# 2009 BFRL Project Description

**Project Title:** Building Information Exchange with First Responders

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**Principal Investigator:** Jason Averill

**Co-Investigator(s):** William Davis
David Holmberg
Alan Vinh

**BFRL Program:** Cybernetic Building Systems

**Objective:** To enable secure real-time communication of building system information to emergency responders and to allow emergency control of building systems by developing an information exchange architecture, data taxonomy, standards, and performance measures. Development and testing is expected to be completed, along with standards committee agreement.

**Problem:**

***What is the problem?*** Today, when first responders arrive at a building in response to an emergency they typically have very little information about what is happening beyond a high-level summary such as, a fire has been reported, a break in has occurred, there is a medical emergency, etc. As a result valuable time must be spent determining the nature of the emergency, details of the building and its systems that are relevant to a response, and the number and type of emergency personnel who may be needed to carry out an effective response. For fire emergencies alone, each year $9.6B property is lost to 524,000 structural fires[1] and over 100 firefighters are killed and 80,000 injured, yielding a net social cost of between $3B and $16B per year[2]. Modern building automation systems increasingly involve integration of HVAC, fire, access control and other systems that contain a wealth of sensor data and other information that could be helpful to first responders. Industry has begun to recognize this potential and document the information needs of first responders[3,4]. Development of products that can provide this information quickly and in a usable form is inhibited by a lack of enabling measurement science, i.e., standard data models, communication protocols, user interface standards, security procedures, and testing tools.

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[1] Karter, M. J., Fire Losses in the United States during 2006 (2007) National Fire Protection Association

[2] TriData Corp,The Economic Consequences of Firefighter Injuries and Their Prevention. Final Report. (2005) NIST GCR 05-874.

[3] The Statement of Requirements for Public Safety Wireless Communications and Interoperability (2004) The SAFECOM Program, Department of Homeland Security Version 1.

[4] Davis, William D., Vettori, Robert, Reneke, Paul, Brassell, Lori, Holmberg, David G., Kostecki, Jodi, and Kratchman, Jessica "Workshop on the Evaluation of a Tactical Decision Aid Display", NISTIR 7268; 28 p. October 2005.

***Why is it hard to solve?*** The problem is difficult at multiple levels. Technically, there are many challenges to collect, format, process, integrate and transport building data out of the building. Beyond this, the system for making building data available must mesh with public safety networks, dispatch systems, and emergency responder interface requirements. There are many stakeholder industries that must be brought together to address the technical issues and work on standards. Taking advantage of remote control of specific building systems by emergency personnel requires a way to make potential interventions options clear to responders. For both information flow and control actions, demonstrable reliability and security are critical considerations.

***How is it solved today, and by whom?*** There is no integrated system for delivering building incident data to first responders. Current practice relies on paper-based pre-plans if they are available. Some fire system vendors offer systems for presenting fire system data on proprietary remote interfaces. There have been limited attempts to develop products relying on custom gateways to building systems and proprietary communications and user interfaces.

There are pieces of a more comprehensive solution available or in progress. The NEMA SB30 committee has formed a task group to develop user interface standards, building information modeling standards are under development that can be used to automate the creation of floor plan displays, the BACnet standard, which can simplify access to building system data, is becoming widely used, and efforts have begun to expand capabilities of 9-1-1 centers.

***Why NIST?*** The fractured nature of the building and fire communities necessitates the objective, measurement science and technical leadership provided by NIST in order to develop baseline standards, as well as deliver usable information to the fire service in a timely manner. This project is aligned with two of the BFRL strategic goals: Measurement Science for Net Zero Energy, High-Performance Buildings and Measurement Science for Innovative Fire Protection. The project addresses the safety and effectiveness of emergency response, and NIST efforts fulfill government's role of supporting public safety. This project addresses the measurement science needed to enable building information exchange with first responders as well as standards to make it successful nationwide. BFRL was instrumental in engaging NEMA in addressing building data interface standards for the fire industry and has close ties to all of the relevant standards development organizations.

