



## Career Captain Dies Conducting Roof Operations at a Commercial Structure Fire - Pennsylvania

### Executive Summary

On April 6, 2013, a 53-year old male career captain died from injuries suffered from a fall during roof operations at a commercial structure fire. The initial box alarm was for smoke in the basement of a fabric store. Approximately 30 – 45 minutes after smelling the odor of smoke, the store owner went to the basement to investigate and found a fire in the rear of the basement (southwest corner). He attempted to extinguish the fire with a portable fire extinguisher, but due to smoke and fire, he was forced to leave the basement. The 1<sup>st</sup> Alarm for companies assigned to Box 1232 had a difficult time finding the seat of the fire due to the amount of



**The crew of Ladder 27 was using a ground ladder to gain access to the roof of the fire building. The apartments with the bay windows are above the basement of the fabric store where the fire originated. This is showing Side Delta at the “C/D” corner of the incident.**

*Photo courtesy of the fire department*

heat and smoke. Crews also struggled to gain access to the basement due to fabric and other products limiting aisle space. After the 2<sup>nd</sup> Alarm was struck, the Incident Commander ordered Ladder 27 (L27) to the roof to make a trench cut between the fire building and the Bravo Exposure. L27 accessed the roof from Side Charlie and were preparing to walk to the Bravo Exposure. The captain of L27 took several steps towards Side Alpha of the roof, which was obscured by smoke, and fell to the roof of a one-story storage building attached to the fire building. The captain died instantly. The other members of L27 heard the sound of the captain landing on the roof of a storage building. The driver/operator of L27 ordered the crew to their knees, conducted a personnel accountability report, and realized the captain was missing. The crew from L27 got off the roof and tried to locate the captain. They found him lying on the roof of the storage building and made several rescue attempts. Before the captain could be removed, the storage building roof collapsed into the basement of the fabric store. Rescue

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operations were started by breaching the wall of the storage building. Approximately 2 hours later, the captain was removed from the structure.

### **Contributing Factors**

- *Delay in reporting the fire to the fire department*
- *Fire in a non-sprinklered commercial building*
- *Building construction and design*
- *High fuel load and limited access to the fire due to excessive merchandise*
- *Lack of situational awareness.*

### **Key Recommendations**

- *Fire departments should integrate current fire behavior research findings developed by the National Institute of Standards and Technology (NIST) and Underwriter's Laboratories (U.L.) into operational procedures by developing standard operating procedures, conducting live fire training, and revising fireground tactics*
- *Fire departments should consider implementing a pre-incident planning program which complies with NFPA 1620, Standard on Pre-Incident Planning*
- *To enhance situational awareness, consider implementing a critical building information system which is available to responding units*
- *Based upon department procedures, the strategy and tactics of an occupancy should be defined by the organization for fire-fighting operations*
- *Fire departments should review procedures on the use and deployment of Rapid Intervention Team(s)*
- *Ensure all fire fighters and fire officers are trained when to call a "Mayday"*
- *Fire departments should provide the Incident Commander with a "Mayday" tactical checklist in the event of a "Mayday".*

The National Institute for Occupational Safety and Health (NIOSH), an institute within the Centers for Disease Control and Prevention (CDC), is the federal agency responsible for conducting research and making recommendations for the prevention of work-related injury and illness. In 1998, Congress appropriated funds to NIOSH to conduct a fire fighter initiative that resulted in the NIOSH "Fire Fighter Fatality Investigation and Prevention Program" which examines line-of-duty-deaths or on duty deaths of fire fighters to assist fire departments, fire fighters, the fire service and others to prevent similar fire fighter deaths in the future. The agency does not enforce compliance with State or Federal occupational safety and health standards and does not determine fault or assign blame. Participation of fire departments and individuals in NIOSH investigations is voluntary. Under its program, NIOSH investigators interview persons with knowledge of the incident who agree to be interviewed and review available records to develop a description of the conditions and circumstances leading to the death(s). Interviewees are not asked to sign sworn statements and interviews are not recorded. The agency's reports do not name the victim, the fire department or those interviewed. The NIOSH report's summary of the conditions and circumstances surrounding the fatality is intended to provide context to the agency's recommendations and is not intended to be definitive for purposes of determining any claim or benefit.

For further information, visit the program Web site at [www.cdc.gov/niosh/fire](http://www.cdc.gov/niosh/fire) or call toll free 1-800-CDC-INFO (1-800-232-4636).



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### **Introduction**

On April 6, 2013, a 53-year old male career captain fell from a three-story roof to the roof of a one-story storage building while operating at a commercial structure fire. The captain died instantly. On April 8, 2013, the United States Fire Administration notified the National Institute for Occupational Safety and Health (NIOSH) of this incident. On April 28 – May 4, 2013, an investigator, two safety engineers, and a safety and occupational health specialist from the NIOSH Fire Fighter Fatality Investigation and Prevention Program traveled to Pennsylvania to investigate this incident. The NIOSH investigators met with the fire commissioner and executive staff of the fire department, the fire marshal and his staff, the health and safety officer, the International Association of Fire Fighters local union, the department's training academy staff, the city's Department of License and Inspection, and the fire department's communication center. The investigators reviewed the standard operating procedures of the fire department, department and Commonwealth of Pennsylvania training records of the captain, and dispatch and tactical channel printouts plus audio radio transmissions. During the investigation, witness statements were reviewed and interviews were conducted with the fire fighters, fire officers, and the Incident Commander involved in this incident. The NIOSH investigators inspected and photographed the personal protective clothing (turnout gear) and self-contained breathing apparatus (SCBA) worn by the captain, which was under control of the Fire Marshal's Office.

### **Fire Department**

The fire department involved in this incident has 61 fire stations with 2,200 uniformed members that serve a population of approximately 1,526,000 within an area of approximately 144 square miles. The department operates 11 battalions in 2 divisions North – Division 2 (Deputy Chief 2) and South – Division 1 (Deputy Chief 1). The South Division operates five battalions – 1, 3, 4, 7, and 11. The North Division operates six battalions – 2, 8, 9, 10, 12, and 13. The fire department currently has 56 engine companies, 27 ladder companies, 1 heavy rescue company, 2 squad companies (pumpers plus a special operations unit), and 3 fire boats (plus 1 in reserve). The department operates specialty companies for technical rescue, hazardous materials incidents, and aircraft rescue fire-fighting (ARFF).

Eight of the engine companies are designated as *Pipeline* (e.g. Pipeline 61) which means the pumper carries large diameter hose (1000 feet of 5-inch hose). Four of the engine companies are designated as *Squirt* (e.g., Squirt 55) which has a 50 foot articulating boom. Three of the engine companies are designated as *Deluge* (e.g., Deluge 24) which carries a 4-inch monitor. Two of the engine companies are designated as *Foam* (e.g., Foam 33) which carries Class B foam. Also, Foam Tender 1 operates with Foam 33. One engine company operates as a *Quint* (Quint 69) which is equipped with a 75-foot rear-mounted aerial. Two of the ladder companies are 85-foot snorkels (articulating boom with a platform) (Snorkel 2 and Snorkel 28). Two of the ladder companies are ladder towers (Ladder Tower 6 and Ladder Tower 22). The remainder of the ladder companies are tractor-drawn aerials.

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The staffing on an engine company is an officer and three fire fighters. The staffing on a truck company is an officer and four fire fighters. Each Squad is staffed with an officer and four fire fighters. Rescue 1 is staffed with an officer and five fire fighters. Each division chief and battalion chief is assigned a staff assistant or chief's aide.

In addition to fire suppression, hazardous materials mitigation, and special operations response, the fire department operates an Emergency Medical Services (EMS) Division which consists of 13 basic life support (BLS) medic units, 37 advanced life support (ALS) medic units, and support staff including EMS field officers. Thirty of the medic units operate on a full time basis and 20 of the medic units operate on a part-time basis. The fire department operates an aircraft rescue fire-fighting (ARFF) station at the airport in the southern part of the city in the 7<sup>th</sup> Battalion.

Department members assigned to the Operations Division work a daily 12/12 shift (0800 - 2000 and 2000 - 0800) with four platoons or shifts (42-hour work week). All fire department apparatus are maintained by the city's fleet maintenance division. Annual testing (e.g., pumps and ladders) as recommended by National Fire Protection Association (NFPA) standards, is conducted by qualified vendors.

The department's SOPs are listed in **Appendix 1**, which include Incident Command System SOP 19 and Incident Safety Officer SOP 40 as they relate to this incident.

### **Training and Experience**

The Commonwealth of Pennsylvania does not have prerequisite training or education requirements for an individual to become a fire fighter. The department participates with the Pennsylvania State Fire Academy in the *Voluntary Participation and Certification Program*, which started in 2003 to provide national certification for department members through the National Board on Fire Service Professional Qualifications (NFSPQ or "Pro Board") and the International Fire Service Accreditation Congress (IFSAC).

To become a member of the fire department, an individual must apply and successfully compete in a civil service examination for fire fighters. Prospective candidates are selected in rank order from the established civil service list. The process includes department interviews, a criminal investigation, and a background investigation. If selected for conditional appointment, a candidate must successfully pass a medical examination that complies with NFPA 1582, *Standard on Comprehensive Occupational Medical Program for Fire Departments*.<sup>1</sup> Selected candidates are appointed as cadets or recruit fire fighters in an extensive 20-week academic, practical, and physical training program at the department's Fire Academy.

At the fire academy, recruit fire fighters are trained in fire-fighting operations as well as emergency medical services, for which they must obtain state certification as an emergency medical technician. Upon the successful completion of training recruit fire fighters are assigned as a probationary fire fighter and receive national certification as a NFPA 1001, *Standard for Fire Fighter Professional*

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Qualifications,<sup>2</sup> Fire Fighter I and Fire Fighter II, Hazardous Material Awareness and Hazardous Materials Operations certification, NFPA 1035, Standard for Professional Qualifications for Fire and Life Safety Educator, Public Information Officer, and Juvenile Firesetter Intervention,<sup>3</sup> and as a state certified emergency medical technician/basic (EMT/B). A probationary fire fighter is assigned to the Operations Division on either an engine company or a ladder company. As an EMT/B, fire fighters are also assigned as needed to work on basic life support (BLS) medic units. During the probationary period, the probationary fire fighter is tested by the fire academy staff at 9 months (written and practical examinations) and 12 months (written examination). Recertification for an EMT/B and paramedics (EMT/P) is every two years, which requires 18 hours of continuing education for EMT/B and 24 hours for (EMT/P).

Members assigned to the Operations Division are required to complete at least one hour of training per shift. Also, fire officers and fire fighters are required to complete 170 hours of training annually. The training must include “Near-Miss Calendar” monthly drills on a particular scenario, which are included in the total training hours.

The captain was appointed to the department in September 1983, was promoted to the rank of lieutenant in November 2003, and was promoted to the rank of captain in August in 2008. The fire department did not have electronic training records prior to 1992, so the computer generated training records for the captain started as of May 1992 when he was a fire fighter assigned to Engine 6. He successfully completed recruit school at the department’s Fire Academy and was certified as a fire fighter and (EMT/B). Other training courses and certifications included: SCBA Safety (1992); EMT/B recertification (1993); National Fire Academy: *Safety and Survival, the Company Officer’s Responsibility* (1993); AIDS Awareness (1994); Shipboard Fire-Fighting (1995); EMT/B recertification (1996); Fire-Fighting Tactics and Strategy (1996); Emergency Vehicle Operations Course (1997); EMS continuing education (1997); Response to Terrorism (1998); Basic Vehicle Rescue (1998); SCBA Orientation (1998); Amtrak Operations Training (1999); Communicable Disease: Hepatitis C (2000); Back to Basics (2000); Rapid Intervention Crew Training (2001); 800 MHz Radio Training (2002); 800 MHz Radio Refresher Training (2004); Officer Development Program (2004); IS 700, Introduction to NIMS (2005); ICS 100, Basic ICS (2005); Arson Awareness (2005); Ethics Training (2006); SCBA CBRNE Training (2007); Cellar Fire Operations (2007); EEOC Training (2008); Vehicle Airbag Training (2009); National Fire Incident Reporting System (2009); “Firezone” Computer Program (2009); Philadelphia Electric Company – Fireground Safety (2009); Philadelphia Electric Company – Fireground Safety (2010); Communications Unit Training (2010); ICS 300, Intermediate ICS (2011); National Fire Academy: *Incident Command for High-Rise Operations* (2011); National Fire Academy: ICS for Structural Collapse Incidents (2011); and Drag Rescue Device (DRD) Training (2012).

### **Equipment and Personnel**

All 911 calls are answered by the city’s police dispatch center. If the 911 call is for a fire or a medical emergency, the call is then routed to the fire department’s Fire Communications Center (FCC). In the event of a structure or building fire, the FCC assigns the appropriate number and type of fire companies to the incident. All incidents are assigned a box number based upon the location of street

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boxes that were used as a method of transmitting alarms to the FCC. The fire department communicated information from an incident to the FCC by a street box, which was done primarily before the radio system came into existence. All of the street boxes have been removed from service but their locations are maintained within the FCC computer system.

