



*1st Invitational Workshop on*  
**Body Area Network Technology and Applications**  
Future Directions, Technologies, Standards and Applications  
June 19-20, 2011  
Worcester Polytechnic Institute

# Integrated First Responder Location and Physiological Monitoring

---

Jim Duckworth

Electrical and Computer Engineering Department  
*Worcester Polytechnic Institute*  
*Worcester, Massachusetts*



# Performance Objectives for WPI's Integrated System

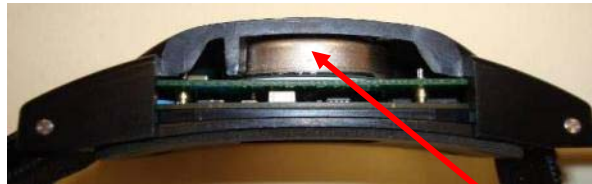
---

- Fundamental capabilities:
  - 3-D location of each user relative to a chosen reference point
  - Graphical display at the incident command center
  - Graphical path information on all users
  - Accuracy: 1m (2D) and floor level (3D)
  
- Physiological information telemetry
  - Heart Rate
  - Respiration Rate
  - Oxygen Saturation Level
  - Skin, and Environment Temperature
  - Posture and Activity Level
  - Core Body Temperature (with ingestible capsule)

# Wearable Wireless Physiological Sensor



Head Band



Optical Module Disposable battery



- Flexible Configuration
- Rechargeable Battery

## Streaming Measurements:



USB-Based Receiver



- $SpO_2$
- HR
- HRV – sympathetic/parasympathetic
- Arrhythmia detection
- Respiration rate
- Perfusion Index
- Posture
- Activity
- Skin temperature
- Motion artifact detection
- Carboxyhemoglobin ( $SpCO$ )
- Hydration/fluid volume loss
- Core body temperature\*

Under development

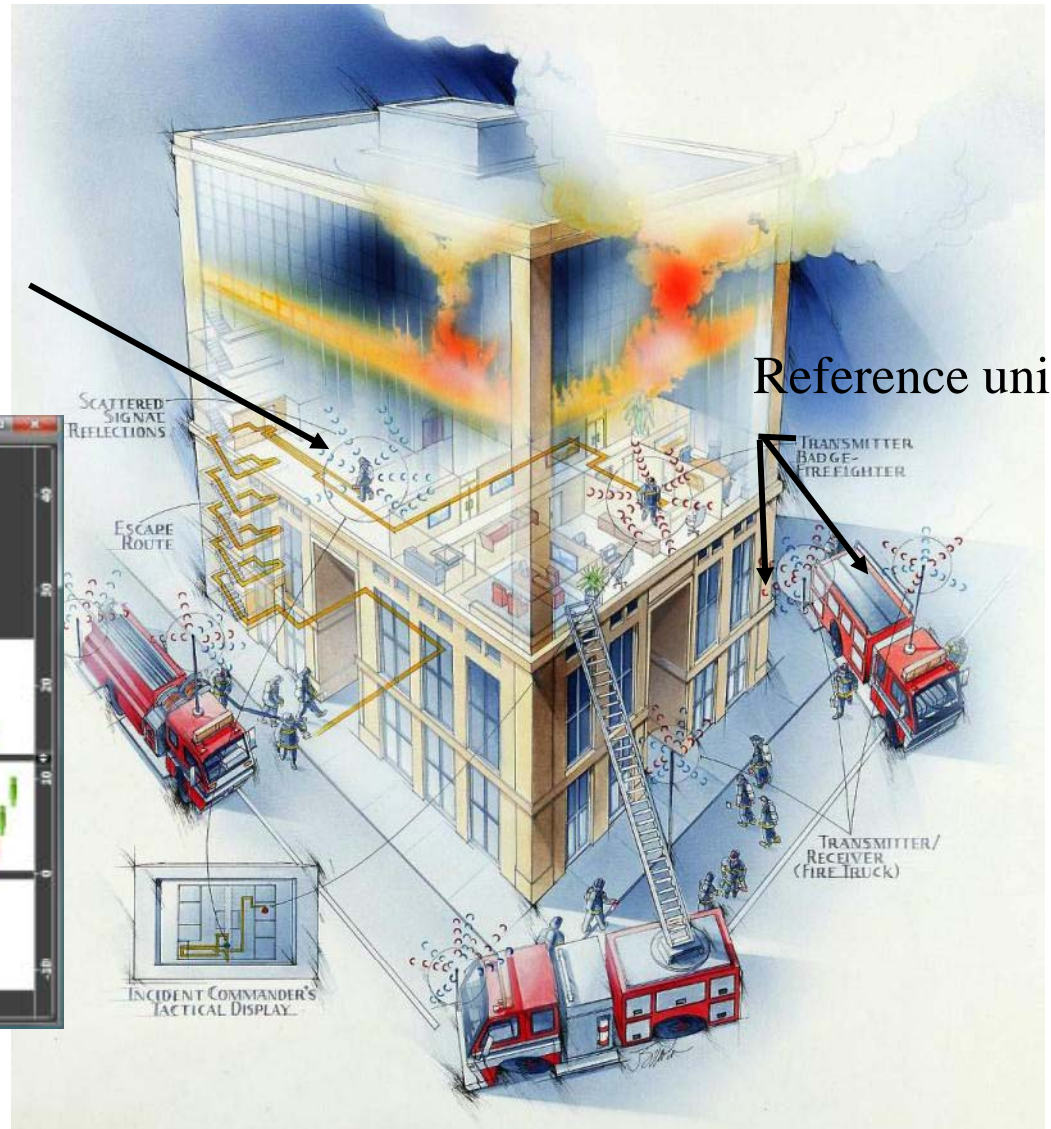
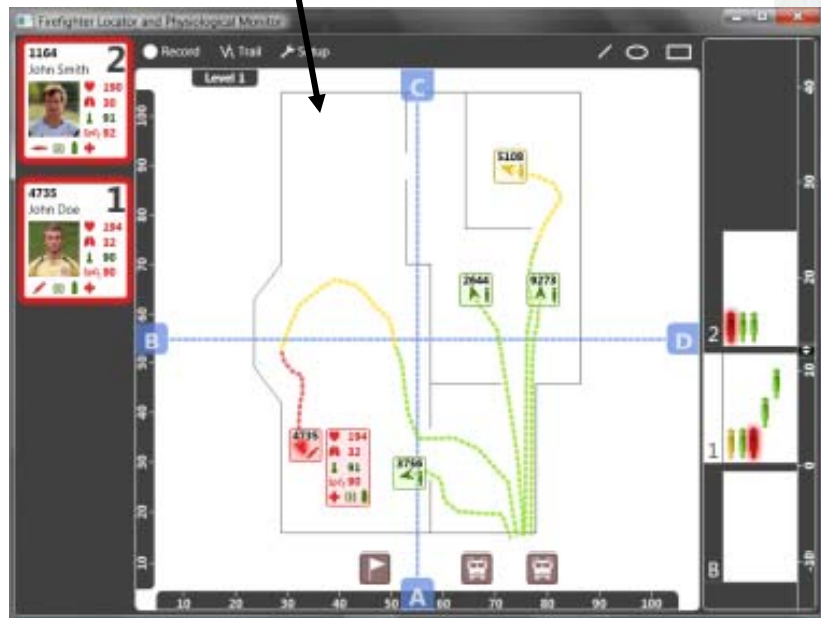


