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**Department of Homeland Security  
(DHS) Science and Technology (S&T)**

# **Multifunctional Eye Protection**

## **TECHNOLOGY SCOUTING RESEARCH SUMMARY**

**Date:** August 2019



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# Multifunctional Eye Protection



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**Overview:** Subject matter experts, proprietary commercial datasets, and open-source research were utilized to compile a preliminary list of Solution Options. A summary of the request is outlined below, and the top solutions identified thus far are displayed on the following pages.

## Problem Description:

Technology Solution Options for eyewear for first responders that provide appropriate eye-protection in a range of mission environments and tasks. Currently, first responders are issued multiple types of eyewear that each provide distinct protection, including sunlight, heat, and impact protection. The result is that first responders are required to carry multiple pairs of eyewear (such as safety spectacles and sunglasses), change eyewear during a mission based on the task, or be forced to choose between types of protection when it is logistically impossible to change. This process puts first responders at risk to harmful ocular exposure and can compromise their safety and effectiveness.

Ideally, first responders would have one pair of multifunctional eyewear that perform at high standards in multiple mission environments, including rescue missions, technical operations, hazardous materials mitigation, disaster response, medical situations, and potentially others. The eyewear could be used by a variety of first responders, including law enforcement, firefighters, emergency medical care responders, and disaster relief professionals. The eyewear would not need to be fit for missions that require an SCBA or welding mask. Obtaining one multifunctional eyewear solution would also streamline equipment selection processes and reduce the need for mission-specific eye protection. The solution should be government-off-the-shelf (GOTS) or commercial-off-the-shelf (COTS) and available for purchase in the next 8-12 months.

## Desired Use Case:

First responders across mission areas would be able to use one multifunctional eyewear Solution in multiple mission environments. For example, a firefighter could move throughout the scene of an emergency with protection from flying fragments, law enforcement chemical sprays, and UV radiation with one eyewear solution. As the firefighter moved from the bright outdoors to the interior of a building, the lenses of the eyewear would adjust from dark-shaded to clear within a short timeframe. The firefighter would not need to change out eyewear from sunglasses to safety goggles. The firefighter would be able to complete the mission unimpeded by logistical difficulties from changing eyewear and is protected throughout the entire emergency response.

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## Technology Requirements:

The solutions identified were assessed against the following technology requirements. The top considerations when evaluating multifunctional eyewear include being able to provide:

<b>Durability</b>	Must have high durability and reusability characteristics, including resistance to high temperatures, scratching, and other environmental hazards
<b>Impact Resistance</b>	Meets ANSI/ISEA Z87.1-2015 impact standards and contains required markings
<b>Photochromic</b>	Lenses are light adaptive, providing protection from sunlight in bright environments in the form of dark lenses and then returning to clear in dimmer light
<b>Radiation Protection</b>	Protects against ultraviolet (UV) and infrared (IR) radiation
<b>Liquids Protection</b>	Protects against chemical splash/droplets/sprays and mists used by law enforcement (OC and CS)
<b>Prescription Integration</b>	Able to integrate optical correction prescriptions into lenses

## Multifunctional Eyewear Market Overview:

There are multiple types of protective eyewear that can be ANSI/ISEA Z87.1-2015 approved that are currently readily available on commercial markets:

**Safety glasses/spectacles:** Safety glasses are safety eye-protection solutions used in a variety of environments, including labs and medical domains. Safety glasses generally are made of plastic or metal frames with impact resistant lenses and contain side-shields along the ocular periphery. The construction of this eyewear is similar to other glasses in that it has temples that are secured around the ears. These glasses should not be used for liquids protection. Safety glasses often are not photochromic.

**Goggles:** Safety goggles provide sealed eye-protection around the entire eye area. Goggles without ventilation provide liquids protection, including mists, vapors, and splashes. Goggles that have ventilation should not be used for liquids protection, but it would be appropriate for impact and dust protection. There are photochromic goggles available on the market, often in the sports industry for skiing. Goggles have a strap that secures the eyewear to the head and tightens the seal around the eyes.

**Hybrid/Sealed Eyewear:** Hybrid or sealed eyewear represent a combination of safety glasses and goggles, with the frames of glasses with additional linings around the eye area that keep dust and debris out of the eyes. They are often worn under face shielding in industrial fields as added protection. Hybrid eyewear does not create a complete seal around the eyes and therefore do not provide complete liquids protection. Hybrid eyewear may have glasses temples that hook around the ears or a strap around the head, depending on the model.

## End Users:



Technologies identified through this Technology Scouting Report could be used by first responders in the law enforcement, firefighting, emergency medical care, and disaster response fields for eye protection in a range of mission environments.

