



# THE FIRE PROTECTION RESEARCH FOUNDATION

## **Revolutionizing the Modern Turnout Suit: Technical Basis for Redesigning Structural Firefighter Protective Ensembles for Reduced Heat Stress**

### PROJECT SUMMARY

5 November 2013

**Background:** Fire fighter personal protective equipment (PPE) is an essential part of today's fire fighting gear. This research will develop and test new structural firefighter turnout suit constructions having a combined thermal comfort and protective performance that exceeds anything currently available for structural firefighters. These prototype turnouts will incorporate advanced materials and design innovations that "push the envelope" to achieve major advances in lightweight turnout wear comfort.

**Methods:** A trio of advanced instrumented manikin test systems, including PyroMan™, RadMan™, and SweatMan™ will provide ensemble level performance assessments that are more accurate than what is obtained using the fabric level tests that have heretofore guided turnout suit designs and criteria in the 2013 edition of NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*. Using whole ensemble assessment of protection will highlight areas of overprotection and allow a reduction of layers in those overprotected areas. Advances in systems level heat stress reduction will be confirmed and documented using human subject physiological wear trials.

**Goal:** This project will produce concept turnout suit prototypes that reflect a systems level understanding on optimum balance between *thermal protective properties* (TPP) and *total heat loss* (THL) requirements for structural firefighter turnout suits.

**Expected Conclusions:** This research will redefine the comfort/protection balance of the turnout suit. It will provide technical basis for considering changes in NFPA 1971 performance requirements for turnout TPP and THL performance, enabling revolutionary turnout designs and materials to be offered by manufacturers. The resulting changes will potentially significantly reduce injuries related to heat stress and exertion in structural firefighting operations. Mechanisms are incorporated within the project that will ensure widespread input and dissemination throughout the structural firefighting community.

**Implementation and Schedule:** This research project is funded by a DHS/FEMA AFG Fire grant and is led by North Carolina State University (NCSSU) with collaborative support from the Fire Protection Research Foundation. The supporting role of the Foundation will be conducted in accordance with section 6 of the Foundation Policies and will be guided by a Project Technical Panel who will provide input to the project, review periodic reports of progress and research results, and review the final project report. This three year project is scheduled to be completed in July 2016.