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Workshop to Define Information Needed by Emergency Responders during Building Emergencies

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Appendix C – White Paper on Building Tactical Information for Public Safety Officials

Introduction

Response to a building incident typically commences with a 911 call. Dispatch provides first responders with the type and location of the incident and determines order of dispatch. A map of the running route will be carried in the emergency vehicles along with building keys and a Knox Box key (a Knox Box is a fire service lock box that is attached to a building and contains the building keys) although not every building will have a Knox Box or keys. When keys are available, they open outside doors, utility rooms and mechanical rooms.

For the fire service, hydrant locations may be indicated on the route map, while the extent of the building information on the map depends on the type and use of the building. For commercial buildings or apartment houses, the map may include an outline of the building and the location of the standpipe/sprinkler connection and door/garage entrances. For newer buildings, the location of the annunciator panel and fire control room is sometimes available. Additional information about the structure may be available in binders carried in the responding apparatus. These preplans may contain interior floor plans, locations of stairwell risers, the location of utility shutoffs, known hazards, etc. Its detail will depend on the person that did the work.

With the development of small, rugged portable computers and compact electronic storage media, the information available to a first responder about a building or other incident can be expanded and made more accessible. Advances in telecommunications have opened up the possibility of supplying first responders with real-time information about the building and incident prior to arrival. Fire departments are moving toward using electronic pre-emergency plans (e-plans) for buildings that can be accessed from computer terminals in the apparatus.

Recent work at NIST has demonstrated the possibility of using building sensors and a decision support system to send information about a developing building fire to first responders prior to their arrival at the building. When added to the information that pre-plans can contain (see NFPA 1620), the amount of building information that can be made available to emergency responders is overwhelming. This paper is designed to start a dialogue that should result in the development of a set of minimum standards for building information provided to first responders while enroute and on the scene of building incidents. The goal of these standards is to provide responders with static (pre-plan) and dynamic (real-time) building information in a format that is readily understandable and is universally accepted such that the use of the information becomes seamless.

An incident can be broken down in time to three general periods. The first period is the time from dispatch until arrival at the incident; typically about five minutes. The second period is the time from arrival until the extent of the incident and method of attack has been determined, and the last period is the mitigation of the incident. The amount of information needed during each of these periods will depend on the type of incident. The key is to look for commonalities in information across incident types and develop information groups that can be readily displayed on a computer screen.

The next sections explore possible minimum information sets for several different incidents. The information contained in these sections prior to the workshop was based on material from NFPA 1620; pre-fire plan information from several sources compiled and supplied by Santa Rosa, CA, Fire Chief Ronny Coleman; Essentials of Fire Fighting, 4th edition; International Fire Service Training Association; several fire department websites; and discussions with Montgomery County Fire Captain Bob Vettori, Prince Georges County EMS responder John Demarest, fire protection engineer Erica Kuligowski and Fire Chief Don Oliver of Wilson North Carolina Fire Department. Information was also used from the workshop on first responders held in July of 2003 at NIST. The following information has now been updated to include input received during the May, 2004 workshop, as well as some follow-on information received from attendees of the NFPA May, 2004, meeting in Salt Lake City.

A building fire, the first five minutes

The "first due" responder typically has five minutes between time of dispatch and arrival at the incident. The officer in charge must make sure that his team is seated and belted in the apparatus, dressed in turn-out gear, and that all the doors are closed. The officer must then check with the driver to make sure that the route to the incident is known and then uses the route map to verify that the route is correct.

At this point, the officer can start to process additional information about the incident. Due to the difficulty of reading computer screens or hard copy when the apparatus is in motion, the information display must be simple which limits the quantity of information that can be displayed. The information that may be displayed comes in two categories, static or time independent information and dynamic or real-time information.

