- Electronic heated lens technology regulates heat to the lens to prevent fogging and uses a rechargeable lithium polymer battery
    - Two operating modes: “on demand” delivers a quick five-minute burst to clear accumulated fog and "always on” continually mitigates fogging
    - Battery life: up to weeks in “on demand,” depending on frequency of use; six hours in “always on” mode
- Lenses available in clear, sunglass, and 11 color and tint options including gold mirror, blue mirror, red mirror, lumen yellow, copper, and “sonar”
- Frames available in black only
- Goggle is not designed to fit over eyeglasses for vision correction, however, a commercial prescription lens insert is sold separately, and can be taken to an optometrist to be filled
- One-year limited warranty
- Kit includes an anti-reflective sleeve to minimize glint when not in use

4.2 E-TINT CTRL MG1

Key features of the e-Tint CTRL MG1 goggle:

Figure 4-2 CTRL MG1
Image courtesy of e-Tint

- Electronic transition lens
    - Two operating modes: quickly change between clear and sunglass with the push of a button or allow goggles to automatically set tint based on ambient light conditions
    - Rechargeable lithium ion battery offers 70+ hours of continuous use when fully charged
- Impact-resistant anti-glare lenses
- Anti-fog coating on lens interiors
- One size fits all design
- Frames available in tan only
- UPLC-compatible prescription adapter available
- Six-month limited warranty
- Kit contains tan frame, non-transitioning clear lens, transition lens, anti-reflective sleeve to minimize glint when not in use, UPLC adapter, charger pack, anti-fog solution, cleaning cloth, and carrying case
- 15% discount offered to government agencies and current and former first responders

4.3 EYE SAFETY SYSTEMS INFLUX

Key features of the ESS Influx goggle:

- Patented Adjustable Ventilation System™ (AVS) allows the goggle to be sealed from blowing sand/dust or opened for maximum ventilation and reduced fogging
- Anti-fog coating on lens interiors complements the AVS
- Lens exteriors treated with protective hard coat to minimize scratching
- Lenses available in clear, sunglass, and colors including yellow, “alpenglow” (a reddish tint), and “smoke gray”
- Available LPL-B laser protective lens blocks 1,064 nm wavelengths (infrared lasers) with an optical density (OD) of 5 and 820-1,090 nm wavelengths (multi-band infrared) with an OD of 4
- Frames come in black, tan, “foliage green,” gray, and white
- One size fits all design
- Proprietary prescription lens carrier and adapter available as well as UPLC adapter
- Five-year warranty against manufacturer defects
- Kit comes with UPLC adapter and anti-reflective sleeve to minimize glint when not in use

Figure 4-3 Influx
Image courtesy of Eye Safety Systems

4.4 HONEYWELL UVEX XMF

Key features of the Honeywell UVEX XMF goggle:

- Inner anti-fog and outer anti-scratch coatings
- Lenses available in clear and sunglass only
- Frames available in black, tan, and “foliage green”
- One size fits all design
- Proprietary prescription lens carrier and adapter are available as well as a UPLC-compatible adapter option
- Limited one-year warranty against manufacturing defects
- Kit comes with UPLC adapter and anti-reflective sleeve

Figure 4-4 UVEX XMF
Image courtesy of Honeywell

4.5 OAKLEY SI BALLISTIC 2.0

Key features of the Oakley SI Ballistic 2.0 goggle:

Figure 4-5 SI Ballistic 2.0
Image courtesy of Oakley

- Patented High Definition Optics® lenses that (vendor claims) eliminate distortion for accurate vision
- Low-profile light-weight design
- Lenses available in clear, sunglass, and a bronze tint (vendor color name is “Vr28”)
- Frames come in matte black and tan.
- ULPC-compatible prescription adapter available
- Limited lifetime warranty against material and workmanship defects
- Kit comes with UPLC adapter and anti-reflective sleeve to minimize glint when not in use

4.6 REVISION DESERT LOCUST

Key features of the Revision Desert Locust goggle:

Figure 4-6 Desert Locust
Image courtesy of Revision

- Inner Occumax Plus anti-fog coating and outer anti-scratch coating
- Lenses available in clear, sunglass, photochromic, yellow, and vermillion
- Frames available in black, “foliage green,” and tan
- UPLC-compatible prescription adapter available
- Three-year warranty against material and workmanship defects
- Kit comes with UPLC adapter and anti-reflective sleeve
- 30% discount offered to the military and law enforcement

4.7 REVISION SNOWHAWK

Key features of the Revision SnowHawk goggle:

Figure 4-7 SnowHawk
Image courtesy of Revision

- Double-paned thermal lens for insulation and improved performance in cold weather
- Inner Occumax Plus anti-fog coating and outer anti-scratch coating
- Lenses available in clear, sunglass, yellow, and vermillion
- Frames available in black, white, and tan
- UPLC-compatible prescription adapter available
- Three-year warranty against material and workmanship defects
- Kit comes with UPLC adapter and anti-reflective sleeve
- 30% discount offered to the military and law enforcement

