A Compact Device to Monitor and Report Firefighter Health, Location and Status

In both structural and wildland firefighting, determining the location and status of firefighters is crucial to the success of the firefighting operation and the safety of the firefighters. In structural firefighting, 15% of the fatalities on the fire ground come from firefighters being lost or trapped within the building.

In general, the sole means of communication between command and firefighters on the wildland or structural fire ground is a low-power voice walkie-talkie, which has limited range and requires a conscious effort to use. If the firefighter is busy or unable to respond or the area is noisy, communication may be impossible or the clarity of the transmission may not be sufficient. Additionally, communication can only take place between one sender and one receiver at a time. If multiple senders are transmitting, (e.g., multiple men in trouble) the strongest signal will dominate (‘capture’) what is typically an FM (frequency modulated) communication channel and repeats will be necessary or communications may be lost.

Systems in the form of an auxiliary attachment to the conventional voice walkie-talkie have become available. These use an external Global Positioning System (GPS) receiver attached to electronics mounted in a microphone handset to determine and transmit the position of the sender (e.g., Thales Communication, Inc. 2005). Sub-audible carrier tones are commonly used to encode position information on the voice channel. Special receivers at the command center must be used to decode these sub-audible tones. Although these systems do not require intervention on the part of the firefighter, they cannot be used to transmit health or fire safety information.

Still other systems monitor environmental conditions and report back to command via a radio link. (RAE Systems 2005) These systems are usually placed in fixed locations and while measuring a number of environmental conditions that may be of use to first responders or firefighters (hazardous materials airborne concentrations, radioactivity levels, etc.) do not provide information on personnel locations or condition.

In response to these issues, we have constructed a system that: (1) answers the need for unattended communication between a firefighter and command; (2) is not tied to the conventional voice communication channel; and (3) transmits firefighter position as well as status, health and environmental information in the vicinity of the firefighter.

The Firefighter System

- Devices communicate to a base unit at command
- Simple switch and light based user interface (like structural firefighters SCBA equipment)
- Extended range operation by relaying
- Uses proprietary radio system at 900 MHz (Maxstream)

The Basic Command System

- Wireless modem connected to a PDA or Field Laptop
- Alarms based on multiple sensor input
- Each firefighter has unique code
- Firefighter positions overlaid on map
- Proprietary network or 802.11 takes care of low level connection problems

This work was supported by the National Aeronautics and Space Administration under Grant NAG5-10051 and by the USDA Forest Service under a Joint Venture Agreement with the Rocky Mountain Research Station. This financial support has been greatly appreciated.