A building fire – en route – the first five minutes

- Building occupancy (abandoned, vacant, number of young children, high occupancy, number of elderly, numbers of occupants should be based on time of day).
- Building condition (let burn, unsafe to enter, dangerous roof, sprinklered and other suppression systems)
- Building type (single family, commercial, gas storage, school).
- Building style (one story, two story, n story, auditorium, sublevels, etc) include square feet.
- Building construction (type I, II, III, IV or V; fire resistive, noncombustible or limited combustible, ordinary, heavy timber, or wood frame – see reference 2).
- Roof construction (light weight metal or wood trusses).
- Hazardous materials (Unusual hazards) (above ground propane tank, gas lines, chemicals, etc)
- Location of fire hydrants on map with building outline. Nonstandard thread sizes should be noted with the hydrant.
- Location of fire department hookups for sprinkler system/standpipes.
- Other sources of water nearby.
- Location of staging areas and entrances and exits to building.
- History of location in case fire stages before police arrive.
- Routing information for emergency equipment to reach the building in case of construction.

The **dynamic and calculated** information available to the first responder

- Confidence in the incident being real (based on number of sensors in alarm and/or calculated fire size)
- Approximate location of fire within building.
- Fire size and duration.
- Estimated water flow in gallons/minute or foam based on fire size
- Assessment of the local hydrants capability of supplying this water.
- Sprinklers are flowing/no sprinklers or other working systems.
- Fire growth (fast, medium, or slow).
- CBR (chemical, biological, radiation) sensors present and in alarm.
- Police on the scene.
- Presence of occupants in building
- Stairwell smoke/heat conditions for positioning.
- Standpipes to use to get to the fire.
- Exposures.

Other units responding to the scene should receive the same type of information even though it may take them an additional five to ten minutes to reach the incident. The fraction of this information that can be supplied will

depend on the building type and age with new, large commercial buildings having the infrastructure to supply most of the points on the list.

On the Scene

Once the first apparatus has arrived, the incident commander will require additional information. For house fires and other small buildings, a visual inspection from the outside and information supplied by occupants would be a first priority. For large buildings, the fire may not be visible from the outside and a visual check may not be a first step. Typically, large buildings have twenty-four hour security or desk people that may provide information on where the incident is located within the building.

Electronic data that would be useful at this time would include a building floor plan and a plot plan of the area. The **floor plan** (static data) would include layers/overlays that would allow the incident commander to locate:

- Key box.
- Doors, windows (with types and which can be used for egress), stairwell risers, fire walls (with ratings and area separation), roof access, fire sensors.
- Security sensors, closed circuit TV cameras, occupancy sensors, security control room.
- Fire alarm panel and remote annunciator panels.
- Utility shutoff.
- Building generator (with indication of what it powers)
- Building system controls (HVAC, smoke control, others), areas covered, special operating systems, and which ones should and should not be used by the responders.
- Persons with special needs.
- Areas of refuge.
- Evacuation quality elevators, floors served, and location of elevator overrides and how to control.
- Convenience stairs/evacuation stairs.
- Areas (zone boundaries) protected by sprinklers or other devices.
- Hazardous materials (type indicated)
- Potential building hazards that may require decontamination.
- Vertical openings.
- Extremely valuable materials.
- Contact number for building engineer.

Dynamic and calculated data that would be useful and could be a series of overlays on the **floor plan** include the following:

- Location of fire detectors in alarm.
- Location of CBR sensors in alarm.
- Location and size of fire/fires.
- Duration of the fire/fires.
- Location and condition of smoke.
- Presence of smoke in elevator shafts or stairwells.
- Identification of activation of sprinklers or other devices.
- Location of elevators used during incident.
- Location of people in need of rescue (911 calls or visual sightings).
- Warnings of structural collapse based on material type, fire location, fire size and duration.
- Location of operational elevators.
- Alarm, occupant, and system histories of building.

The **plot plan (outside building)** would be resizable and contain the following information:

- Building location with street designations.
- Location of fire fighting obstacles such as street widths, overhead clearance and elevations.
- Location of underground pipelines and other utilities.
- Name and phone numbers of building owners and managers.
- Name and phone numbers of utility contact people.
- Location of police line necessary to isolate the incident.
- Indicated runoff or water table problems.
- Helicopter landing areas.
- Evacuation routes.
- Bomb blast radii for buildings.
- Chemical/radiation staging.