4.8 SMITH OPTICS OUTSIDE THE WIRE

Key features of the Smith Optics Outside the Wire goggle:

Figure 4-8 Outside the Wire
Image courtesy of Smith Optics

- Inner anti-fog coating and outer anti-scratch coating
- Lenses available in clear, sunglass, and yellow
- Frames available in black, tan, and "foliage green"
- UPLC-compatible prescription adaptor included in the kit; proprietary lens carrier and mounting adapter also available
- Limited lifetime warranty against manufacturing defects
- Kit comes with UPLC adaptor and anti-reflective sleeve

4.9 WILEY-X NERVE

Key features of the Wiley-X Nerve goggle:

Figure 4-9 Nerve
Image courtesy of Wiley-X

- Inner anti-fog coating and outer anti-scratch coating
- Lenses available in clear and sunglass only
- Frames available in black and tan
- Limited lifetime warranty against manufacturing defects
- Kit comes with anti-reflective sleeve

4.10 WILEY-X SPEAR

Key features of the Wiley-X Spear goggle:

Figure 4-10 Spear
Image courtesy of Wiley-X

- Inner anti-fog coating and outer anti-scratch coating
- Lenses available in clear, sunglass, and rust
- Frames available in matte black and tan
- UPLC mount available
- Limited lifetime warranty against manufacturing defects
- Kit comes with UPLC prescription mount and anti-reflective sleeve

4.11 WILEY-X SPEAR THERMAL

Key features of the Wiley-X Spear Thermal goggle:

- Double paned thermal lens for insulation and improved performance in cold weather
- Inner anti-fog coating and outer anti-scratch coating
- Lenses available in clear, sunglass, and rust
- Frames available in matte black and tan
- UPLC mount available
- Limited lifetime warranty against manufacturing defects
- Kit comes with UPLC mount and anti-reflective sleeve

Figure 4-11 Spear Thermal
Image courtesy of Wiley-X

5.0 MANUFACTURER AND VENDOR CONTACT INFORMATION

Additional information on the products included in this market survey report can be obtained from the following companies.

Table 5-1 Manufacturer and Vendor Contact Information

Company	Address	Phone Number	E-mail/Website
Abom Inc.	7145 SW Varns Street Suite 101 Portland, OR 97223	(503) 430-5494	www.abom.com/pages/contact-us www.abom.com
e-Tint	1950 State Route 59 Kent, OH 44240	(330) 676-1390	sales@e-tintproducts.com www.e-tintproducts.com
Eye Safety Systems	314 South River Street Suite 301 Hailey, ID 83333	(877) 726-4072	cssinfo@esseyepro.com www.esseyepro.com
Honeywell	10 Thurber Blvd. Smithfield, RI 02917	(800) 430-5490	www.sps-support.honeywell.com/s/ www.safety.honeywell.com
Oakley	1 Icon Drive Foothill Ranch, CA 92610	(800) 403-7499	customercare@oakley.com www.oakley.com
Revision	7 Corporate Drive Essex Junction, VT 05452	(802) 879-7002	customercare@revisionmilitary.com www.revisionmilitary.com
Smith Optics	13 F Street Freeport Center Clearfield, UT 84016	Not available	“Contact us” link on website www.smithoptics.com
Wiley-X	7800 Patterson Pass Road Livermore, CA 94550	(800) 776-7842	www.wileyx.com/contact-us www.wileyx.com

6.0 SUMMARY

Tactical eyewear protects emergency responders from many dangers, including impacts from blunt objects, airborne debris, bullets or other fragments, exposure to hazardous substances, and other causes of eye damage and irritation. Special lenses are available that protect against lasers and other hazardous light energy as well.

This market survey report provides information on 15 spectacles and 11 goggles designed with emergency response in mind. All products come in a kit with clear and sunglass interchangeable lenses that provide impact protection (to include against fragmentation), 99.9 percent UV protection, and good quality optics, as verified via testing in accordance with the ANSI Z87.1 standard. Furthermore, all clear and sunglass versions of the products are cited on the Authorized Protective Eyewear List (APEL) maintained by the U.S. military.

The tactical eyewear identified in this market survey report are available in a variety of costs, sizes, and frame colors. Most products offer an optional prescription lens carrier that allows a prescription lens to fit beneath the protective lens. Many products have optional specialty lenses (e.g., colored, mirrored, polarized, or photochromatic) that may or may not meet the same level of protection as the standard clear and sunglass lenses.

Emergency responder agencies that are considering purchasing tactical eyewear should carefully research each product's overall capabilities and limitations in relation to their agency's operational needs.

7.0 REFERENCES

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