

**The Federation of Behavioral, Psychological, and Cognitive Sciences**  
*and*  
**the Human Factors and Ergonomics Society**

*Science Forum on*

**Human Factors Research and Homeland Security:  
Current and Future Applications**

*11.17.05*

**Talk Abstracts**

**Wendy A. Rogers, PhD**

*Introductions*

The Science Forum on Human Factors Research and Homeland Security is co-sponsored by the Federation of Behavioral, Psychological, and Cognitive Sciences and the Human Factors and Ergonomics Society (HFES). HFES is the premier scientific organization for the field. Its mission is to support the science and practice of human factors and ergonomics which is designing for human use with consideration for the needs, capabilities, and limitations of users. It is a multidisciplinary field which includes psychology, engineering, and biomechanics. The ultimate goal of human factors and ergonomics is to ensure safe and effective human-system interactions. The purpose of the forum is to foster an exchange of knowledge by: providing examples of current human factors and ergonomics research relevant to issues of homeland security; identifying gaps in the literature and needs for future research; and understanding the research needs of Department of Homeland Security. The overall goal is to set an agenda for future directions for advancement of science and practice that will enhance the safety and security of the American people.

**Nancy J. Cooke, PhD**

*Human Factors of Homeland Security*

In this presentation, examples of human factors applications and successes are described with the goal of communicating the breadth of the discipline as well as its contribution to large, complex systems such as homeland security systems. A case is also made for the early consideration of human factors in system design. The presentation then covers the significant role that humans play in homeland security systems as they prepare, detect, respond, and communicate often using technology and in collaboration with others. Therefore, it is argued that it is essential that human capabilities and limitations be considered early in the design of such systems. An overview of ongoing research in human factors of homeland security is provided with deeper coverage of the topics of detection of deception, coordination metrics, uninhabited aerial vehicles and homeland security, and safety symbols.

**Thomas F. Sanquist, PhD**

*The Human Element in Homeland Security Systems*

Dr. Sanquist's presentation will address the general topic of human factors in homeland security with a discussion of human factors as an engineering discipline in the spiral development life cycle model, descriptions of security system functions and human roles and performance models within these functions. He will discuss in detail two specific projects involving homeland security applications: (1) the use of threat likelihood displays for low probability/high consequence radiological events, and (2) assessment of public acceptance of security technologies based on perceived benefits and risks to information privacy. Both projects illustrate the applicability of human factors methods to specific homeland security issues, and the resulting benefits gained from early consideration of these issues in the system life cycle.

**Peter Hancock**

*Psycho-Security: What Psychology and Human Factors Can Contribute to DHS*

In respect of our present meeting, the task is to provide help and assistance to the Department of Homeland Security in achieving their aims. To that end, I have developed my comments under the theme 'from the practical to the theoretical.' In practical terms, I have employed Haddon's framework to capture a number of specific activities to which we can contribute through our development of methodological innovations and empirical insights. In particular,

I will emphasize our work with first responders and the threats that they face, the dimensions underlying threat detection, and the capability to produce superior response in the face of high level stress. Our methodological enhancements come in the form of extensions to signal detection theory, which is a fundamental pillar of Human Factors and is of central importance to DHS. I present the development of applications in Fuzzy Signal Detection Theory [FSDT] in which categorical decisions do not have to default only to the two states of either signal or non-signal. In particular, I can show that expanding possible response categorizations, increase detection sensitivity and thereby serves the function of improving performance. Next, I introduce the idea of temporal signal detection theory that seeks to integrate memory capacities into traditional SDT. This methodology, when fully articulated, can address the problem of component separation, where threatening elements are distributed in space and time to avoid detection. These and allied contemporary efforts serve to help solve the problems of the present. However, I offer observations on longer term issues. Homeland is a concept in physics; security is a concept in psychology. Thus infrastructure safety is a necessary but not sufficient prerequisite to enhanced security. Research is consequently needed on the neuroscience of belief and the way technology can mediate change in belief structures. This effort needs integration with macro-ergonomic concerns for system level functioning, the restriction of focus to just individuals being insufficient to the task. Finally, DHS needs to defeat the disadvantage of the 'imperative of negation.' Negation suffers both philosophical and practical disadvantages which need to be counteracted as soon as is feasible.