Dynamic data that could be displayed on an overlay of the **plot plan** would include:

- Location of responding units (fire, police, and EMS).
- Location of units responding but not yet on scene.
- Hospital availability.
- Helicopter availability.
- Hazmat response.
- Location of police line necessary to isolate the incident.
- Location of triage or evacuation area.
- Suggested hazard perimeter.
- Local weather conditions and predicted spread directions.
- Wind direction and velocity.

Additional data that may be needed concerning the incident include a long list of contact numbers for public safety or relief agencies.

Medical Emergency

A medical emergency within a building can require a subset of the information needed for a building fire. For large structures, the location of the victim and how to get to him/her is of primary importance and a simple floor plan becomes very useful. On dispatch, a route map and a simple plot map showing the outlines of buildings and adjacent streets would be useful. Upon arrival at the building, a simple floor plan containing the following static and dynamic information would be required.

The e-plan floor plan display should include the following static information:

- Doors and stairwell risers.
- Elevators with elevator cars designated for ambulance stretchers.
- Building hazards that may require patient decontamination.

Dynamic data that would be useful include:

- Nature of medical emergency and estimate of need for patient transportation.
- Location of patient.
- Quickest route in building to location.
- Victim data including age, size, sex, allergies and pre-existing medical problems.
- Police on scene.

- Hospital availability.
- Helicopter availability.

Police Action

Building information that would be useful for an incident involving a break-in or other criminal incident would require a building floor plan with different sets of sensor data than would be used for a fire. Static data that should be included consist of a building floor plan and plot plan and a route map.

The building floor plan should include the location of:

- Key Box.
- Doors, windows and stairwell risers.
- Security alarm panel and remote annunciator panels.
- Utility shutoff.
- Hazardous materials (and types).
- Motion detectors.
- Surveillance cameras.
- Security office.
- Security zones and door access point locations with type of security (key, card reader, biometric device, RFID reader)
- Telephones and corresponding phone numbers.

The plot plan should include:

- Building location with street designations.
- Building occupancy (abandoned, vacant, young children, high occupancy, elderly).
- Building type (single family, commercial, gas storage, school, etc)
- Building style (one story, n story, n story with basement, auditorium, etc).
- Name and phone numbers of building owners and managers.
- Name and phone numbers of utility contact people.

Dynamic information from sensors that would be involved with security would include:

- Door access history, location and progress on intrusion.
- What security devices were operated (tripped) and their location and time of operation.
- Lighting and elevator use history.
- Location of activated motion sensors and other security sensors.
- Surveillance cameras.
- Confidence in the incident being real.

As police respond to a building alarm, bringing up this information electronically either within the responding patrol car or at the police station would provide the responders with a tactical advantage compared with what is now available.

Summary

This list of information represents a first cut for electronic information available at an incident. In particular, needs for police and EMS were discussed and are included here but additional input is needed due to the limited number of representatives from these areas. While additions and subtractions to this list are expected over the next months, a next step is to decide how to order the information by electronic screens and standardize the symbols

used on the displays. An excellent starting point is NFPA 170, Standard for Fire Safety Symbols, and NFPA 72 annex, National Fire Alarm Code. A subset of these symbols should represent a starting point for the e-plan standard. There are several companies developing GIS based software that is being used for preplanning by fire and other public officials and the good ideas in their products should be incorporated in the standard.

Discussion of the display of information led to the following conclusions. The methods used to present this information must be kept simple and can include both audio and visual presentations. Audio can be very beneficial in communicating to a first responder who must watch the road, or to others in a vehicle who cannot see a visual display. Specific phrases used in audio messages should be standardized. The use of colors on displays needs to be explored as an aid in recognition of information. There was some discussion about presenting building information in 2D or 3D formats, with participants agreeing that need for 3D information was limited. The use of icons in some instances was also suggested but short text messages could also be effective. A set of symbols is useful for the video display and would include:

- Drop of blood for a medical hazard
- Skull and crossbones for hazardous materials
- Life safety for a person
- Fire symbol for a fire
- Gun symbol for shots fired
- Bomb symbol for a bomb.