The FCC sends three assignment levels to reported or confirmed structure fires:

The *Tactical Box Alarm Assignment* is assigned to fires in a single-family dwelling; **Note:** *When multiple calls are received, people are reported trapped, severe weather conditions, or first engine arrives on scene with fire showing, the incident is upgraded to a Box Alarm Assignment.*

- **Tactical Box Alarm Assignment:**

- 2 Engines
- 2 Ladders
- 1 Battalion Chief

The *Box Alarm Assignment* is assigned for fires in commercial or industrial buildings, factories, warehouses, educational buildings, or multiple-family dwellings fewer than seven stories in height;

- **Box Alarm Assignment:**

- 4 Engines
- 2 Ladders
- 2 Battalion Chiefs

The *High-Rise Box Alarm Assignment* is assigned for fires in buildings seven stories in height or higher;

- **High-Rise Box Alarm Assignment:**

- 4 Engines
- 3 Ladders
- 2 Battalion Chiefs (1 for Lobby Control)
- Rescue Company (Rescue 1)
- 1 Medic Unit

When the Incident Commander assigned to a *Tactical Box Assignment* advises FCC that “all hands are working”, FCC will dispatch an additional ladder company to serve as the rapid intervention team (RIT), a squad company (either Squad 47 or Squad 72), the rescue company (Rescue 1) (if they are not already assigned), and a medic unit. **Note:** *Squad 47 and Squad 72 are engine companies trained and equipped in technical rescue and hazardous materials mitigation.*

If the Incident Commander advises FCC that the alarm assignment needs to be filled out to a “full box” the Deputy Chief (Division 1 or Division 2) is dispatched.

If the fire is large and of enough severity, the Incident Commander, either a battalion chief or deputy chief, will transmit additional alarms, starting with a 2<sup>nd</sup> Alarm Assignment going up to 9<sup>th</sup> Alarm, to

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bring more companies and staffing to the scene above the existing *Tactical Box Assignment*, *Box Alarm Assignment*, or *High-Rise Box Assignment*.

- **2<sup>nd</sup> Alarm Assignment:**
  - 5 Engines(1 for Logistics)
  - 2 Ladders
  - 4 Battalion Chiefs
    - 1<sup>st</sup> due Battalion Chief is assigned as Logistics Officer with 1<sup>st</sup> due Engine on the 2<sup>nd</sup> Alarm
    - 2<sup>nd</sup> and 3<sup>rd</sup> due Battalion Chief are assigned to fire-fighting operations (e.g. Bravo Division, Delta Division)
    - 4<sup>th</sup> due Battalion Chief is assigned as Safety Officer
  
- **3<sup>rd</sup> Alarm Assignment:**
  - 4 Engines
  - 1 Ladder
  
- **4<sup>th</sup> Alarm Assignment:**
  - 4 Engines
  - 1 Ladder
  
- **5<sup>th</sup> Alarm to 9<sup>th</sup> Alarm Assignments:**
  - 4 Engines per Alarm

When a report of a small fire, such as a rubbish or trash fire, the FCC will send an “Outside Fire Assignment”, for minor fires or outdoor/rubbish fires. The closest engine company is sent. If a ladder company is available to respond from close by, it will also be added;

- **Outside Fire/Local Alarm:**
  - 1 Engine or 1 Engine and 1 Ladder

For Box 1232, the FCC dispatched a *Box Alarm Assignment* based upon the 911 call. The 911 caller reported a fire in the basement of a store. Upon arrival, Engine 11 (the 1<sup>st</sup> due engine company) advised FCC they were on scene with a “three story, 15-ft. by 45-ft. store front, we have light smoke showing.” The captain of E11 stated we are putting “1 and 1” (first due engine company and first due ladder company) in service at this time.”

The initial response for Box 1232:

### **Box Alarm Assignment**

- Engine 11: Officer and 3 fire fighters;
- Pipeline 3: Officer and 3 fire fighters;
- Engine 10: Officer and 3 fire fighters;
- Engine 53: Officer and 3 fire fighters; *Note: Engine 53 is housed with Ladder 27*
- Snorkel 2: Officer and 4 fire fighters;
- Ladder 5: Officer and 4 fire fighters;

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- Rescue 1: Officer and 5 fire fighters;
- Battalion 4: Battalion Chief and Chief's Aide;
- Battalion 1: Battalion Chief and Chief's Aide;

### **All Hands Working**

- Ladder 27: Officer and 4 fire fighters; (Rapid Intervention Team)
- Squad 47: Officer and 5 Fire Fighters;
- Medic 40: 1 EMT and 1 Paramedic;

### **Full Box**

- Deputy Chief 1: Deputy Chief and Chief's Aide

### **2<sup>nd</sup> Alarm Assignment**

- Engine 27: Officer and 3 fire fighters; (Logistics Company)
- Pipeline 28: Officer and 3 fire fighters;
- Pipeline 49: Officer and 3 fire fighters;
- Engine 24: Officer and 3 fire fighters;
- Engine 43: Officer and 3 fire fighters: *Note:* Replaced by Engine 20
- Ladder 3: Officer and 4 fire fighters;
- Ladder 9: Officer and 4 fire fighters;
- Battalion 3: Battalion Chief and Chief's Aide; (Logistics Officer)
- Battalion 7: Battalion Chief and Chief's Aide;
- Battalion 8: Battalion Chief and Chief's Aide;
- Battalion 2: Battalion Chief and Chief's Aide; (Safety Officer)

### **3<sup>rd</sup> Alarm Assignment**

- Engine 43: Officer and 3 fire fighters;
- Engine 29: Officer and 3 fire fighters;
- Foam 60: Officer and 3 fire fighters;
- Pipeline 34: Officer and 3 fire fighters;
- Ladder 6: Officer and 4 fire fighters;

## **Timeline**

This timeline is provided to set out, to the extent possible, the sequence of events according to recorded radio transmissions. Times are approximate and were obtained from review of the dispatch records, witness interviews, and other available information. Times have been rounded to the nearest minute. NIOSH investigators have attempted to include all radio transmissions. This timeline is not intended, nor should it be used, as a formal record of events.

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Incident and Fireground Communications	Time	Response & Fireground Operations
<b>April 6, 2013</b>		
<p>“911” at the Police Dispatch Center received a telephone call which reported smoke in the basement of a building.</p>	1733 Hours	
<p>The fire communication center (FCC) dispatched a Box Alarm Assignment for Box 1232: Battalion 4, Battalion 1, Engine 11, Pipeline 3, Engine 10, Engine 53, Snorkel 2, Ladder 5, and Rescue 1.</p>	1735 Hours	
	1737 Hours	<p>Engine 11 reported on scene; “We have a three story, 15-ft. by 45-ft. store front; we have light smoke showing with 1 and 1 in service.” <b>Note:</b> “1 and 1 in-service means the 1<sup>st</sup> due engine (E11) and 1<sup>st</sup> due ladder (Snorkel 2) are going to work.” <b>Note:</b> <i>Ladder 5 arrived on scene before Snorkel 2).</i></p>
<p>FCC announced for all companies except Engine 11 and Snorkel 2 to proceed in and stand by.</p>	1737 Hours	
	1739 Hours	Battalion 1 on scene.
	1740 Hours	Ladder 5 on scene.
<p>Battalion 4 assumed “Command”.</p>	1742 Hours	Battalion 4 and Pipeline3 on scene.
<p>“Command” calls FCC and advises “We have medium smoke showing; We are putting 2 and 2 in-service.” <b>Note:</b> “2 and 2 in-service means the 2<sup>nd</sup> due engine (Pipeline 3) and 2<sup>nd</sup> due ladder (L5) are going to work”. <i>Ladder 5 was on scene before Snorkel 2.</i></p>	1743 Hours	
	1744 Hours	Engine 10 and Rescue 1 on scene.

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Incident and Fireground Communications	Time	Response & Fireground Operations
FCC calls "Command" for size and dimensions of the structure.	1745 Hours	"Command" stated "We have a 15 ft. x 60 ft. structure with a store and apartments."  "Command" called Snorkel 2 and ordered a search of the apartments above the store; Snorkel 2 officer advised they were not yet on scene. <i>Note: Snorkel 2 delayed due to traffic.</i>
"Command" advised FCC he was "putting all hands in service."	1746 Hours	Engine 53 on scene.
FCC dispatched Ladder 27 (RIT), Squad 47, and Medic 40 for Box 1232.	1747 Hours	Snorkel 2 on scene.
FCC dispatched Deputy Chief 1 and ES4 (EMS Field Supervisor - Fire Service Paramedic Chief) for Box 1232.	1748 Hours	
	1749 Hours	E11 Officer radioed "Command" and reported he "has located the fire in the basement, which is above our heads. We knocked the fire down."
	1750 Hours	Engine 10 officer advised "Command" that the Bravo Exposure has heavy smoke conditions.
	1751 Hours	Squad 47 on-scene.  "Command" ordered Squad 47 to conduct an interior search of the apartments. Rescue 1 was going to search the basement of the store.
	1752 Hours	Ladder 27 on the fireground;

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Incident and Fireground Communications	Time	Response & Fireground Operations
	1753 Hours	<p>“Command” called Ladder 5 officer and asked for a report from the interior on the occupants. Ladder 5 officer reported they were still working on a primary search and ventilating the front of the building.</p> <p>Command” called Snorkel 2 officer and asked for status and conditions. Snorkel 2 reported they were on the 2<sup>nd</sup> floor with heavy smoke, still conducting a primary search.</p>
	1754 Hours	<p>“Command” called Engine 11 officer to verify Engine 11 was in the basement. Engine 11 officer reported E11 had been in the basement but unable to locate the fire. E11 was now on the 1<sup>st</sup> floor. The fire was now in the ceiling of the first floor towards the rear of the building.</p>
	1755 Hours	<p>Rescue Company 1 is split with part of the crew going into the store with Engine 11 and the remainder of the company doing a search of the apartments.</p> <p>“Command” called Rescue 1 officer and asked for a status. Rescue 1 officer acknowledged Engine 11’s status on the fire. Rescue 1 is on the 1<sup>st</sup> floor going to the 2<sup>nd</sup> floor apartments. “Command” advised them to proceed with extreme caution.</p>
	1756 Hours	<p>Deputy Chief 1 (Division 1) on-scene.  <b>Note:</b> For the purposes of this report, the term Deputy Chief 1 will be used so not to confuse the reader with the geographical term “Division” (e.g., Division 1).</p>
	1800 Hours	<p>Deputy Chief 1 assumed “Command”. Battalion 4 was assigned as Alpha Division and Battalion 1 as Charlie Division.</p>

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Incident and Fireground Communications	Time	Response & Fireground Operations
<p>B4A (BC4 Chief’s Aide) contacted FCC; “Per the orders of Deputy Chief 1, strike a 2<sup>nd</sup> Alarm; Staging will be at South 4<sup>th</sup> Street and Bainbridge Street.” B1A (BC1 Chief’s Aide) was assigned as Staging Area Manager.</p>	1801 Hours	Engine 53 officer reported to “Command” that Engine 11 has water on the fire; still heavy smoke conditions.
	1803 Hours	“Command” ordered “Communications” (BC4 Chief’s Aide) to transmit a 2 <sup>nd</sup> Alarm for Box 1232.
	1803 Hours	“Command” advised Rescue 1 officer to get the roof and get the roof open.
<p>FCC dispatched the 2<sup>nd</sup> Alarm for Box 1232; Engine 27 (Logistics), Pipeline 28, Pipeline 49, Engine 24, Engine 43, Ladder 3, Ladder 9, Battalion 3 (Logistics Officer), Battalion 7, Battalion 8, Battalion 2 (Safety), and Medic 21. <i>Note: Pipeline 20 arrived on the fireground before E43. E43 was recalled at 1811 Hours.</i></p>	1804 Hours	Alpha Division and Charlie Division were pulling companies out of the building.
	1805 Hours	
<p>“Communications” radioed FCC to dispatch another RIT company, which could be an engine company or ladder company.” FCC dispatched Ladder 4 as the RIT. Engine 43 is recalled.</p>	1807 Hours	“Command” radioed “Communications” and requested another rapid intervention team (RIT); <i>Note: “Command” had put Ladder 27 in-service for roof operations;</i> “Command” advised “Communications” “that the RIT could be an engine company or ladder company. The company can use Ladder 27’s RIT equipment.”
	1811 Hours	“Command” radioed Rescue 1 officer and asked if he was on the roof; Rescue 1 officer stated they were getting ready to open up the roof; “Command” assigned Rescue 1 officer as Roof Division.

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Incident and Fireground Communications	Time	Response & Fireground Operations
<p>FCC advised “Command” that the new RIT will be Ladder 4.</p>	<p><b>1812 Hours</b></p>	
<p>“Command” provided FCC with a status update of the incident. “All hands are in-service. We are transitioning to an exterior attack. We are trying to get the roof open over the original fire building, which is the corner property. Bravo Exposure is similar property, storefront, and dimensions are identical. There is a heavy volume of smoke throughout the fire building and the first floor. The presumption is the fire is in the basement. We are making slow but steady progress.”</p>	<p><b>1813 Hours</b></p>	
<p>“Command” advised FCC they had “a 15-ft. by 60-ft., four story apartment; companies are making good progress, steady progress; we have not located the source of the fire; no exposures at this time.”</p>	<p><b>1815 Hours</b></p>	<p>“Command” called Alpha Division (BC4) to determine what companies were assigned to him; Alpha Division replied he had Engine 11 and Engine 10 in Bravo Exposure; A crew from Squad 47 is ventilating Bravo Exposure.</p>
	<p><b>1816 Hours</b></p>	<p>“Command” ordered Battalion 1 to the “Delta Division”.</p>
	<p><b>1817 Hours</b></p>	<p>Ladder 27 called “Command” and advised he was on the roof of Bravo Division. Ladder 27 Officer advised that heavy smoke was pushing on Delta Division and was pushing from the 2<sup>nd</sup> floor of the fire building; “Command” ordered Ladder 27 officer to get a trench cut between Bravo Division and the original fire building; “Command” assigned Ladder 27 officer as Bravo Roof.</p>