## Approach:

***What is the new technical idea?*** The new concept is the definition, collection, and integration of building information required for emergency response and providing a means for delivery of the information both to emergency responders at the building site as well as to public safety officials at remote sites such as 9-1-1 centers, fire trucks and ambulances in a format that is readily usable by these end users. There are four distinct elements of this effort:

1. Develop a data classification methodology for categorizing building sensor data to enable alert filtering as well as data delivery to SB30 user interfaces. Develop the data model required to move the data from building server to end use client.

2. Develop a Building Information Server and Access Control System (BISACS) architecture to enable transmitting building alerts to the Next Generation 9-1-1 system (NG9-1-1) public safety network.

3. Develop a protocol for communication with the building data server. Develop the protocol for this communication and the protocol for encapsulating that data for delivery to external systems.

4. Address the integration of real-time building data into a NEMA SB30 display. A standard floor plan data model must be identified and a protocol developed for mapping a sensor alert location on the floor plan.

***Why can we succeed now?*** A critical combination of technology enhancements and stakeholder support are in place to make this effort a success. Computer networking technology is sufficiently advanced to be adapted to this application, an effort is underway to develop a Next Generation 9-1-1 system capable of intelligent routing of messages that could be linked to building data sources, public safety officials are starting to recognize buildings as potential sources of mission-critical data, and manufacturers have already begun developing more sophisticated interfaces to their systems and participating in NEMA SB 30 interface standardization activities.

***What is the research plan?*** The plan is to address in parallel the elements laid out in the Technical Idea section above, with the addition of a workshop to guide the research agenda. Planned for October 2008, the workshop will gather key stakeholders in order to solicit industry feedback on the proposed building information delivery architecture.

1. Develop a data classification methodology for categorizing building sensor data to serve the needs of machine filterable alerts as well as data delivery to SB30 user interfaces. Develop the data model required to move the data from building server to end use client. This work will be done in cooperation with the NEMA SB30 Building Interface Task Group (BITG).

2. Develop the BISACS architecture to enable transmitting building alerts over the Next Generation 9-1-1 system (NG9-1-1) public safety network. This requires coordination with the National Emergency Numbers Association (NENA) to address alert format, security, and web services connection. The NG9-1-1 system routes alerts to authorized (dispatched) responders and provides a link for those responders to connect back to the building data server.

3. Develop a protocol for communication with the building data server. This interface includes a protocol for this communication and a protocol for encapsulating the data for delivery to external systems. This work will include linking the NIST VCBT via an external data server to allow outside first responders to receive simulated alerts and connect to the building server to get more information on the incident.

4. Address the integration of real-time building data into a NEMA SB30 display. A standard floor plan data model must be identified and a protocol developed for mapping a sensor alert location on the floor plan.

This measurement science research will be pursued in cooperation with industry stakeholders, including fire system manufacturers, public safety officials, central station alarm companies, public safety access point officials (dispatch and 9-1-1), graphical information system vendors, and other consumers of building emergency data. To this end, NIST will not only participate in NG9-1-1 and SB30 BITG technical meetings, but also bring together project stakeholders to build industry awareness and acceptance as well as gain feedback on the technical goals. This activity will lead up to a testbed demonstration of the protocols with industry partners and local public safety users.

**Recent Results:**

**Output:** Davis, Holmberg, Reneke, Brassell Vettori, *Demonstration of Real-Time Tactical Decision Aid Displays*, NISTIR 7437, 2007.

**Output:** Davis, Vettori, Reneke, Brassell, Holmberg, Kostecki, Kratchman, *Workshop on the Evaluation of a Tactical Decision Aid Display*, NISTIR 7268, 2007.

**Outcome:** NEMA SB30 revision finished and submitted to NEMA and NFPA 72 for adoption.

**Output:** Completed implementation of and summary report for a first generation Building Information Services and Control System (BISACS) that delivers alert messages from building.

**Output:** Vinh, "Building Information Services and Control System (BISACS): Technical Documentation, Revision 1.0", NISTIR 7466, December 2007.

**Standards and Codes:**

Adoption of the enabling measurement science in industry standards and national model codes is a focus of this project. The BISACS services interface will be included as part of NEMA SB30, which is currently an addendum to NFPA 72. In support of the updated version of SB30, NIST staff will participate in NEMA SB30 BITG meetings. Further, staff will develop an extension of OASIS Common Alerting Protocol for building source data and work to include the building interface specification as a recognized data source in the NG9-1-1 effort.