Finally, available information enroute must be carefully selected as the incident commanders typically have very little time to look at it prior to arrival on the scene. There was general agreement that the types of information that should be sent to an incident commander would provide more safety and better informed command decisions. There was also concern that too much information would lead to information overload.

Appendix D – Summary of speaker presentations

This section presents a summary of the morning presentations. The purpose of the presentations was to have experts provide their perspectives on the potential impact of having accurate and reliable information from building systems for tactical decision aids. Speaker biographies are presented in Appendix E. The presenters were as follows:

Kathleen Higgins: Director, NIST Office of Law Enforcement Standards

Ronny Coleman: Fire Chief, Santa Rosa, CA, Fire Department and former CA State Fire Marshall

Joel Leson: Special Assistant to the Executive Director & Chief of Staff /Staff Liaison to the Homeland Security Committee, International Association of Chiefs of Police

Don Hewitt: Program Manager, Responder Knowledge Base, Terrorism Research Center, Inc.

Ms. Kathleen Higgins: "Perspective of the NIST Office of Law Enforcement"

The NIST Office of Law Enforcement Standards (OLES) came about with the recognition in the 1960s of the need for equipment standards and information sharing. The National Institute of Justice came to NIST and cooperatively set up OLES, which has since addressed many issues of interest to the law enforcement community.

After 9/11 there was a significant expansion and refocusing on homeland security issues. This was true not only at OLES but also in every local jurisdiction. And while interoperability issues have been known and potential technology to address the needs available, post 9/11 has seen new determination at the federal and state levels as well as at the local levels to make interoperability a reality. Post 9/11 has seen the concentrated efforts of the federal government as demonstrated by the establishment of Department of Homeland Security (DHS) and steady evolution of programs within DHS to address needs of the emergency response community.

The DHS mission focuses on (1) preventing terror attacks and (2) responding to terror attacks. Part of response is having necessary equipment, and a second part is having information. The focus of the current workshop is getting building information out to the emergency responder. The goals are collaboration and sharing about the future of emergency response. This work goes beyond the traditional law enforcement focus of OLES and beyond the terror focus of DHS, because it is useful for any building emergency in the everyday work of emergency responders.

Chief Ronny Coleman: "Future Information Needs for the Fire Service"

Chief Coleman began his talk by describing the contributions of two men in order to provide a historical basis for his talk.

- Sir Eyre Massey Shaw, London Fire Brigade, who authored "A Complete Manual of the Organization, Machinery, Discipline, and General Working of the Fire Brigade of London" in 1876. A quote from this manual, "If you wish to control a problem, you must know more about the problem than anyone else and if you need to know more about the problem, you must coin a terminology, a lexicon, that allows you to understand it and not use imperial rhetoric." So, don't just be random about your collection of information, have a systems approach to it. In 1876, the London Fire Brigade was already developing fire pre-plans for buildings.
- Lloyd Layman authored "Fire Fighting Tactics" in 1953 (first published in 1940 under the title: "Fundamentals of Fire Fighting Tactics") and developed the concept of "size-up." Size-up encompasses facts, probabilities, possibilities, plan of action, etc. for an incident. "If you are going to rush into an emergency, you better have your information together."

"Today (2004) I would characterize the Fire Service as having one foot firmly planted in the 1870's and the other foot firmly planted in the 1950's and grasping to catch up with technology."

The first issue the Chief discussed was Risk Assessment. It is a limitation and potential liability for fire departments that very few communities know about Risk Assessment, and there is a great need to have better knowledge of Risk Assessment. He is working to develop RAVE, Risk Hazard and Value Evaluation, which is a computer-based methodology for risk assessment of buildings. It addresses the questions of:

- What is in the building?
- What can hurt you in the building?
- What do you need to know about the building?

Without a model to understand how everything fits together, there is a gap between the fire community and the technology community. The Chief gave his perspective in the following chart which provides an overview of how fire departments across the country are using data and technology and how the use of technology evolves.