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Incident and Fireground Communications	Time	Response & Fireground Operations
<p>FCC raised “Communications” (B4A); “Rescue 1 Roof and Ladder 27 Roof have emergency activation of their portable radios”; “Communications” responds, “You said Rescue 1 Roof and Ladder 27 Roof – emergency activations”. FCC replied, “Affirmative, Rescue 1 Roof and Ladder 27 Roof.”</p>	<p><b>1818 Hours</b></p>	<p>Bravo Roof called “Command” and advised they need a hoseline to the Bravo Division 2<sup>nd</sup> floor.</p>
	<p><b>1821 Hours</b></p>	<p>Rescue 1 Roof, “We need someone to the rear Bravo Exposure in the courtyard. There’s a man down back there, he just fell off the roof.”</p>
	<p><b>1822 Hours</b></p>	<p>FCC raised Rescue 1 officer and asked if he was declaring a “Mayday”. Rescue 1 officer replied, “somebody fell off the roof and onto a porch roof.”</p>
	<p><b>1823 Hours</b></p>	<p>FCC tried to raise L27 officer.</p>
	<p><b>1824 Hours</b></p>	<p>Rescue 1 Roof , “Priority to “Command”, We need a team to push through the Bravo Exposure immediately so we can get a ladder up there, he (Ladder 27 Captain) is on the roof between the 2<sup>nd</sup> and 3<sup>rd</sup> floors. There is no access to get to the member”. Rescue 1 Roof advised that “we are trying to get him by going from roof to roof.”</p>
<p><b>1825 Hours</b></p>	<p>Ladder 4 (RIT) is on the fireground.</p>	

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Incident and Fireground Communications	Time	Response & Fireground Operations
	1826 Hours	<p>Roof Division (R1 officer) advised "Command" that "We are in the process of removing the member who fell from the roof. It is going to be a labored operation, but we are making process."</p> <p>Bravo Division (BC8) raised "Command" and reports that Squad 47 is working with Rescue 1 to get the equipment they need to remove the member from the roof. Bravo Division also reported that Pipeline 28 has taken a 1¾" hoseline to the 2<sup>nd</sup> floor of Bravo to protect the member.</p>
	1827 Hours	<p>Roof Division tried to contact "Command", but someone interrupts saying "they need a hoseline to the rear now, we need that line yesterday."</p>
	1828 Hours	<p>Bravo Division (BC8) raised "Command" and informed "Command" that "Engine 53 is taking a hoseline through Bravo 1 to the rear. Pipeline 28 is taking a line to the 2<sup>nd</sup> floor of Bravo 2 to protect the member." Command asked Bravo Division if the member was in any peril from smoke or fire. Bravo Division advised "Command" "he will speak to him face to face."</p>
	1830 Hours	<p>Roof Division advised "Command", "We have heavy fire conditions in the rear; We have no water pressure in the handlines, and the fire is impinging on our downed member."</p>

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Incident and Fireground Communications	Time	Response & Fireground Operations
	<b>1831 Hours</b>	<p>“Command” raised Bravo Division and told him that Delta Division had a report of another member down. “Command” asked if we are talking about 2 members now. Bravo Division stated that his impression is that it is the same member. The member was located close to the Charlie/Bravo corner. He’s on Bravo 2’s roof. Bravo Division then requested additional resources: another engine company to back-up Engine 53, and another engine or ladder to assist on Bravo 2 roof.</p>
	<b>1836 Hours</b>	<p>“Command” raised Charlie Division. Charlie Division reported, “There is one handline on the fire; there is a partial collapse, and we are still trying to get to the downed fire fighter. The downed fire fighter seems to be in the corner stuck between the 2<sup>nd</sup> and 3<sup>rd</sup> floors.”</p>
	<b>1837 Hours</b>	<p>“Bravo Division called “Command” and reported all available resources were going to the roof of Bravo 3 to get the fallen member. Rescue 1, Ladder 3, and an engine company were putting a mobile 2½-inch handline into service in Bravo Exposure 3 for protection. Bravo Division requested another company.</p>
<p>“Communications” (B4A) called FCC; “Per Deputy Chief 1, Deputy Chief 1 has requested a 3<sup>rd</sup> Alarm for Box 1232; Have the 3<sup>rd</sup> Alarm companies proceed to Staging.”</p>	<b>1838 Hours</b>	<p>Delta Division (Battalion 1) radioed, “All the members in Charlie Division get off the roof now. The building is coming down.”</p> <p>Safety radioed “Command” and reported the 1<sup>st</sup> Floor wall on Side Delta (Delta Division) is buckled and is going to collapse into the street.</p>

## Career Captain Dies Conducting Roof Operations at a Commercial Structure Fire - Pennsylvania

Incident and Fireground Communications	Time	Response & Fireground Operations
FCC dispatched the 3 <sup>rd</sup> Alarm for Box 1232: Engine 43, Engine 29, Foam 60, Pipeline 34, and Ladder 6. FCC advised "Staging is located at South 4 <sup>th</sup> Street and Bainbridge Street."	1840 Hours	
	1846 Hours	Car 2 (Deputy Fire Commissioner of Operations) responded to Box 1232.
	1849 Hours	"Command" sent Ladder 9 to Bravo Exposure 1 to breach the wall of the collapsed one-story building; "Command" ordered Bravo Division to monitor the progress and to request additional resources as needed.
	1851 Hours	"Command" sent Ladder 3 to assist Squad 47 and Rescue 1 with the breaching of the wall.
	1852 Hours	Special Operations Chief 1 enroute to Box 1232.
	1854 Hours	"Communications" (B4A) asked "Command" for a progress report. "Command" reported, "We have an exterior attack on the original fire building. Bravo Exposure 1 and Bravo Exposure 2 have a 1¾-inch hoseline in service; They have a partial collapse in Delta Division and Charlie Division. The member (Ladder 27 Captain) has fallen into the original rear of the fire building. We are trying to extricate him by breaching the wall in Bravo 1."
	1855 Hours	Medic 21 transported Ladder 27 Roof (fire fighter) to hospital for burns to his hands.
	1856 Hours	Car 1 (Fire Commissioner) responded on Box 1232.
	1900 Hours	Special Operations Chief 1 on scene.

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Incident and Fireground Communications	Time	Response & Fireground Operations
FCC dispatched Medic 1 on the 3 <sup>rd</sup> Alarm.	1912 Hours	
	1914 Hours	Car 1 on scene.
	1916 Hours	Car 2 on scene.
	1922 Hours	Car 2 assumed "Command". Deputy Chief 1 assigned as Rescue Group Supervisor. Rescue Group was Deputy Chief 1, Rescue 1, Squad 47, and Ladder 3.
	1928 Hours	Rescue Group Supervisor radioed "Command" and advised the masonry wall had been breached; Rescue 1 was searching for the Ladder 27 Captain with a camera.
	1943 Hours	Rescue Group raised Bravo Roof to request that hoselines be shut down as this is generating a lot of smoke in the extrication area.
	2049 Hours	Rescue Group advised "Command" that they are bringing the member out now.
"Communications" (B4A) called FCC, "Per the orders of the Incident Commander", place this incident under control."	2100 Hours	
	2128 Hours	Car 2 cleared the scene. "Command" transferred to Deputy Chief 1.
<b>April 7, 2013</b>		
	0012 Hours	Deputy Chief 1 cleared the scene. "Command is transferred to Battalion 4.
	0325 Hours	Companies on scene: Battalion 4 (Available on Radio) Engine 53, Engine 11, Engine 12, Snorkel 2, and Medic 11.
	0951 Hours	Engine 11, Engine 43, Pipeline 3, Snorkel 2, and Medic 11 are units on scene. All other companies are "taking up".

**Career Captain Dies Conducting Roof Operations at a Commercial Structure Fire - Pennsylvania**

Incident and Fireground Communications	Time	Response & Fireground Operations
	1412 Hours	Battalion 4 cleared the scene. "Engine 11 will be your point for communications."
April 8, 2013		
Incident terminated.	0703 Hours	

**Building Construction and History**

The building of origin was located in an area of the city known as Fabric Row, which was part of larger section of the city known as Queen Village (see **Photo 1**). Fabric Row became the city’s textile-hub, earning its namesake approximately a century ago. The store owner operated a fabric store on the 1<sup>st</sup> floor and in the basement. In Fabric Row, many longtime, family-owned fabric stores disappeared as textile production shifted overseas, leaving the street in a state of transition. A patchwork of boutiques, salons and cycle shops are now filling in the gaps. During the early 20<sup>th</sup> century, immigrants, skilled as tailors or seamstresses, made their living by working in stores or renting pushcarts. Today, restaurants, hair salons and even small grocery stores are sandwiched between second-, third-, and fourth-generation fabric businesses.<sup>4</sup>

After World War II, the lifestyle changed dramatically for merchants located on Fabric Row. Merchants who had once lived above their stores now commuted to work. Because of the post-war building boom, people began buying more home decorative fabrics. To go along with the trend, many stores shifted their merchandise from dress fabrics and ready-made curtains to decorative fabrics.<sup>4</sup> These stores sell a variety of fabrics that are used to make draperies, bridal dresses, prom dresses, custom furniture, bedding, pillows or reupholstered furniture (see **Photo 2**).<sup>4</sup>

## **Career Captain Dies Conducting Roof Operations at a Commercial Structure Fire - Pennsylvania**

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**Photo 1. The fire originated in the basement of the fabric store located on the corner.**

*Photo Source: World Wide Web*

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**Photo 2. An example of the fabric found stored in the basement of the fire building. The bolts of fabric are on rolls in a variety of lengths.**

*Photo Source: World Wide Web*

## **Career Captain Dies Conducting Roof Operations at a Commercial Structure Fire - Pennsylvania**

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The structure involved in this incident was constructed of Type III ordinary construction and consisted of a three-story mercantile/residential occupancy with a full basement. According to city records from the Department of License and Inspections, the structure was built prior to 1908. The structure consisted of brick walls with wooden floors and a flat wooden roof (see **Diagram 1**). As indicated in **Diagram 1**, there is no access to **Side C** or **Side Charlie** due to an adjacent one-story business and apartment buildings.

The dimensions of the fire building were:

- Side A: 21 feet, 8 inches
- Side B: 42 feet, 4¾ inches
- Side C: 64 feet, 6 inches
- Side D: 58 feet, 10¾ inches

The building consisted of two sections that were joined perpendicular to one another to form an “L” shape. Both sections of the building had a full basement and were connected by a door with a fusible link.

The front section’s construction system consisted of exterior bearing walls constructed with concrete block with a façade of brick and mortar. The back section’s structural support system on Side D was supported by a steel I-beam; under the steel I-beam the wall was framed with wooden members and covered with a façade of brick and mortar (see **Diagram 2** and **Photo 3**).

On Side A, a bay window assembly extended outward from the façade approximately 2 feet. This assembly was constructed of wooden members and housed windows for the second and third floor. Four more identical bay window assemblies were along Side D. The roof was flat with 2 inch x 12 inch wood rafters and a rolled tar surface. The wood floor joists were 2 inch x 12 inch with a hardwood floor covering. The floor joists in the entire front section of the building and the back section of the building where the building did not meet were fire-cut and supported by the load bearing masonry walls (see **Photo 4** and **Photo 5**). Where the two building sections joined, the floor joists on the back section of the building were supported with steel I-beams for the second and third floors (see **Photo 5**).

The fabric store and the apartments on the second and third floors were not sprinklered.