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Solution Options							
#	Solution	Description	Requirements				
1	 <u>SI Ballistic M Frame 2.0</u> by Oakley (USA)	<p>Complies with ANSI Z87.1 Industrial Standards for high-mass and high-velocity impact protection and are stamped for industrial and military safety compliance.</p> <p>Features:</p> <ul style="list-style-type: none"><li>• Plutonite lens material blocks 100% of all UVA/UVB/UVC and harmful blue light</li><li>• Full compatibility with PASGT, CVC and MICH helmets</li><li>• Full compatibility with helmet-mounted night vision devices</li><li>• Distortion-free optics via patented Polaric Ellipsoid lens geometry that minimizes refraction</li><li>• Extended upper/lower/lateral/ viewing fields via Polaric Ellipsoid geometry</li><li>• Lightweight design (1.05 oz. total weight)</li><li>• Secure fit, even under wet conditions via hydrophilic Unobtainium at all contactpoints</li><li>• Easy lens replacement with no need for tools</li><li>• Photochromic - Sport performance lens for flat to bright light. Neutral transmission for truer color perception across a wide variety of light conditions. Lens darkens in sunlight.</li><li>• Fully compliant with all ANSI Z87.1-2010 protection requirements</li><li>• Fully compliant with MIL-PRF-31013 Vo Ballistics</li></ul>	Durability	Yes			
			Impact Resistance	Yes			
			Photochromic	Yes			
			Radiation Protection	Yes			
			Liquids Protection	No			
			Prescription Integration	Yes			
			2	 <u>3M SmartLens Safety Glasses with Photochromic Lens</u> by 3M (USA)	<p>Photochromic lens that is compliant with the ANSI Z87.1-2015 eyewear safety standards. The SmartLens's photochromic lens has a 22% VLT (visible light transmission) in its darkest state. The glasses are designed for indoor and outdoor protection, but the lenses may take a few minutes to adjust. These glasses do not protect against airborne chemical sprays and do not provide splash protection from molten metal.</p>	Durability	Yes
						Impact Resistance	Yes
						Photochromic	Yes
Radiation Protection	Yes						
Liquids Protection	No						
Prescription Integration	*						
<i>*More Information Required for Detailed Product Specifications</i>							

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#	Solution	Description	Requirements
3	<p><a href="#"><u>SecureFit Tactical Series SF613AS-TAC</u></a> by 3M (USA)</p>	<p>Photochromic lenses that are compliant with ANSI Z87.1-2015 eyewear safety standards. The lenses are made of anti-scratch polycarbonate. Also contains a coating of 3M Scotchgard Anti-Fog Technology, which reduces vision obscurity caused by condensation. The fit can be customized, reducing the need for frequent repositioning of the glasses due to head movement. Photochromic lens darkens when exposed to UV light outdoors and lightens when removed from UV exposure indoors. These glasses do not provide protection from chemical sprays or molten metal splash.</p>	
			Durability
			Impact Resistance
			Photochromic
			Radiation Protection
			Liquids Protection
			Prescription Integration
4	<p><a href="#"><u>SecureFit Safety Glasses SF613AS</u></a> by 3M (USA)</p>	<p>Photochromic lenses that are compliant with ANSI Z87.1-2015 eyewear safety standards. The lenses are half-frame and made of polycarbonate with an anti-scratch coating. Pressure Diffusion Temple Technology which helps diffuse pressure over the ear and has been tested to the Military Vo High Velocity Impact standard of MIL-PRF 32432(GL) (not listed on QML/QPL). This eyewear does not provide protection from chemical sprays or molten metal splash.</p>	
			Durability
			Impact Resistance
			Photochromic
			Radiation Protection
			Liquids Protection
			Prescription Integration
5	<p><a href="#"><u>Ryders Face GX</u></a> by Ryders Eyewear (Canada)</p>	<p>100% UV 400 protection. The lenses are scratch and impact resistant with an anti-fog coating. This model is also compatible with optical prescriptions to reduce the need for switching glasses. Vendor outreach is needed to determine if this eyewear meets ANSI Z87.1- 2015 eyewear safety standards. This eyewear does not provide protection from chemical sprays or molten metal splash.</p>	
			Durability
			Impact Resistance
			Photochromic
			Radiation Protection
			Liquids Protection
			Prescription Integration
6	<p><a href="#"><u>Uvex Livewire™ Sealed Eyewear</u></a> by Honeywell (USA)</p>	<p>Meets ANSI Z87.1+ high impact and safety standards. The sealed eyewear has anti-scratch and anti-fog coatings. The wraparound frame design accommodates respirators and other PPE, while the low-profile temples fit comfortably with earmuffs. The eyewear stays in place by a flame- retardant band that allows for the full-range of movement. The frame is foam-lined to close the gap around the face to keep debris out. This model is also certified to the requirements of the CSA Z94.3 standard. This eyewear does not protect against chemical sprays and molten metal splash.</p>	
			Durability
			Impact Resistance
			Photochromic
			Radiation Protection
			Liquids Protection
			Prescription Integration