

# DHS Science and Technology Directorate

## Burn Saver Thermal Sensor

### Working to assist firefighters with avoiding burn hazards associated with fires

Firefighters can often find themselves in thermal environments that place them in danger because of a rapid rise in the ambient temperature to a level beyond the protective capabilities of the Self-Contained Breathing Apparatus (SCBA) and their other personal protective equipment (PPE). The hazard associated with infrared radiation (IR) is particularly threatening because the intensity of IR can increase to dangerous levels in seconds. Developing an early detection system that informs the firefighter of a rapid temperature rise, which might not be immediately evident inside the protective gear, would greatly improve firefighter safety.

### Addressing a firefighter capability gap with a real time temperature sensor

*“The capability to continuously detect, monitor and analyze threats and hazards in real time can enable timely mitigation and protect responders from unwarranted risk.”*  
— Project Responder 3

Through a Small Business Innovative Research (SBIR) award, the Department of Homeland Security Science and Technology Directorate’s First Responders Group is working with TDA Research, Inc. to develop and produce the “Burn Saver” thermal sensor that can provide real time alerts to firefighters in dangerous thermal conditions. Real time notification allows firefighters to immediately mitigate the risks associated with those conditions by leaving the fire scene.

The firefighters' turnout gear ensemble can only tolerate exposure to Class IV fire conditions [(500° – 1832° F; heat fluxes of 10 – 100 kilowatts per square meter (kW/m<sup>2</sup>)] for less than one minute before degrading. Therefore, providing firefighters with a timely warning that PPE failure, especially for the face piece of the SCBA mask, is imminent due to the current thermal environment will permit them to respond to the thermal hazard to avoid catastrophic protective ensemble failure.

Working with their industrial partner, TDA developed a small, lightweight, battery-powered device that is constructed of thermoplastic and mounted on the straps of the firefighter’s SCBA.



Figure 1: Picture of Generation 3 (Gen 3) prototype Burn Saver device.

The Burn Saver will respond to both radiant (i.e. infrared) and convective heat sources and will be submitted for inclusion as a component of the turnout gear ensemble to meet the National Fire Protection Association’s (NFPA) 1984 standard (Figure 1).

### Providing real time alerts about temperatures and radiant loads

An SBIR Phase II Option contract was awarded in November 2017 for TDA for developmental testing of the Burn Saver device. Initial experiments have indicated that the Burn Saver thermal sensor can respond quickly (less than ten seconds) to Class IV radiant and 260°C ambient air temperatures. Laboratory testing was performed to develop the SCBA mask face piece temperature profile alarm matrix software, to optimize sensor design, and test the alarm algorithms that will govern the prototype unit's response to fire conditions.

Field tests are tentatively scheduled to begin in mid-2018. The results of these tests will guide the final development of the prototype. It is anticipated that initial prototypes will be ready for independent testing and an Operational Field Assessment (OFA) by late FY 2018. Successful development and implementation of TDA’s Burn Saver device will provide firefighters with a warning of dangerous thermal conditions, giving them time to escape the situation and reduce the incidence of thermal injuries and fatalities.