### Career Captain Dies Conducting Roof Operations at a Commercial Structure Fire - Pennsylvania

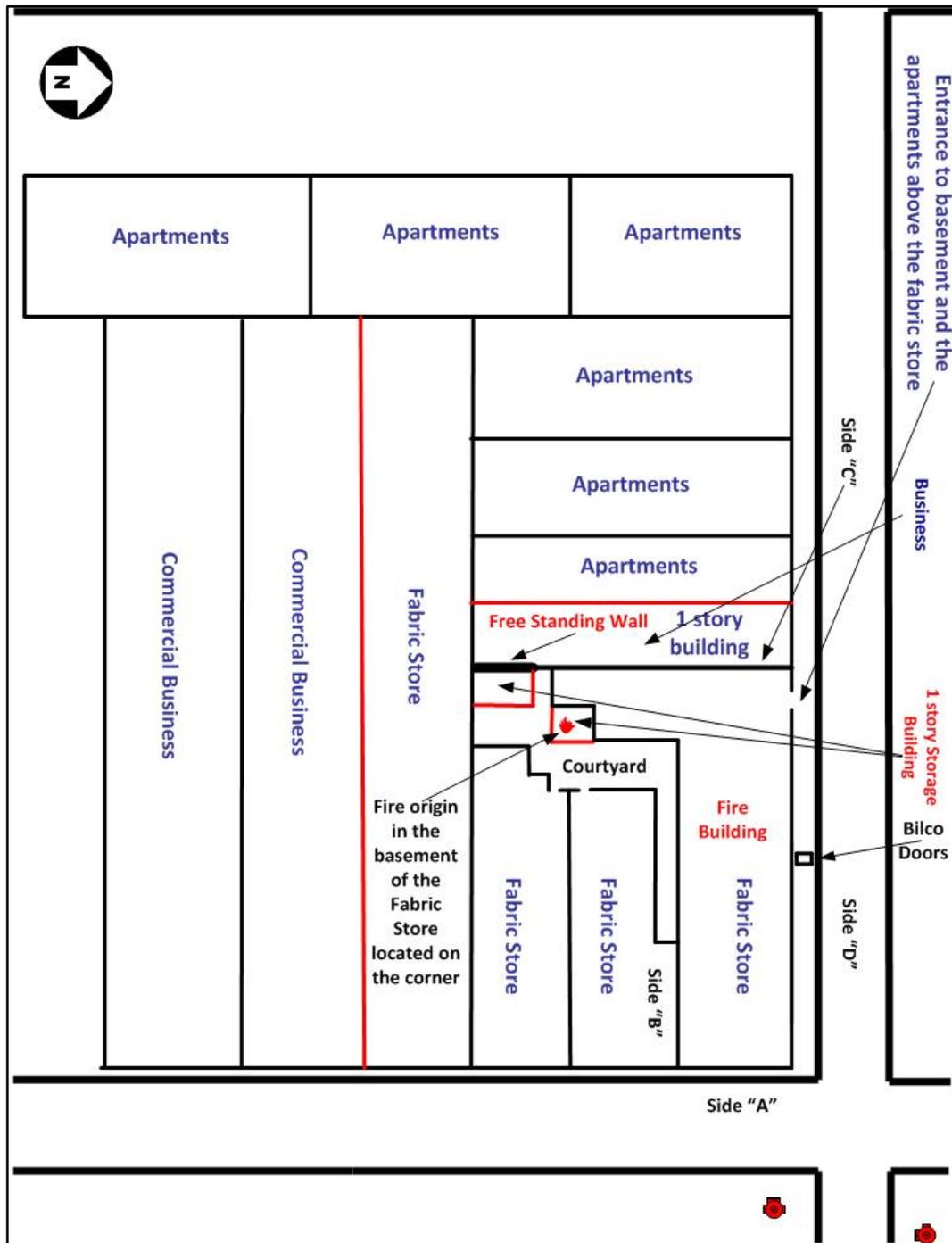
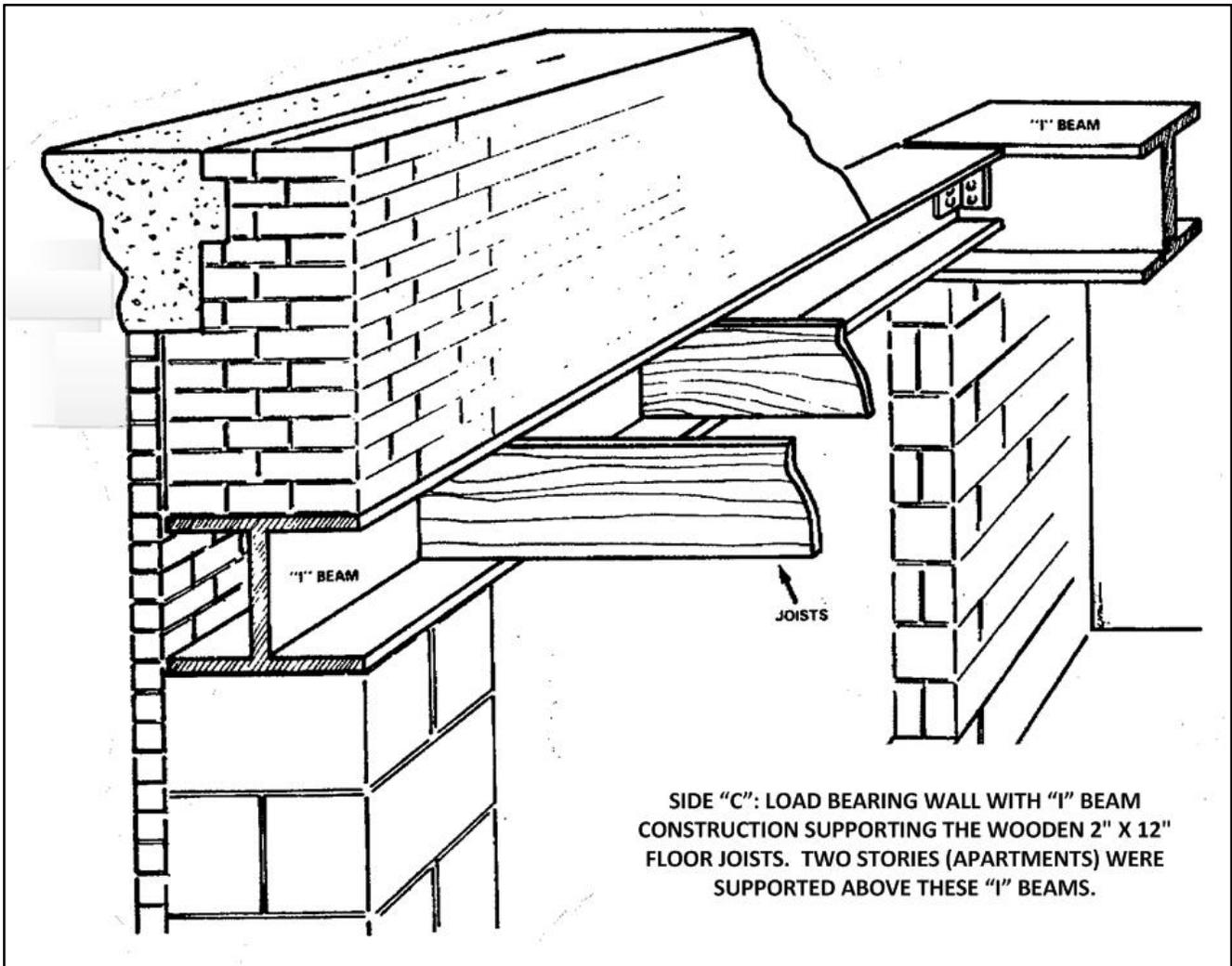


Diagram 1. Diagram of the fire building and location where the fire originated.

**Career Captain Dies Conducting Roof Operations at a Commercial Structure Fire - Pennsylvania**



**Diagram 2. An example of the building construction of the first floor on Side C of the fire building.**

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**Photo 3.** The collapse of Side D which shows the steel and wooden joist construction.  
*Photo courtesy of the fire department*

## **Career Captain Dies Conducting Roof Operations at a Commercial Structure Fire - Pennsylvania**

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**Photo 4. Arrows indicating the location of the floor joists which went from Side B to Side D.**  
*NIOSH Photograph*

## **Career Captain Dies Conducting Roof Operations at a Commercial Structure Fire - Pennsylvania**

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**Photo 5. Side C showing the design and construction of the walls and flooring.**  
*NIOSH Photograph*

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## Career Captain Dies Conducting Roof Operations at a Commercial Structure Fire - Pennsylvania

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**Photo 6. Side D. The fire has caused the first floor to start collapsing into the basement. This is the beginning of the collapse of the 2<sup>nd</sup> and 3<sup>rd</sup> floors.**

*Photo courtesy of the fire department*

Two beams ran from Side B to Side D where the two buildings adjoined. There were additional beams running down Side D to provide support and one I-beam was used as a column on Side D for vertical support where these beams met. The horizontal beams on Side D appeared to be on top of the first floor concrete block mortar (see **Photo 5**). Differential thermal expansion may cause a wall to bulge during a fire which happened in this incident (see **Photo 6**). Exposed I-beams absorb heat during a fire and will expand and cause masonry walls to dislodge due to the lack of lateral strength in those walls.<sup>5</sup>

The basement was divided into storage spaces that did not coincide with the first floor layout. Both the first floor and the basement were stock piled with fabric which reduced the already limited aisle space and produced a maze-like condition. In the basement, merchandise was stockpiled from floor to ceiling. The basement could be accessed from the front of the building by interior stairs on Side B and Side D. Additionally stairs were along the interior wall of Side C in the rear building. Also on Side D, an exterior access to the basement was through sidewalk doors (Bilco® doors) on Side D leading into

## **Career Captain Dies Conducting Roof Operations at a Commercial Structure Fire - Pennsylvania**

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the basement and to the rear building (see **Photo 7**). *Note: The sidewalk access entrance is used to move merchandise in and out of a store versus having to use interior stairs to access to the basement.*



**Photo 7. Sidewalk access doors (Bilco® doors) to the basement of a business. This is similar to the doors on Side Delta of the fire building.**  
*NIOSH Photograph*

### **Fire Behavior and Extension**

The fire started in the rear of the basement of the fabric store. The fire burned for approximately 45 – 60 minutes before the store owner notified the fire department. The fire spread to the 1<sup>st</sup> floor of the fabric store and then to the apartments located on the 2<sup>nd</sup> and 3<sup>rd</sup> floors of the building. Approximately 60 minutes into the incident (from the time of arrival of the first fire department resource on scene), all three floors started to collapse. The fire was confined to the building of origin.

The fire investigators determined that the fire started in the basement of the fabric store. The fire investigators listed the cause of the fire as undetermined.

### **Personal Protective Equipment**

At the time of the incident, the captain was wearing his station/work uniform; turnout gear which included helmet, fire resistant hood, turnout coat, turnout pants, structural fire-fighting boots, and gloves; and self-contained breathing apparatus (SCBA) with facepiece. During the interviews, the members of Ladder 27 told NIOSH investigators that the captain was wearing his facepiece while operating on the roof of the fire building.

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The NIOSH investigators inspected the captain's personal protective equipment (PPE) and SCBA at the fire department's Fire Marshal's evidence storage room located at fire department Headquarters. While the PPE and SCBA suffered damage from the fire as the result of the collapse of the one-story storage room, the PPE and SCBA was not considered to be a contributing factor in this incident. No further evaluation or testing of the PPE and SCBA was done by NIOSH.

### **Weather Conditions**

At 1654 hours, the temperature was 51 degrees Fahrenheit (51° F), the humidity was at 23%, the barometric pressure was 30.30 inches, visibility was 10 miles, the wind was from the South at 5.8 miles per hour, and the skies were clear. There had been no precipitation in the past 24 hours.<sup>6</sup>

### **Investigation**

On April 6, 2013 at 1733 hours, the city's 911 Center (operated by the police department) received a telephone call reporting smoke in the basement of a structure. The police operator called the fire department communication center (FCC) and advised there was smoke in the basement of the structure, which was probably a commercial building.

At 1735 hours, the fire department communication center dispatched a box alarm assignment for Box 1232. (see **Pages 5-6 and Diagram 3 for dispatch information**).

Engine 11 arrived on scene at 1737 hours and reported, "We have a 3 story 15 ft. x 45 ft. store front; light smoke showing, placing 1 and 1 in service." *Note: The officer of Engine 11 assumed the first due ladder company – Snorkel 2 was on scene. Actually, Ladder 5 had arrived as the first due ladder company at 1742 hours.*

An occupant of the building met the officer of Engine 11 and advised that he had put out the fire with a fire extinguisher. *Note: The occupant was later identified as the store owner's son who was the store manager. The store manager had been advised by a customer that the customer smelled smoke in the building. The store manager stated he would check the store to see if he could find the source of the smoke. The store manager then went to a convenience store to get a drink. Approximately 30–45 minutes later, he returned to the store and started to investigate the source of the smoke, found the fire and tried to put out the fire with a portable fire extinguisher. The store manager then called 911. The store manager initially told arriving fire fighters that he had extinguished the fire. He later stated to the fire investigators that he could not put out the fire due to the amount of smoke and fire. He had entered and exited the basement using the stairs in the apartment building which were located on Side D (see **Diagram 1**).*

Engine 11 initially stretched a booster line into the front door of the fabric store. The first floor of the store was clear. The store manager followed E11 into the store and kept telling the officer of E11 that "I am pretty sure I got it out." The officer of E11 then ordered a 1¾-inch hoseline stretched into the store. E11 took the hoseline to the rear left basement entrance and went down the basement stairs (south stairs), but were unable to locate the fire. E11 came back up the stairs and then found a second

## **Career Captain Dies Conducting Roof Operations at a Commercial Structure Fire - Pennsylvania**

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set of stairs to the basement (north stairs). A fire fighter from E11 went down the stairs but could only make it halfway due to all the boxes and stored merchandise in the way. The fire fighter told the officer from E11 that the basement was clear. At 1739 hours, the E11 officer notified “Command”, “there is apparently smoke in the basement, we are ventilating and going down to check.”

At 1742 hours, Battalion 4 arrived on scene at the corner across the street from the fire building. He assumed “Command” and established the Command Post at the southeast corner of this intersection (across the street from the fire building). At 1743 hours, Battalion 4A (chief’s aide and communications officer) advised FCC that there was medium smoke in the building and we are “putting 2 and 2 in service (2<sup>nd</sup> due engine company – Pipeline 3 and the 2<sup>nd</sup> due ladder company - Snorkel 2) with a status report to follow.”

At 1746 hours, Battalion 4A radioed FCC and stated “all hands” are being placed in service. The assignments for the 1<sup>st</sup> Alarm Assignment were as follows:

- Engine 11 was in the fire building on the 1<sup>st</sup> floor and tried to move to the basement;
- Ladder 5 went to the 2<sup>nd</sup> floor to conduct a primary search of the apartments and ventilate the 2<sup>nd</sup> floor;
- Pipeline 3 took a 1¾ inch hoseline into the Bilco® doors going into the basement;
- Engine 10 took a 1¾” inch hoseline into the Bravo Exposure 1 to check for extension;
- Engine 53 was assigned to back up Engine 11 and take a 1¾ inch hoseline into the fire building ;
- Snorkel 2 was assigned to search the 2<sup>nd</sup> floor and 3<sup>rd</sup> floor apartments above the fabric store;
- Rescue 1 split crews: 3 fire fighters for search and 3 fire fighters for ventilation; the search crew went to the basement through the Bilco® doors with Pipeline 3; the ventilation crew went to the apartments on the Side D to ventilate.

At 1746 hours, FCC dispatched Ladder 27 (RIT), Squad 47, and Medic 40. At 1748 hours, FCC dispatched Deputy Chief 1 and ES4 (EMS Field Supervisor - Fire Service Paramedic Chief) for Box 1232.

