

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

# **Integrated Structural Turnout Gear**

**TECHNOLOGY SCOUTING  
RESEARCH SUMMARY**

**Date:** August 2019



**Homeland  
Security**

**Science and Technology**

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### Problem Description:

Firefighter turnout gear and supplemental garments must meet all federal standards. These include high visibility requirements as outlined in FHWA Regulation 23 CFR Part 634 and PPE requirements to protect the first responder from dangerous work environments and hazards. As firefighters are being tasked with increasingly violent and/or dangerous mission environments, the multitude of standards and requirements associated with these environments cannot be met with current, universal turnout gear. Instead, the firefighter must change their gear to comply with the situation at hand, often disregarding safety for improved readiness (e.g., removing one's seatbelt to put on the high visibility vest required for working alongside Federally funded roadways).

- Compliance with standards: NFPA 3000 (Active Shooter), FHWA Regulation 23 CFR Part 634 (High Visibility)
- Improves Visibility
- Provide Ballistic Protection
- Cut/Slice protection for lower extremities
- Used for structural firefighting environments

This report will identify turnout gear solutions that incorporate many of the above requirements. Additionally, this report contains information on advancements in fabrics and textile raw materials that potentially can be integrated into turnout gear.








In discussions with subject matter experts on PPE, there is a general agreement that there are material solutions that can address the requirements listed by the first responder community. Turnout gear manufacturers are able to customize products and create new firefighting suits that incorporate many layers of protection. The largest barriers to the creation of these garments are: 1) Added weight; 2) Reduced mobility or user comfort; 3) Lack of consistent demand; and 4) Increased Price in a market that is highly sensitive to managing cost.






Research also indicates that there has been a general downward trend in the number of structural fires fought over the last 15 years in the North American market<sup>1</sup>. This trend could have further impacts on the long-term viability of the firefighter turnout gear market, but at the present, staffing levels have remained consistent. However, the need for specialized turnout gear may decrease given the reliance on firefighters responding to medical emergencies and car accidents.

<sup>1</sup>U.S. Fire Administration. <https://www.usfa.fema.gov/data/statistics/>.

## Representative Solutions and Textiles for improved Firefighter safety







### Icon Legend:

	Provides improved ballistic protection		Provides enhanced fire protection
	Provides improved cut/slice protection		Provides enhanced visibility
	Provides improved chemical and carcinogen protection		Provides reduced system weight
Turnout gear with integrated sensors for firefighter monitoring			

#	Vendor/ Solution Name	Description/Capacity	Protection Categories
1	<a href="#">Flex9 Armor Shirt</a> By Protect The Force	The PTF Flex9Armor Gen 2 Long Sleeve Armor Shirt by Protect The Force provides ballistic integration. Using an advanced technique, the ballistic panels on the shoulders act as an exoskeleton increasing protection without sacrificing mobility.	
2	<a href="#">Dyneema</a> By Royal, DSM	Dyneema is made from Ultra-High Molecular Weight Polyethylene (UHMwPE) and is used in a wide variety of applications including enhanced <a href="#">cut protection</a> and incorporation into several different types of <a href="#">body armor</a> .	  
3	<a href="#">INNOTEX GRAY</a> By INNOTEX	INNOTEX GRAY is a series of protective interfaces in order to address the growing industry concern of increased cancer cases in firefighters. By using a particulate blocking layer, it mitigates the risks of carcinogenic particulate contamination while maintaining air permeability. INNOTEX GRAY aims to protect multiple vulnerable areas, including the head, neck, wrists, body and legs, while maintaining comfort and mobility.	


# Integrated Structural Turnout Gear



4	<p><a href="#">Globe Guard</a> By Globe/MSA</p>	<p>The Globe Guard System, in combination with turnout gear from Globe, helps reduce exposure to toxic substances without impeding performance.</p>	
5	<p><a href="#">ORALITE</a> By Orafol</p>	<p>Prismatic Reflective Film is designed to increase visibility.</p>	
6	<p><a href="#">Pioneer</a> By TenCate</p>	<p>TenCate Pioneer has an outer shell using ENFORCE Technology. TenCate Pioneer delivers enhanced strength in a lighter weight outer shell along with elevated comfort and flexibility.</p>	
7	<p><a href="#">COMBAM</a> By Rocky Research</p>	<p>Coordinative Molecular Bond Armor Material (COMBAM) is a cooling technology now being developed by Rocky Research. COMBAM can be designed with an endothermic feature and serves as thermal protection against unintended high temperature conditions. COMBAM is a novel non-traditional blast mitigation material, which can synergistically be integrated with traditional armor, resulting in optimal and mass efficient armor solutions against blast/fragment threats.</p>	
8	<p><a href="#">Chase Lifetech FR Jacket</a> By Nokia, Kolon, and GINA</p>	<p>A firefighting SMART Jacket with modular sensors that can detect heart rate, temperature, motion and GPS location, but can also be swapped out for different sensors such as body cams to accommodate the responder's needs. Data collected from the sensors is sent back to a base to be viewed in real-time and help track the first responder with the software management system put in place by GINA. The data can help locate a first responder who goes missing, or alert officials if a responder is showing signs of fatigue.</p>	
9	<p><a href="#">smartPRO2 Safety System</a> by GoodPRO</p>	<p>The smartPTRO2 integrates sensors with a wireless Bluetooth application to allow for the measurement and control of settings within the firefighting suit. Integrated features of the suit include an active light system embedded in the garment, sensors to measure the temperatures inside and outside of the garment, a SOS feature to alert the location of the endangered firefighter to control and command, a tracer feature to continuously monitor timing/duration of the firefighter, and a black box feature which allows the recording of all data for retrospective analysis. A cheaper version of the turnout gear suit does not include the above sensors but does include an RFID system to track maintenance of the gear</p>	

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10	<p><a href="#">WASP: Wearable Advanced Sensor Platform</a></p> <p>By Globe Manufacturing</p>	<p>WASP is an integrated body-worn electronics system that collects, transmits, and displays integrated user data in real time to a command station or remote monitoring location. Knowing where First Responders are and what condition they are in will be a major improvement to workplace safety. The WASP system is currently installed at multiple fire training institutes and fire departments in the US, and is being utilized for university-based fire fighter health and safety research.</p>	
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