### **Gary Klein, PhD**

#### *The Cognitive Dimension of Homeland Security*

Many aspects of homeland security depend on cognitive functions such as naturalistic decision making, sensemaking, problem detection, common ground, and adaptive planning. These functions emerge in field settings -- they are not typically studied in the laboratory. The presentation offers a framework for understanding cognitive functions in field settings and describes some applications such as new military decision making doctrine, baggage screening, intelligence analysis and team coordination.

### **Mary (Missy) Cummings, PhD**

#### *Real-Time Decision Support Under Uncertainty*

This presentation will illustrate the parallels between the Department of Defense and the Department of Homeland Security in terms of the need for decision support systems for human supervisory control of complex command and control systems under significant uncertainty and time pressure.

### **Joshua Rubinstein, PhD**

#### *Human Factors Research at the Transportation Security Laboratory, DHS*

The Federal Aviation Administration's (FAA) Aviation Security Laboratory has had an active human factors program since its creation in 1992. Following the creation of the Transportation Security Administration (TSA) in 2001, the lab moved from the FAA to the TSA and was renamed the Transportation Security Laboratory (TSL), indicating a focus on aviation and other modes of transportation. In 2005, the TSL was transitioned out of TSA and is now a federal lab under the Science and Technology Directorate of the Department of Homeland Security. This is expected to further broaden the focus of human factors beyond countering terrorism aimed at transportation.

TSL's Human Factors Program supports the security industry in one of the following capacities: 1) Test and evaluation, 2) Product development, and 3) Long-term research. Test and Evaluation research includes usability analyses on all security technologies that require a human operator. This has included research on X-ray machines, Explosive Detection Systems (EDS), Explosive Trace Detectors (ETD) and portals, hand-held metal detectors, and whole-body imaging portals. Test and Evaluation also includes performance testing of new operator-machine systems during behavioral threat detection evaluations.

Product Development includes short-term research (6-18 months) designed to produce a deliverable for use in the field. This research has focused on the development of selection tests, training, new visual displays, improved screener operating procedures, performance monitoring processes, detection of deception methods and technologies, and fatigue monitoring technologies. Some of this research is conducted in coordination with industry and academia.

Long-Term Research examines many of the same issues described under Product Development, but does so under a longer time frame (3-5 years) and with the intent of uncovering the underlying cognitive, perceptual, and attentional principles underlying operator performance of the various screener tasks.

**Elizabeth L. Grossman, PhD**

In this presentation, I will describe the federal budget process from the perspective of Congressional staff and talk about Congressional priorities for federal research in general and for homeland security science and technology in particular. I will also touch on some issues affecting Congressional attitudes and assumptions about the social sciences.

**William Grosshandler, PhD**

*An Introduction to the Building and Fire Research Laboratory, and the Need for Behavioral Research*

- Background on National Institute of Standards and Technology (NIIST) and the Building and Fire Research Laboratory (BFRL)
- Targets for Fire Risk Reduction
- Eliminating flashover is key to reducing residential fire deaths
- New technologies, measurement standards, improved training tools and a shift to an information -rich environment will lead to reducing risks for the fire service
- Need to deal with risks to life and property loss in public and commercial buildings and in the wildland/urban interface
- Safety of threatened buildings program:
  - improve emergency egress and access
  - increase structural integrity
  - enhance fire resistance
  - establish building and equipment standards and guidelines
- National Construction Safety Team investigations: The WTC collapse and The Station nightclub fire
- Elevators for emergency use
- Real-time information for emergency responders
- Building egress during emergencies
- Fire Grants Program

**Paul (Wyn) Jennings, PhD**

During this presentation, Dr. Jennings will provide perspective on the opportunities for Human Factors researchers in their efforts to contribute to the DHS mission. He will give an overview of DHS and some specific comments regarding the office of the University Programs attempting to provide areas of contact for research opportunities.