At 1750 hours, the Engine 10 officer advised “Command” that Bravo Exposure was charged with heavy smoke. “Command” advised the E10 officer to evacuate the building. At 1752 hours, L27 arrived on scene and established “RIT” across the intersection from the “Command” and near Ladder 5’s apparatus (**see Diagram 3**). At 1754 hours, the E11 officer contacted “Command” and reported there was fire in the ceiling. “Command” asked if he was in the basement. The E11 officer reported he had been in the basement, but could not locate the fire. E11 went back to the first floor and the officer of E11 advised “Command”, the fire was now in the ceiling of the first floor towards the rear of the building. The crew from E11 started to knock down the fire. Due to the amount of fabric stored on the first floor, the fabric kept falling on the members of E11. The E11 officer then noticed the fire from floor to ceiling on the west wall. The crew from E11 was unable to bring the hoseline out due to

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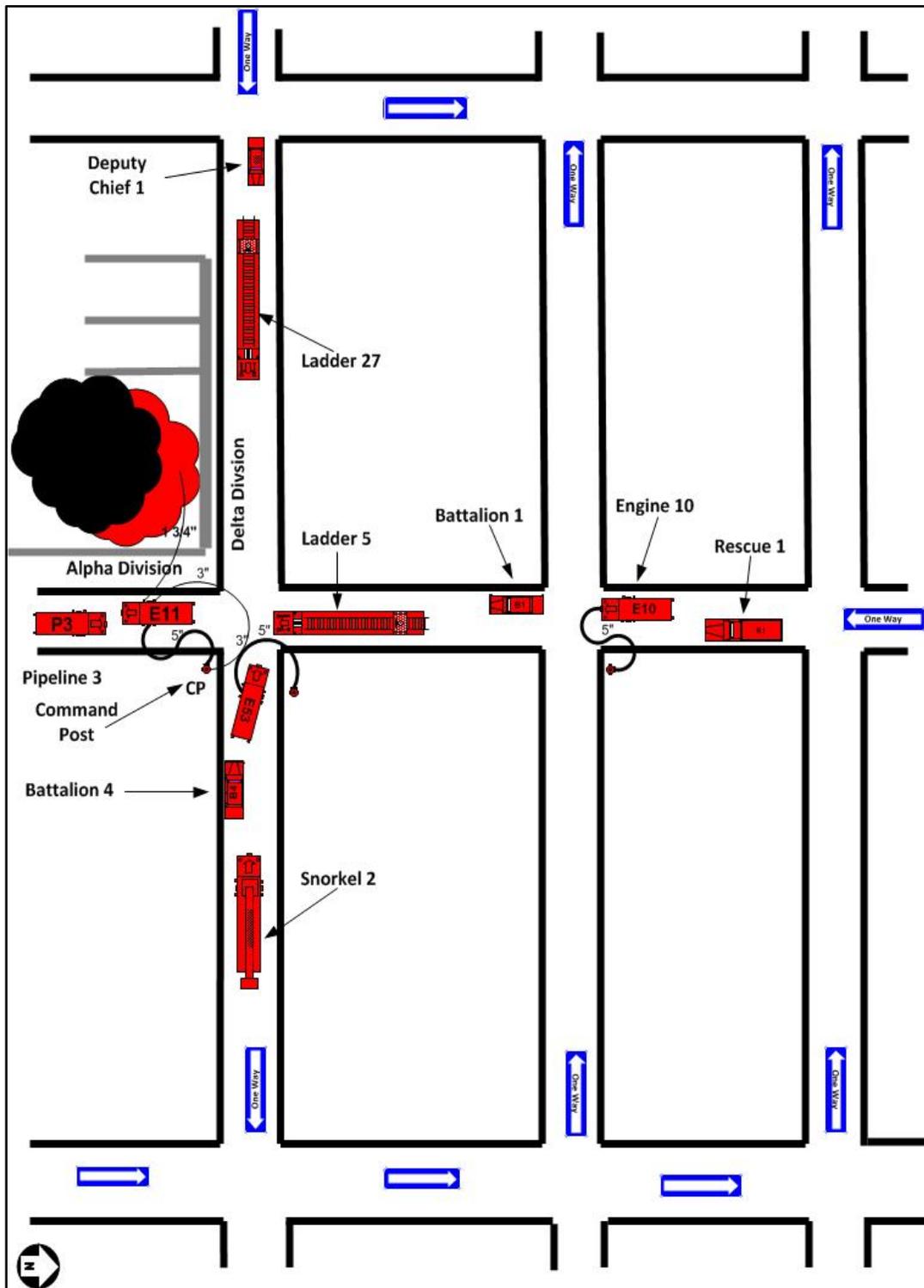


Diagram 3. Apparatus placement for 1<sup>st</sup> Alarm Assignment for Box 1232.

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the fabric that had fallen on the 1¾ inch hoseline. Squad 47 (SQ47) and Pipeline 3 entered the basement through the Bilco® doors to make a fire attack in the basement. The SQ47 fire attack team met Pipeline 3 in the basement. Both companies had trouble moving through the aisles which were barely shoulder width. They located the fire in the northwest corner of the basement, but water had no effect on the fire. The lieutenant from SQ47 stated he tried to use the thermal imaging camera (TIC) but the image was featureless due to the amount of heat and fire in the basement. The crew from Pipeline 3 left the basement due to members being low on air. The crew from SQ47 stayed in the basement until the evacuation was ordered at 1805 hours.

At 1800 hours, Deputy Chief 1 assumed “Command” and assigned Battalion 4 to Alpha Division. Battalion 1 was assigned Charlie Division. The crews from E11 and E53 were inside the fire building on the first floor with the “search” crew from Rescue 1. The crews from L5 and Snorkel 2 were in the apartments on the 2<sup>nd</sup> floor and 3<sup>rd</sup> floor with the “search” crew from SQ47 and Rescue 1. Companies operating on the 2<sup>nd</sup> and 3<sup>rd</sup> floors of the apartment building reported conditions to be very hot, smoky, and limited visibility. The crew from E10 was in the Bravo Exposure. The crew from Pipeline 3 was getting fresh cylinders for their SCBA.

At 1803 hours, “Command” radioed the Rescue 1 officer and ordered the crew from R1 to the roof to ventilate. Alpha Division (B4) contacted the officer from SQ47 and told him to continue ventilation on the 2<sup>nd</sup> and 3<sup>rd</sup> floor apartments. Once this task was completed, they were to leave the building. “Command” radioed Charlie Division and asked if everyone was out of the building. Charlie Division replied that everyone was on the way out. “Command” ordered a 2<sup>nd</sup> Alarm struck for Box 1232. “Command” also identified the location of Staging for the 2<sup>nd</sup> Alarm Assignment. Battalion 1A (Chief’s Aide) was assigned as the Staging Area Manager.

FCC dispatched the 2<sup>nd</sup> Alarm for Box 1232 at 1805 hours. The companies assigned to the 2<sup>nd</sup> Alarm were E27 (Logistics), Pipeline 28, Pipeline 49, Engine 24, Engine 43, Ladder 3, Ladder 9, Battalion 3 (Logistics Officer), Battalion 7 (Fireground Chief), Battalion 8 (Fireground Chief), and Battalion 2 (Safety Officer).

At 1807 hours, “Command” contacted the L27 officer and advised him that L27 was going to be put in-service to help ventilate the roof of the fire building once the 2<sup>nd</sup> Alarm companies arrived. “Command” sent a request to FCC to dispatch either an engine company or ladder company to replace L27 as RIT. At 1811 hours, Ladder 4 was dispatched as RIT to replace L27. Ladder 4 arrived on scene at 1825 hours.

The crew of L27 went to L27 to get tools to ventilate the roof. All ground ladders on L27 had been removed by other companies. Companies assigned to roof operations were Rescue 1 “Search” crew (3 members or a Personnel Accountability Report of 3 members (PAR 3)), SQ47 (2 members or a Personnel Accountability Report of 2 members (PAR 2)), and L27 (5 members or a Personnel Accountability Report of 5 members (PAR 5)) (see **Diagram 4**). Originally, L27 was going to the roof on Side A, but there were no ground ladders. The ground ladder they were going to use had been moved to Bravo Exposure 2. A 28-foot ground ladder had been placed on the Delta Division to the

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roof of the structure, which was a one-story commercial building. A 20-foot straight ladder had been placed on the roof of the one-story commercial building to the roof of the fire building (see **Diagram 4**). The crew of Rescue 1 went to the roof first. The officer of R1 took out a skylight and smoke pumped out with pressure. SQ47 (PAR 2) went to the roof by Bravo Exposure 2 and was going to make a trench cut closer to Side A on the roof of the fire building.

At 1820 hours, the crew of Ladder 27 went to the roof of the fire building in the same manner as Rescue 1 (**Diagram 4**) and encountered heavy smoke and very limited visibility. The captain of L27 was walking on the roof from Side Charlie towards Side Alpha of the fire building, which was obscured with smoke, when he fell off the roof. The captain of L27 landed on the roof of a one-story storage building. The L27 driver and the members of L27 heard the sound of the captain landing on the roof of the one-story storage building. The L27 driver told everyone to get down on their knees and he conducted a personal accountability report (PAR). *Note: The actions of the driver of Ladder 27 are a prime example of crew resource management in terms of leadership and situational awareness. The L27 driver immediately assumed the role of acting company officer insuring the safety of the crew of L27 plus recognizing the immediate need to rescue the captain of L27.* Two fire fighters from Rescue 1 (“Search 2” and “Roof 1”) were on the roof of Bravo Exposure 2 and witnessed the L27 captain fall from the roof of the fire building (see **Diagram 5**).

At 1821 hours, R1 “Roof 1” and L27 “Roof” activated their emergency buttons on their portable radios. R1 “Roof 1” stated on the radio, “We need someone to the rear of Bravo Exposure in the courtyard. There’s a man down back there, he just fell off the roof.” FCC radioed “Communications” (Battalion 4A) and stated that they received “emergency activation on South Tac 1 for Rescue 1 “Roof” and Ladder 27 “Roof”. At 1822 hours, “Communications” radioed the R1 officer regarding the two emergency button activations. The R1 officer stated the activation was for the man down. “Communications” again asked if the R1 officer was declaring a “Mayday”. The R1 officer stated “that somebody fell off the roof to the porch roof”. At 1824 hours, R1 “Roof” contacted “Command” and stated “We need a team to push through the Bravo Exposure to get a ladder up to the roof between the 2<sup>nd</sup> and 3<sup>rd</sup> floors. There was no access to the courtyard except through the buildings.”

L27 “Roof” got a 16 foot straight roof ladder to try and reach the L27 officer. The fire fighter placed the ground ladder horizontally from the roof of a one-story building to the roof of the storage building where the captain of L27 landed (see **Diagram 6**). The distance was about 17 – 18 feet, so a 20-foot ground ladder was located and put in place to reach the captain of L27. L27 “Roof” went across the horizontal ground ladder, reached the captain, and tried numerous times to pull the captain off the roof and onto the ground ladder. While the fire fighter was trying to remove the captain, the color of the smoke changed from light gray to black. Fire erupted from a window of the storage building and the fire fighter was forced to crawl back across the ladder and leave the captain on the roof. There was no response from the captain. The driver from L27 tried several times to cross the ladder, but was driven back by the fire which was now coming through the roof. After several minutes, the roof of the storage building collapsed into the basement of the fire building with the captain. The time was approximately 1836 hours. Hoselines were put in place to try and protect the captain.

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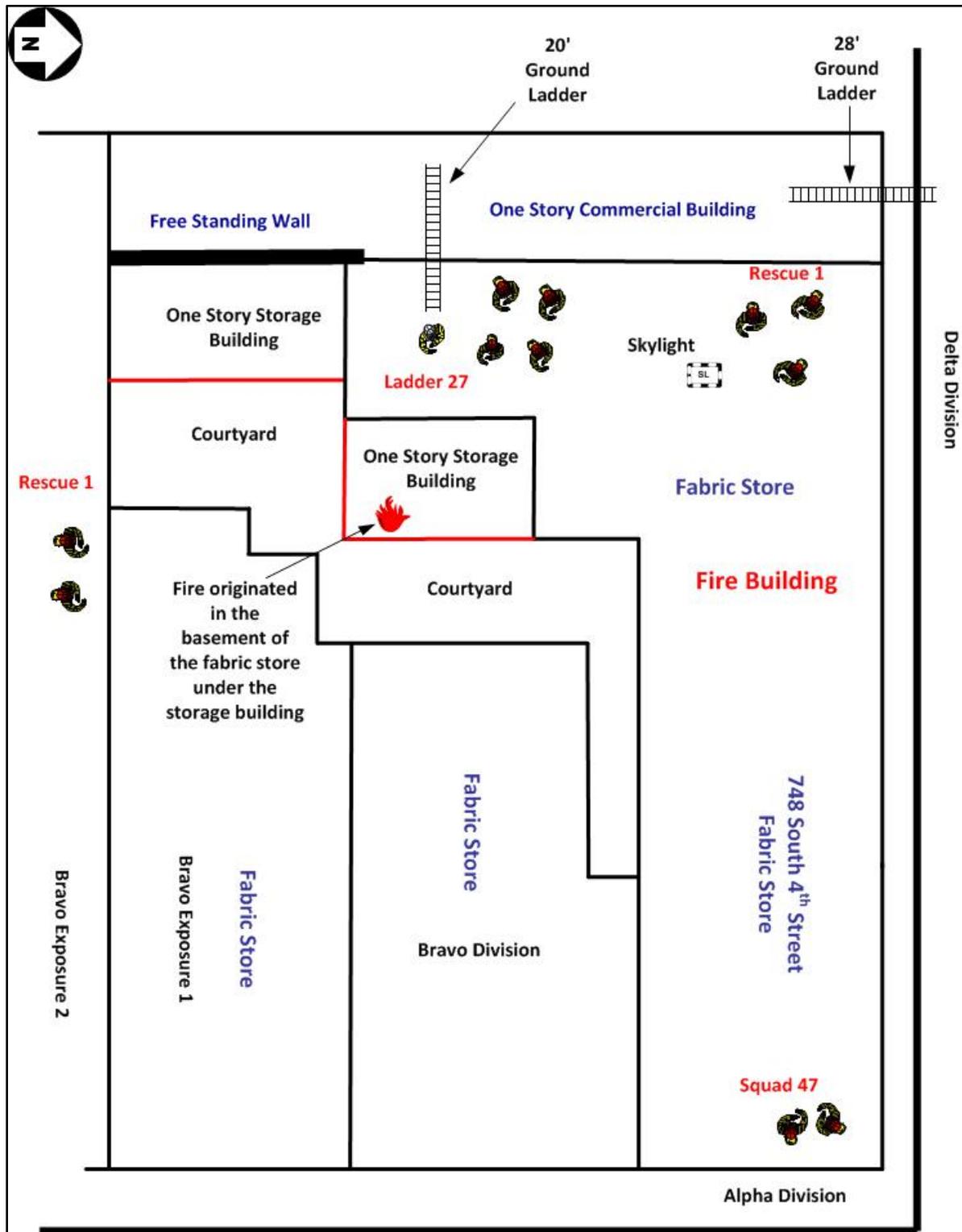


Diagram 4. The location of companies when “Command” ordered the roof opened up at approximately 1811 hours.