# System Overview

Commander Display

Personnel Unit

Reference units





# 2008 PPL Workshop Demo

## WFD: Full CONOPs search and rescue



Five WFD teams  
test five search  
and rescue systems



(c) WPI ECE 2008



# BALSM

## ➤ Battlefield Automatic Life Status Monitor

- Remotely monitor physiological signs for the purpose of triage, rescue or recovery and provide a health status history over time for each member of a Special Forces team.



Development as part of QinetiQ-NA project for AFRL

# August 1-2, 2011 Workshop

## *Precision Personnel Locator* PROJECT

### **Precision Indoor Personnel Location and Tracking Sixth Annual International Technology Workshop**

**Sponsored by Department of Homeland Security Science and Technology Directorate  
WPI (Worcester Polytechnic Institute), Worcester, Massachusetts**

#### **Overview**

This Workshop provides a forum for researchers and developers working in the important area of indoor location and tracking to share technical knowledge and to define the state of the art. The focus of this workshop is on any-time, anywhere tracking of critical personnel (such as emergency responders), with extension to the breadth of commercial uses that will arise from the maturation of this technology. Further, the focus is on systems that provide complete tracking and position information on all equipped personnel. This year's workshop will also include consideration of the applicability of commercial location-aware systems to the needs of the first responder community. The important topic of standards development for location and tracking systems will also be addressed, as will integration with other sensor technologies that benefit from location awareness.

#### **Materials**

- [Workshop Announcement](#)
- [Request to Participate Form](#)
- Agenda TBD



# Acknowledgments

---

- The rest of the WPI team
  - ECE and BME Departments
- WFD and MA Firefighting Academy
- Support from
  - DOJ/NIJ
  - DHS/FEMA – Fire Prevention and Safety Grant
  - DHS/S&T and NSRDEC
  - QinetiQ-NA, Honeywell, Raytheon
  
- Thank you!
  - Jim Duckworth, [rjduck@wpi.edu](mailto:rjduck@wpi.edu)



[www.ece.wpi.edu/Research/PPL/](http://www.ece.wpi.edu/Research/PPL/)