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For information on partnering with the Firefighter Life Safety Research Fund, contact

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For more information on the variety of research that IFSI conducts, visit the IFSI web site at

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Illinois Fire Service Institute



Firefighter Life Safety Research Fund

IFSI Research: Practical solutions to protect people and property

IFSI is a national leader in developing research-based solutions to the problems and perils faced by firefighters.

Our successes have come from our commitment to applied-science research – the development of knowledge and technologies that have a direct impact on firefighters’ work. Our research projects focus on reducing risks for firefighters, and in hand protecting the general public and physical structures from the unwanted effects of fire and. These action-oriented studies focus on:

- **Individual firefighters** – Physical fitness, psychology, physiology and other human factors that affect the health and safety of first responders.
- **Environment** – Impact of fire ground environment on the health and safety of firefighters, and the effect of suppression techniques on structures.
- **Tools and equipment** – Research, development and testing of tools, equipment and technologies for fire suppression and rescue scenarios.

**“The more we learn
about the science of
firefighting, the safer
we are. Saving lives
is our number-one
research priority.”**

– Gavin Horn
Research Program Manager



A firefighter with SCBA navigates various space configurations to measure gait, functional balance and other factors.

Learning Resource and Research Center

IFSI added an extraordinary new set of research capabilities with the 2011 opening of the Learning Resource and Research Center (LLRC). This 21,000-square-foot facility includes two state-of-the-art laboratories, the Firefighter Life Safety Research Center and the Illinois Fire Protection Engineering lab.

Located on the IFSI campus, the LLRC allows academic and industry researchers to gather critical scientific data immediately adjacent to one of the most realistic, yet safe, live-fire hands-on training facilities in the country. This unique combination allows us to study the impact of different characteristics of the firefighter, fireground and firefighting equipment on firefighter health and safety in a clinical research setting—literally just 90 seconds away from the firefight.

The IFSI Research Team

IFSI's research projects are carried out by experienced scientists, whose primary role at the Institute is for firefighter health and safety studies. The team is led by Dr. Gavin Horn, who holds a Ph.D. in Mechanical Engineering and serves as a volunteer firefighter.

Research scientists and their specialties include:

- Dr. Denise Smith, Exercise Physiology
- Dr. Terry von Thaden, Human Factors
- Richard Kesler, M.S. Bioengineering

Their work is enhanced by IFSI's affiliation with one of the premier research universities in the United States at the University of Illinois, which includes nationally and internationally recognized programs in Engineering, Medicine, Kinesiology, Communications and Psychology. Institute scientists collaborate with University of Illinois professors and researchers from campus departments to carry out broad, multidisciplinary studies.

The IFSI research team is also active in delivering their research results in peer-reviewed, archival publications and through national and international academic conferences, as well as translating and disseminating to the fire service through reports to fire departments, articles in fire service publications and at fire service conferences.



Dr. Gavin Horn, right, participates in the fire-fighting scenarios to assure consistency of the testing regimen. Dr. Denise Smith (left, in red) has been an integral part of IFSI's studies on the effects of fire fighting on the cardiovascular system.

Peter Vadorpe

Chief of Training, Chicago Fire Department



“One of the best things that is happening with fire service research these days is that the fire service is involved at the very beginning. We are literally sitting at the table when the research questions are being developed and asked and we are involved in this process throughout the whole thing.”

“The researchers themselves are firefighters. These guys have crawled the halls, they've raised the ladders, they understand our jobs, because it's their job as well.”

Craig A. Haigh

Fire Chief, Hanover Park Fire Department



One of the most important areas that research can help the fire service to be able to have a better understanding of the physiological impact of fire suppression – once we understand physically what's going on inside of firefighters, it allows us to implement tactics that are going to better protect our personnel and thereby reducing line-of-duty deaths and injuries.”



After completing live fire activity, a firefighter returns to the laboratory for detailed cardiac and vascular analysis. The researcher on the left is performing an ultrasound of the brachial artery to measure blood vessel stiffness and flow. The researcher on the right is measuring changes in microvascular reaction. By comparing these factors – and many more – before and after the live fire activity, researchers can learn how the body's cardiovascular system reacts to the stresses of fire fighting.

Dr. Gavin Horn

Director of Research, Illinois Fire Service Institute



“With the research that we conduct here, we can take firefighters directly out of a live-fire training scenario into a clinical research setting in less than two minutes, so we can very quickly get a measurement of the cardiovascular strains and biomechanical changes. And then we can feed that back into the training to complete the loop, so that training can be updated based on the research results that we collect here.”

Royal P. Mortenson

Director, Illinois Fire Service Institute

“Applied research that addresses real-world health and safety challenges facing first responders, benefits both the responders and the communities they serve.”