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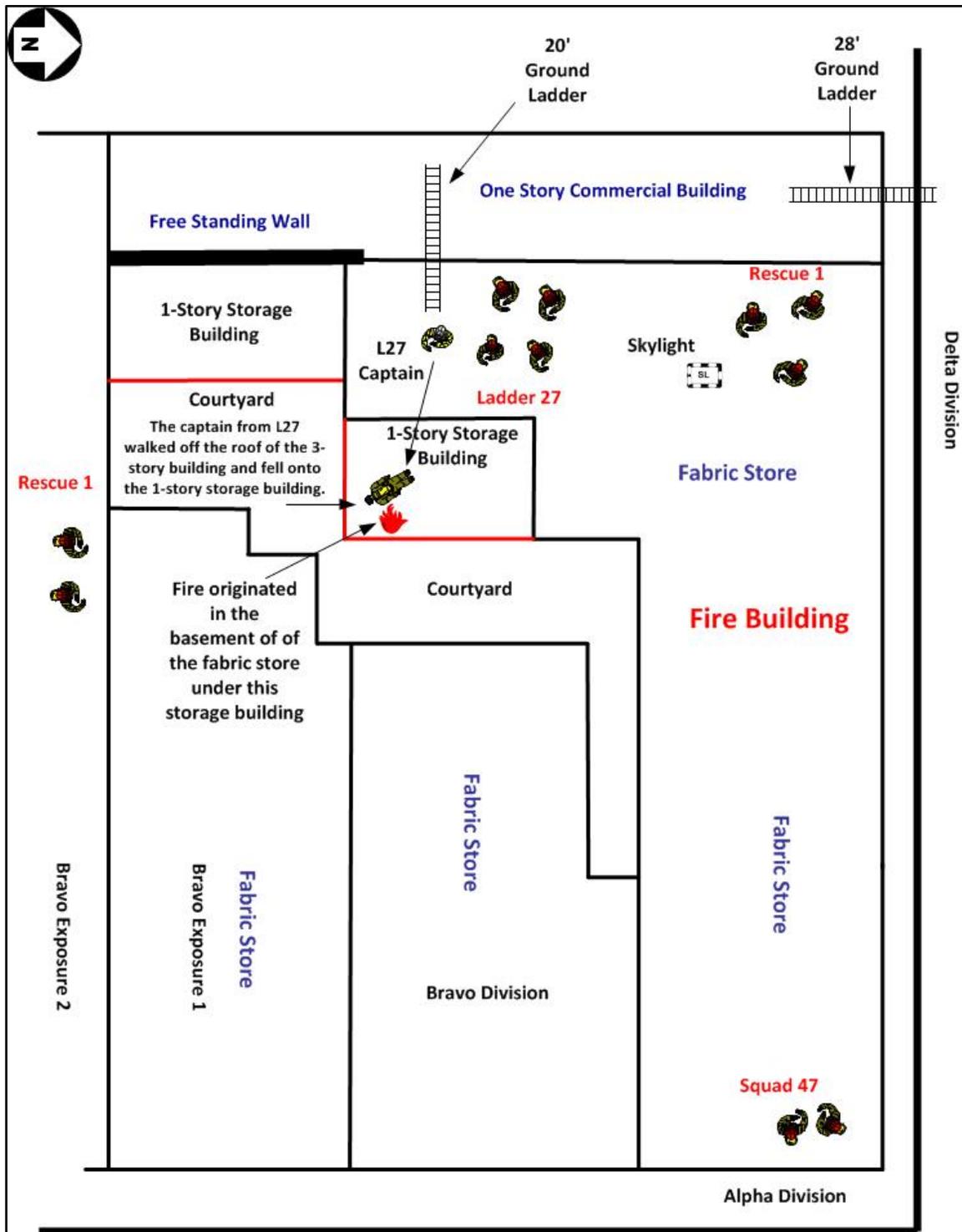


Diagram 5. The officer from L27 was walking towards Alpha Division. He did not realize the building was “L” shaped and fell onto the roof of a one story storage building. The time is approximately 1820 hours.

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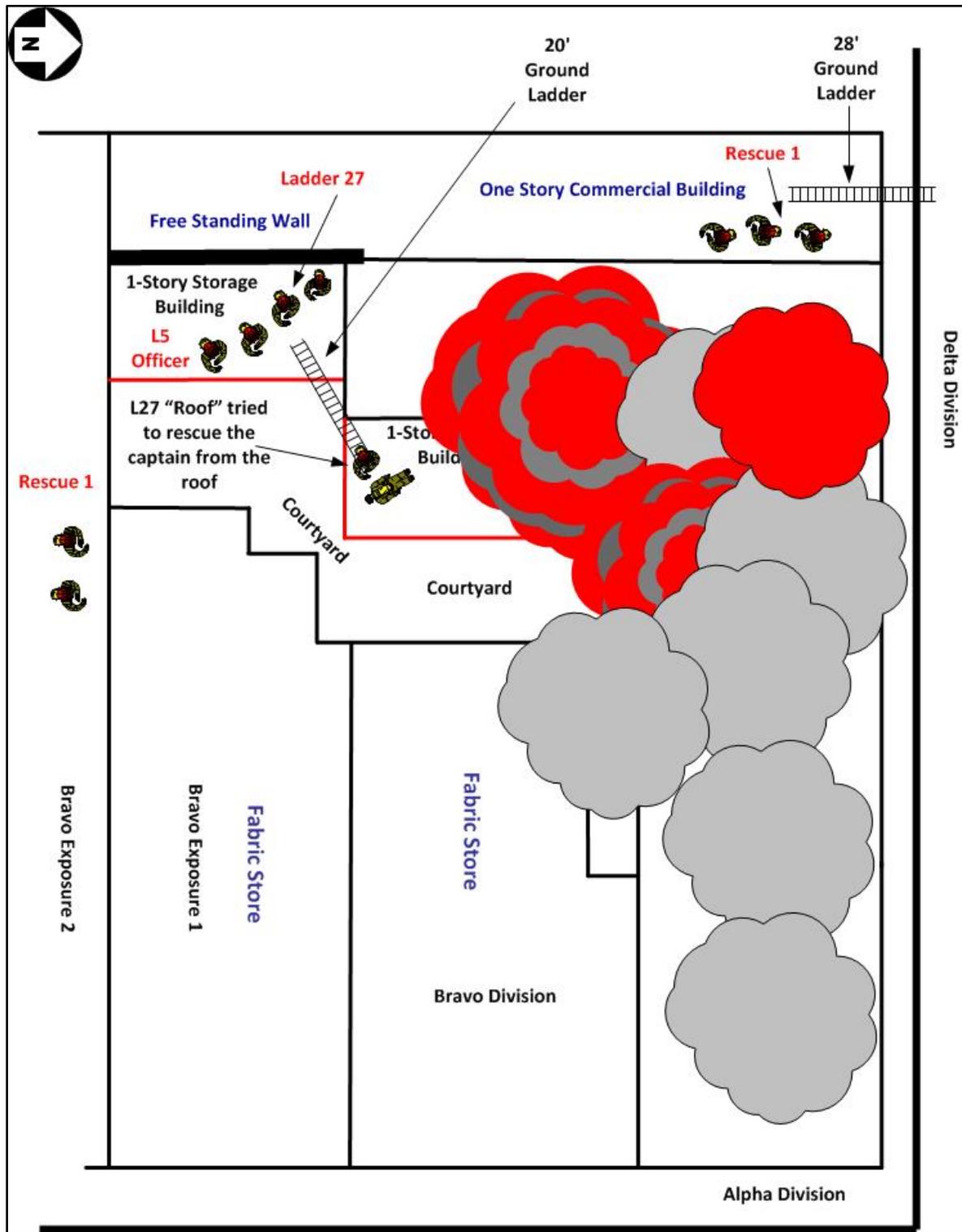


Diagram 6. The rescue attempt by L27 “Roof” to remove the L27 captain from the roof of the one story storage building. The time is approximately 1824 hours.

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The Rescue 1 officer radioed “Command” and advised the storage building had collapsed. They needed hoselines to the roof of Bravo Exposure 3, which was a one-story building. The fire building was now free burning with heavy fire on all floors. At 1838 hours, Delta Division (B1) radioed for all members operating on the roof of Charlie Division to get off the roof. Also, the Safety Officer (Battalion 2) radioed “Command” and reported the 1<sup>st</sup> floor wall on Side D (Delta Division) was buckled and was going to collapse into the street (see **Photo 6**).

At 1840 hours, a 3<sup>rd</sup> alarm for Box 1232 was struck. FCC dispatched: E43, E29, Foam 60, Pipeline 34, and Ladder 6 for Box 1232. Also, FCC identified the location of “Staging”. The Rescue 1 officer with the officer of Squad 47 and Battalion 8 (Bravo Division) developed a rescue strategy to remove the victim from the one-story building. The rescue group planned to go through Bravo Exposure and breach the wall of the one-story building. The wall was constructed of double course brick and then wood joists.

At approximately 1850 hours, the rescue operation began to recover the captain. This process continued until 2049 hours when the victim was removed from the structure (see **Photo 8**). During the rescue operation, Car 2 assumed “Command” and assigned Deputy Chief 1 as the Rescue Group Supervisor.

Ladder 27 “Roof” was taken to the hospital due to burns to his hands from trying to pull the captain off the roof while being impinged by fire. Ladder Company 27 was placed out of service on the fireground until the captain of L27 was ready to be removed from the building. Members of Ladder Company 27 and Engine Company 53 moved the victim from the building to Medic 40.

At 2100 hours, “Command” notified FCC and ordered the incident placed “under control”. At 2128 hours, Car 2 cleared the scene and transferred “Command” to Deputy Chief 1.

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**Photo 8. With very limited workspace, the members of the Rescue Group performed a very difficult operation under very trying conditions to recover the captain. The process took approximately 2 hours.**

*Photo courtesy of the fire department*

### Contributing Factors

Occupational injuries and fatalities are often the result of one or more contributing factors or key events in a larger sequence of events that ultimately result in the injury or fatality. NIOSH investigators identified the following items as key contributing factors in this incident that ultimately led to the fatalities:

- Delay in reporting the fire to the fire department
- Fire in a non-sprinklered commercial building
- Building construction and design
- High fuel load and limited access to the fire due to excessive merchandise
- Lack of situational awareness.

## **Career Captain Dies Conducting Roof Operations at a Commercial Structure Fire - Pennsylvania**

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### **Cause of Death**

According to the death certificate, the medical examiner listed the captain's cause of death as due to multiple blunt impact injuries.

### **Recommendations**

***Recommendation #1: Fire departments should integrate current fire behavior research findings developed by the National Institute of Standards and Technology (NIST) and Underwriter's Laboratories (U.L.) into fireground operations by developing standard operating procedures, conducting live fire training, and revising fireground tactics.***

Discussion: The National Institute of Standards and Technology (NIST) and Underwriters Laboratories (UL) have conducted a series of live burn experiments designed to replicate conditions in modern homes and residential structures and to validate previous testing done in laboratory settings. The results of these experiments will enable fire fighters to better predict and react to effects of new materials and construction on fire. The fire research experiments were conducted in cooperation with the Fire Department of New York, Chicago Fire Department, Spartanburg, SC Fire and Rescue and other agencies. The live burn tests are aimed at quantifying emerging theories about how fires are different today, largely due to new building construction and the composition of home furnishings and products. In the past, these products were mainly composed of natural materials, such as wood and cotton, but now contain large quantities of petroleum-based products and synthetic materials that burn faster and hotter and also generate large volumes of fuel-rich smoke. Where a fire in a room once took approximately 20 minutes to “flashover” — igniting all the contents — this can happen with today's products in as little as four to five minutes.<sup>7</sup>

In addition, modern living spaces tend to be more open, less compartmentalized and are better insulated than homes built years ago. As a result, interior residential fires can generate an oxygen depleted, fuel rich environment within minutes. This fire condition of hot, fuel rich smoke is highly reactive to the introduction of oxygen. Introducing oxygen to this environment by opening a door or venting a window may result in a rapid transition to flashover. These same conditions can occur in commercial structures as seen in the Charleston, SC *Sofa Super Store fire*.<sup>8</sup>

The NIST and UL experiments evaluated individual and combinations of methods for strategically ventilating and isolating fires to prevent flashover—or at least delay it. In contrast, kicking a door open or breaking a window without knowledge of conditions inside could create a portal for air that can literally fan the flames by introducing oxygen into an oxygen-limited fire environment.

Traditionally, fire suppression operations were conducted from the interior of the structure as a means to reduce water damage and limit fire damage to structures. These operations must be coordinated with the ventilation operations. Previous research and examinations of line of duty deaths have shown that ventilation events occurring with fire fighters in the structure prior to suppression have led to tragic results.<sup>8,9,10</sup> One means of eliminating the possibilities of this occurrence would be a transitional attack, in which water is directed into the structure from the exterior to cool the fire gases and reduce

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the heat release rate of the fire, prior to the fire fighters entering the building. The major concern with this type of operation is the potential harm that might occur to people trapped in the structure or the amount of water damage to the structure. Therefore, measurements are needed to document the changes of the thermal environment within the structure and the impact on the viability of people, who might be trapped in the structure.<sup>7</sup>

Based upon the NIST and UL research, the following fireground operations should be considered for implementation.

- **Size-Up**  
Size-up should occur at every fire. The size-up should consider the resources available and situational conditions, such as weather, fire location, size of the fire and building, and the construction features. Ensure a 360-degree size-up is conducted whenever possible. A tactical plan for each fire must be developed, communicated and implemented.
- **Ventilation**  
Fire departments should manage and control the openings to the structure to limit fire growth and spread, and to control the flow path of inlet air and fire gases during tactical operations. All ventilation should be coordinated with suppression activities. Uncontrolled ventilation allows additional oxygen into the structure which may result in a rapid increase in the fire development and increased risk to fire fighters due to increased heat release rates within the flow path.
- **Fire-fighting Operations**  
Given the fuel-rich environment that the fire service operates in today, water should be applied to the fire as soon as possible. In many cases, water application through an exterior opening into a fire compartment may be the best first action, prior to committing firefighting resources to the interior. Fire departments should cool the interior spaces of a fire building with water from the safest location possible, prior to committing personnel into spaces with, or adjacent to, fully developed or smoldering (ventilation limited) fire conditions.
- **Rapid Intervention**  
Fire department rapid intervention procedures should be updated to provide water on the fire as soon as possible and control ventilation openings during fire fighter "Mayday" incidents.<sup>11</sup>

This recommendation is presented to educate the fire service and to ensure that fire departments consider a change in fireground tactics based upon the current research presented by NIST and UL. Much of this research has been directed toward developing a better understanding of the characteristics of the modern fire. This modern research provides members of the fire service with the information and knowledge needed to modify essential fire-fighting tactics. While fire-fighting will never be without risk, this research represents a vital contribution to overall efforts to reduce risks and to save lives.

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***Recommendation #2: Fire departments should consider implementing a pre-incident planning program which complies with NFPA 1620, Standard on Pre-Incident Planning.***

Discussion: Pre-incident planning is the process of gathering and documenting information that could be critical for making life-saving decisions at an incident such as a structure fire. Pre-fire planning is essential, no matter the size of a fire department. Even the smallest towns contain buildings or sites that require pre-incident plans based upon a community risk assessment. These occupancies can include but are not limited to schools, high-rise occupancies, hospitals, nursing homes, medical clinics, hazardous materials manufacturer or shipper, transportation agency (e.g., a railroad), or any other businesses that is deemed by the fire department to be a high-risk occupancy or target hazard.

NFPA 1620, *Standard for Pre-incident Planning* serves as the foundation for this process. The purpose of NFPA 1620 is to develop pre-incident plans to assist responding personnel in effectively managing emergencies for the protection of occupants, responding personnel, property, and the environment.<sup>12</sup> Moreover, NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program* requires fire departments to develop pre-incident plans as determined by the authority having jurisdiction which complies with NFPA 1620, *Standard for Pre-incident Planning*.<sup>13</sup>

The pre-incident plan is designed based upon an emergency occurring in the occupancy, which can assist the Incident Commander in developing the strategy and Incident Action Plan.<sup>12</sup>

A detailed pre-incident plan highlights all aspects of the structure including:

- a site plan,
- floor plans,
- construction type,
- age and condition of the building,
- ingress and egress,
- pre-existing structural damage/deterioration,
- presence of wall anchor plates or stars,
- engineered load systems/lightweight construction,
- types of doors and windows,
- roof construction and covering including HVAC units,
- renovation/modifications to structure,
- height of the building,
- fuel loads,
- fire protection features such as sprinkler systems, standpipe system, fire alarm system, and hydrant locations,
- stairwells,
- utility shut-offs,
- occupant contact information,
- and, any other pertinent information.<sup>14</sup>

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Also, a pre-incident plan identifies deviations from normal operations and can be complex and a formal notation about a particular problem, such as the storage of flammable liquids, explosive hazards, lack of hydrants, or modifications to structural building components.

Another consideration of the pre-incident planning process is that strategy and tactics which need to be utilized for a target hazard occupancy. Based upon the potential risks encountered at target hazard occupancies, the pre-incident plan should outline the deployment of resources (front-loading the incident), type of strategy to be considered, and how to deploy resources once fire-fighting operations are initiated.

Another benefit of this program is the ability to provide information to company officers and chief officers responding from other battalions or from different jurisdictions that may not be familiar with a specific occupancy. Moreover, a jurisdiction's building and permit office or department may have information that the fire department does not have. Information should be routed to the department's dispatch center to ensure vital information about a structure is available. For example a target hazard is included in the comments of the CAD system dispatch. Information should also include the number and type of code violations and whether the building has been abandoned or vacant, or is undergoing extensive renovation. Additionally, the CAD system can provide a real-time view of an occupancy from mapping programs that are available on the internet.<sup>12</sup>

At this incident, no information relating to the fabric store was available to the Incident Commander through the CAD system. According to fire department members, the occupancy was not classified a target hazard per department protocol. Based upon the hazards encountered during this incident, this occupancy should have been pre-planned considering the fire load of the building, excessive storage of fabrics, lack of aisle space, the floor plan and accessibility of the basement, renovations to the building, the roof design/configuration, and the building did not have a sprinkler system.

**Recommendation #3: *To enhance situational awareness consider implementing a critical building information system which is available to responding units.***

Discussion: Coupled with the Pre-Incident Planning program, the critical incident dispatch system (CIDS) program provides critical building information which may not be readily apparent to responding companies upon arrival. This program also provides accurate and consistent information for required radio progress reports and indicates where standard operating procedure variations would be necessary due to previously known features found at this location.

The process starts with input from the company officers who must consider all buildings in their first-due area as potential CIDS buildings. In considering a building, the company officer must look for conditions that would not be immediately apparent to arriving companies assigned to the initial alarm assignment. Additionally, there are key building factors which should automatically be included in CIDS. Examples could be bowstring truss, major alterations have occurred, or if a pre-incident plan exists for the building. Other examples that should be included or considered for inclusion in the CIDS program are:

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- Hazardous chemicals, liquids and substances and always indicate floor and location.
- High voltage equipment including transformers containing PCBs and always indicate floor and location of such equipment.
- Interconnected odd or unusually shaped buildings and indicate which floors are interconnected.
- Buildings with structural hazards or heavy fire loading.
- Renovated buildings with hidden voids, or duplex apartments. Indicate which floors give access to duplex apartments.
- Truss buildings (describe type of truss).
- Metal bar joist and other lightweight construction materials
- Q-deck roofs or floors, steel plated buildings.
- Handicapped, bedridden, or incapacitated individuals. Where possible, specify the location.
- Schools with handicapped students.
- Special extinguishing systems, and the location of related controls.
- Siamese locations, if not in a normal location or readily visible.
- The location of OS&Y (outside screw and yoke) valves or alarm panels, if not located in an easily found location.
- Sub-cellar levels and access locations.
- Location of guard dogs.
- Telephone numbers of knowledgeable persons, such as the owner, building engineer or superintendent.
- Vacant buildings

This list is not intended to be all-inclusive. Company officers should be encouraged to include other items if they feel that the condition or hazard should be identified.<sup>15</sup>

Fire departments can utilize a variety of methods to ensure critical building information is available during response to an incident. Mobile data terminals or mobile computer terminals, hand-held computers or tablets, information from station response printers, or printed pre-incident plans can provide location specific data triggered by place, address, and/or name. This information can be a valuable tool for the fire officers and command officers, especially when the jurisdiction has a large number of defined target hazard occupancies. Also, this information assists the Incident Commander in implementing the strategy and Incident Action Plan.<sup>16</sup>

This fire department currently utilizes a Vital Building Information Report (VBI) which gathers pertinent information regarding hazardous conditions or unsafe buildings and also enables company officers and fire fighters to familiarize themselves with properties in their first-due response area. The information on the completed VBI Report is entered into a database on the company level. After review of the VBI paper copy by company members, the information is placed in the company's VBI book(s) and kept in the unit office. This information should be provided to the Fire Communications Center (FCC) and to all battalion chiefs and companies through the use of mobile data terminals or mobile computer terminals, hand-held computers or tablets, information from station response printers, or printed pre-incident plans.

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***Recommendation #4: Based upon department procedures, strategy and tactics should be defined by the organization for fire-fighting operations.***

Discussion: Effective fireground standard operating procedures (SOPs) define the initial strategy and tactics for a coordinated deployment of departmental resources for specific incidents. SOPs are based on factors not limited to but including: department staffing, deployment capabilities; knowledge and skill levels; apparatus, tools and equipment; building inventory including height, area, construction class, and type of occupancy; and potential life hazard. This ensures initial responding units understand and implement operational goals and tactics at various events with or without a chief officer on the scene to maximize efficiencies while minimizing confusion and duplication of effort. The Incident Commander will build on the current strategy and incorporate the necessary incident management components to utilize as the incident demands. The goal of effective fireground procedures is to increase the safety of our members, eliminate confusion, and prevent the loss of life.<sup>17</sup>

Occupancies define the space inside the class of building. Construction types/classes of construction define how the building is constructed with either combustible or non-combustible materials. Occupancies exist inside the constructed building. SOPs must consider numerous factors that affect operations. This will ensure essential strategic, tactical, and task level functions are performed by fire fighters, fire officers, division/group supervisors, and the Incident Commander. Additionally, this process compliments the defined knowledge, skills, abilities, competencies, and fire experience to assist:

- the Incident Commander to plan and implement an effective strategy and Incident Action Plan;
- division/group supervisors to formulate and follow tactics;
- company officers to successfully carry out assigned tasks,
- and, the individual members to effectively perform their duties.<sup>17</sup>

Obviously, the strategy and tactics of an incident are dictated by the size-up, initial risk assessment, and situational report by the first arriving officer. If physical barriers make the 360° size-up impractical for the first arriving officer, the size-up of Side C or Side Charlie may be delegated to another fire department unit. However, unless an obvious life safety issue exists (e.g., visible victims requiring immediate assistance), interior fire-fighting operations should not commence until a report from Side Charlie is received. A radio report of conditions, including those on Side Charlie, should be transmitted over the assigned tactical channel to the Incident Commander and the dispatch center. The transmission should include the following:

- Smoke and fire conditions, with an emphasis on identifying the seat of the fire; The Initial radio report from the first arriving unit for a structural fire should include the signal for a working fire, the number of stories, type of occupancy and location of fire. This lays the foundation for additional reports and serves as notification to responding units as to type of SOPs to implement.
- If there were critical building description information through the critical incident dispatch system (CIDS) for the address, then this information would aid in implementing or adjusting SOPs. CIDS could contain info that would necessitate alternative action to fulfill said operational goals.
- Building features – e.g., number of stories (particularly if there is a difference between sides Alpha and Charlie;

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- Basement access;
- Any other safety hazards;

Any change to operational priorities or responsibilities based on the above size-up shall be clearly communicated to “Command”, all responding units, and the dispatch center via the assigned tactical radio channel.<sup>17, 18</sup>

There are necessary tasks which need to occur at any fire regardless of the occupancy such as initial on scene report upon arrival, initial risk assessment, situational report, water supply, deployment of handlines and back-up handlines, search and rescue, ventilation, initial rapid intervention crews (IRIC), ground and aerial ladder placement, fire attack and extinguishment, and salvage and overhaul. This closely follows Lloyd Layman’s model of *RECEO VS* (Rescue, Exposure, Confinement, Extinguishment, Overhaul, Ventilation, and Salvage).<sup>9</sup>

Procedures developed for fireground operations must be flexible enough to allow the change due to:

- Life hazard (must be given first priority);
- Problems with water supply and water application;
- Volume and extent of fire, requiring large caliber streams;
- Location of the fire, inaccessible for hand-line operations;
- Materials involved in the fire and explosion potential compounding the problem;
- Exposure problems where further fire spread would be a major concern;
- Stability of the structure, which would be dependent on the condition of the structural components of the building, the intensity and duration of the fire.<sup>17</sup>

At this incident, Engine 11, the first due engine company, arrived on scene approximately 4 minutes after the initial dispatch. The Engine 11 (E11) officer provided a scene size-up with the building dimensions and placed “1 & 1” in service. The E11 officer did not assume “Command” or declare a strategy for this incident. Battalion 4 assumed “Command” at 1742 hours which was 5 minutes after the arrival of E11. “Command” then put “2 & 2” in service at 1744 hours. Ladder 5 was assigned to search the apartments above the fabric store. Pipeline 3 was sent to the basement through the Bilco doors. Snorkel 2 arrived on scene at 1749 hours and assigned to search the apartments above the fire. When an “All Hands” Assignment was transmitted at 1747 hours, E10 was assigned to take a hoseline into Bravo Exposure and check for extension. E53 was assigned to fire attack to back-up E11. “Command” assumed the building was being laddered by the ladder companies, but this was never confirmed by “Command”. Also ventilation was being done by the ladder companies as they searched the second and third floors (apartments). Roof ventilation was being done by Rescue 1 and Ladder 27 at 1811 hours when the captain of L27 fell off the roof at 1820 hours.

### ***Recommendation #5: Fire departments should review procedures on the use and deployment of Rapid Intervention Team(s).***

Discussion: In order to ensure compliance with 29 CFR 1910.134, *Respiratory Protection*,<sup>19</sup> fire departments must maintain a rapid intervention team or teams when members are operating in an immediately dangerous to life and health (IDLH) or potentially IDLH atmosphere. The rapid

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intervention team function should be incorporated into the department's incident management system and the personnel accountability system (PAR).<sup>13</sup> Critical fireground operations and staffing needs should be continuously evaluated in regards to fire fighter safety. Resource assignments should be made with the goal of having the RIT function in place at all times.

When the Incident Commander needs additional resources, the consideration of deploying the rapid intervention team for an operational assignment without additional resources on scene to function as RIT should be carefully assessed.<sup>13</sup> The following restrictions regarding the use of RIT should be considered by the Incident Commander during fireground operations:

- The RIT should not be used for fire-fighting operations. The RIT is dedicated to assist, and if necessary, rescue members who become trapped, distressed or involved in other serious life threatening situations.
- When the Incident Commander orders the RIT to work, the Incident Commander shall immediately assign another on-scene company to stand by as the RIT. If no units are available, the Incident Commander must assign at least two members to act as a rapid intervention team while awaiting the special called RIT to arrive. An engine company may be designated as the RIT pending arrival of an additional ladder company or rescue company. This ensures compliance with OSHA's "Two In/Two Out" rule under 29 CFR 1910.134, *Respiratory Protection*,<sup>19</sup>
- The RIT should not be used to provide relief for operating companies until the fire/incident has been declared "Under Control" by the "Command".
- If assigned by a superior officer to other than RIT duties, the RIT unit officer should remind such officer of RIT designation.<sup>20, 21</sup>

Many fire departments have a defined response plan for the dispatch of an additional company (engine, truck, squad, or rescue company) to respond to an incident and standby as the rapid intervention team. Based upon the complexity, magnitude, configuration of the structure, or geographical layout of the incident, the Incident Commander may deploy additional rapid intervention teams by location or function.<sup>22</sup>

Upon arrival or upon appointment, the RIT officer should confer with the Incident Commander. The RIT officer should establish an area to stage the rapid intervention team and the necessary RIT equipment. The RIT equipment should include:

- A tool staging tarp,
- Rescue SCBA (RIT Pack),
- Forcible entry tools such as a Halligan bar or other pry tool,
- Stokes basket,
- 150' long rope for search and rescue,
- Wire cutters,
- Rebar cutter
- Saws
- Thermal Imaging Camera,
- Emergency strobe lights.

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- Rebar cutter
- Life Saving Rope/Life Belt
- Elevator keys for buildings with elevators [20, 21, 23](#)

It is important to stage all necessary RIT equipment in an expedient manner. The RIT officer, accompanied by one member of the RIT, should perform an incident scene survey while the remaining RIT members assemble the RIT equipment. If the size of the structure negates a 360° survey of the building, this fact shall be relayed to the Incident Commander as soon as possible. This should be a benchmark for “Command” to designate another RIT in order to effectively cover all sides of the building.

During this survey, the RIT officer and members should look for ways in and out of the structure, window configuration, fire escapes and construction features. The RIT officer should note the feasibility for placement of ground ladders for rescue or escape purposes. The RIT officer shall be responsible for setting up and securing a suitable secondary egress for interior crews. This may include laddering multiple sides of the structure. Once the RIT has determined the need for an egress ladder the window opening shall be cleaned of glass. This should only be done after conferring with “Command” that the removal of the window will not affect fire-fighting operations. Once approved by “Command”, the egress ladder should be placed at the window. The location of the egress ladder(s) shall be announced over the radio by the RIT Officer. After the above tasks are completed, the RIT Officer shall inform “Command” that a 360° survey is complete and the RIT is ready to intervene, if necessary. Once the incident scene survey has been completed and the RIT’s equipment is in place, the entire RIT shall be located in an area immediately accessible to the building in order for rapid deployment plus maintaining radio contact with the Incident Commander. The RIT officer shall brief all members of the RIT as to the results of his/her incident scene survey. The RIT should operate as one unit. Additional crews may be added to or in support of the team as necessary. When more than one company is added as part of the rapid intervention team, a rescue group should be formed with a rescue group supervisor.<sup>20</sup>

Another consideration for “Command” is to request the response of an advanced life support (ALS) engine company or truck company as a component of the RIT Group. The members of the ALS company are trained to operate in an IDLH, can function as part of the RIT, and provide advanced life support to affected fire fighters.<sup>23</sup>

The RIT Officer and RIT members will coordinate with the Incident Commander to formulate rescue plan contingencies and continue to monitor the radio and fire ground conditions. RIT protection is not a passive assignment. This is a process of ongoing information gathering and diligent scene monitoring until the unit is released by the Incident Commander. The RIT is a critical component for fire fighter safety.

At this incident, Ladder 27 was dispatched as the RIT to Box 1232 at 1746 hours. At 1807 hours, “Command” contacted the captain of L27 and advised him that L27 was going to be put in-service to help ventilate the roof of the fire building once the 2<sup>nd</sup> Alarm companies arrived. “Command” sent a

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request to FCC to dispatch either an engine company or ladder company to replace L27 as RIT. At 1811 hours, Ladder 4 was dispatched as RIT to replace L27 which was placed into fire-fighting operations. At 1820 hours, the captain from L27 fell off the roof of the fire building onto the one-story storage building. Ladder 4 arrived on scene at 1825 hours.

### ***Recommendation #6: Ensure all fire fighters and fire officers are trained when to call a “Mayday”.***

Discussion: When a fire fighter experiences a life-threatening situation either themselves or witness a member seriously injured, fire fighters must take the necessary steps to alert rescuers. Examples of situations where the term “Mayday” should be used include: a lost or missing member, an SCBA malfunction or loss of air supply, a member is seriously injured or incapacitated, a member is trapped or entangled, or any life threatening situation that cannot be resolved. NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, Chapter 8 – Emergency Operations, Section 8.2 – Communications discusses “Mayday” operations. Paragraph 8.2.3.2 states, “the standard operating procedure shall use “Mayday” as a designator to identify when a member is in a life-threatening situation and in need of immediate assistance.” Paragraph 8.2.3.3 states, “This “Mayday” shall be permitted to be declared by any member who is in or who becomes aware of a member who is in a life-threatening situation and in need of immediate assistance.”<sup>13</sup>

Each fire department should train members for emergency operations, and to develop rules and performance standards for a fire fighter to call a “Mayday”. Any “Mayday” communication must contain the location of the fire fighter in as much detail as possible and, at a minimum, should include the division (floor) and quadrant. It is imperative that fire fighters know their location at all times when operating in an “immediately dangerous to life and health” (IDLH) environment. This ensures that fire fighters can be able to give their location in the event of a “Mayday”.<sup>22</sup>

Once a life-threatening situation occurs, fire fighters must immediately declare a “Mayday”. When a “Mayday occurs, the fire fighter(s) declaring a “Mayday” should use the synonym *LUNAR* – location, unit assigned, name, assistance needed, and resources needed - to gain additional information in identifying the assistance needed by the affected fire fighter(s).<sup>22</sup>

The rescue of a lost, missing, trapped, or injured fire fighter is time sensitive. A very narrow window of survivability exists for a fire fighter who is out of air or trapped by a hazardous condition. Fire fighters must not delay in communicating a “Mayday” ensuring the Incident Commander is notified. The Incident Commander will be required to revise the strategy and Incident Action Plan (tactics) to incorporate a priority rescue. This will impact fireground communications as well. The Incident Command should declare the use of “emergency traffic only” until the situation is resolved. Once a “Mayday” condition is broadcasted on the radio, using distinctive emergency traffic alert tones, the Incident Commander and/or dispatch center is responsible for taking action to clear the radio channel and to determine the member’s location, situation, and resources needed to remedy the situation.<sup>24</sup>

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Company officers and Division/Group Supervisors should immediately conduct a personnel accountability report (PAR) of all fire fighters assigned to them. The Incident Commander should confirm a PAR for the entire incident.

The National Fire Academy has two courses addressing the fire fighter “Mayday” training. The National Fire Academy’s “Mayday” courses present specific parameters or rules for when a fire fighter should call a “Mayday”. The courses may help fire departments develop and implement “Mayday” procedures for fire fighters. A training CD is available to fire departments free of charge from the U.S. Fire Administration Publications Office.<sup>25, 26</sup>

The courses are:

- QO133 *Firefighter Safety, Calling the Mayday*, a 2-hour program covering the cognitive and affective learning domain of the fire fighter Mayday principle;
- HO134 *Calling the Mayday: Hands-on Training*, an 8-hour course covering the psychomotor learning domain of the fire fighter Mayday principle.

Additionally, NFPA 1001, *Standard on Fire fighter Professional Qualifications*, Fire Fighter I, (2013 edition), includes job performance requirements related to the fire fighter calling for assistance (such as a Mayday situation).<sup>2</sup>

The International Association of Fire Fighters *Fire Ground Survival* program is another valuable resource fire departments can use. This program was developed to ensure that training for “Mayday” prevention and “Mayday” operations are consistent between all fire fighters, company officers, and chief officers.<sup>27</sup>

At this incident, fire fighters from Rescue 1 witnessed the officer from Ladder 27 fall from the roof of the fire building onto the one-story building at approximately 1820 hours. A fire fighter from Rescue 1 (“Roof”) and a fire fighter from Ladder 27 (“Roof”) both activated their “emergency buttons” on their portable radios. The dispatcher immediately contacted “Communications” and advised that R1 “Roof” and L27 “Roof” had emergency activations on the assigned tactical channel. At this time there was radio traffic from R1 “Roof” stating, “We need someone to the rear of Bravo Exposure in the courtyard. There’s a man down back there, he just fell off the roof.” “Communications” contacted the R1 officer regarding the emergency activation. The R1 officer stated the emergency button was activated for a man down and they are trying to get to him now. “Communications” radioed the R1 officer again and asked if he was declaring a “Mayday”? The R1 officer replied that somebody had fallen off the roof to a porch roof. “Communications” attempted to contact the L27 officer at 1823 hours.

A “Mayday” was never declared at this incident. The dispatcher asked “Communications” if the two fire fighters who had emergency radio activations were declaring a “Mayday.” No one ever replied back to the dispatcher – yes or no. During the interviews with the Incident Commander and Division/Group Supervisors, revealed that they never initially realized the magnitude of this situation. No one other than the fire fighters in the immediate area of the captain knew what had occurred. The

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intent of the “Mayday” is to ensure that everyone on the fireground, especially the Incident Commander, knows a life threatening situation is occurring. This situation would have driven the Incident Commander to immediately remove fire fighters from the roof and interior positions and then initiate defensive operations once a PAR has been completed. The significance of a “Mayday” is to ensure that the Incident Commander and all fire fighters understand the seriousness of the situation.

Once the collapse in the basement of the fire building occurred and the fire intensified, the strategy and Incident Action Plan were changed to focus on the rescue of the captain of L27.

***Recommendation #7: Fire departments should provide the Incident Commander with a “Mayday” tactical checklist in the event of a “Mayday”.***

Discussion: When a “Mayday” is transmitted for whatever reason, the Incident Commander has a very narrow window of opportunity to locate the lost, trapped, or injured member(s). The Incident Commander must restructure the strategy and Incident Action Plan (tactics) to include a priority rescue.<sup>22</sup>

Some departments have adopted the term “LUNAR” – location, unit assigned, name, assistance needed, and resources needed - to gain additional information in identifying the assistance a fire fighter who is in trouble and in need assistance. The Incident Commander, division/group supervisors, company officers, and fire fighters need to understand the seriousness of the situation. It is important to have the available resources on scene and to develop a plan established prior to the “Mayday”.<sup>22, 28</sup>

A checklist is provided in **Appendix 2 - Incident Commander’s Tactical Worksheet for “Mayday”** which can assist the Incident Commander to ensure the necessary steps are taken to clear the “Mayday” as quickly and safely possible. This checklist serves as a guide and can be tailored to any fire department’s “Mayday” procedures. The intent of the checklist is to provide the Incident Commander with the essential actions in the form of a checklist to be taken in the event of “Mayday”. This format allows the Incident Commander to follow a structured worksheet. This process is too important to operate from memory and risk missing a vital step that could jeopardize the outcome of the rescue of a fire fighter who is missing, trapped, or injured.

At this incident, the Incident Commander did not realize the captain from L27 had fallen two stories from the roof of a building and could not be reached by fire fighters; or what his condition was until he was briefed by Bravo Division. Once a “Mayday” occurs, communications, such as emergency traffic alert tones are requested, or emergency radio activation occurs that states “someone has fallen off a roof.” This should key the Incident Commander that a fire fighter or fire fighters are in trouble. The “Mayday” tactical checklist will provide the Incident Commander with the guidance to ensure all critical steps are covered in the event a fire fighter becomes lost, missing, or trapped.

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***Recommendation #8: Fire departments should utilize a personnel accountability system that accounts for all resources assigned to an incident.***

Discussion: A personnel accountability system is a system that readily identifies both the location and function of all members operating at an incident scene.<sup>22,13</sup> The philosophy of the personnel accountability system starts with the same principles of an incident management system company - unity and unity of command. Unity can be fulfilled initially and maintained throughout the incident by documenting the situation status and resource status on a tactical worksheet.

One of the most important functions of “Command Safety” is for the Incident Commander to initiate an accountability system that includes the functional and geographical assignments at the beginning of operations until the termination of the incident. It is very important for the first on-scene officer or supervisor, to initiate an accountability system. This initial system allows the passing or transfer of information to the next officer who assumes “Command” upon his/her arrival.<sup>22</sup>

A functional personnel accountability system requires the following:

- development and implementation of a departmental SOP,
- necessary components and hardware,
- training all members on the operation of the system,
- strict enforcement during emergency incidents.

There are many different methods and tools for resource accountability. Some examples are:

- tactical worksheets,
- command boards,
- apparatus riding lists,
- company responding boards,
- electronic bar-coding systems,
- or accountability tags or keys (e.g., PASSPORT System).<sup>22</sup>

These components can be used in conjunction with one another to facilitate the tracking of responders by both location and function. The components of the personnel accountability system should be modular and expand with the size and complexity of the incident.<sup>22</sup>

The fire department’s standard operating procedure (SOP) **Operational Procedure #19** states the Incident Commander “*primary consideration is the safety and accountability of all members which will be achieved through the appropriate control and monitoring of personnel operating on the incident scene. All measures regarding interior and exterior operations are absolutely critical for the safety of all involved. This may require a significant number of dedicated safety resources.*”

Resource accountability should be assigned to personnel who are responsible for maintaining the location and status of all assigned resources at an incident. As the incident escalates resource status would be placed under the Planning Section. This function is separate from the role of the Incident Commander. The Incident Commander is responsible for the overall command and control of the

## **Career Captain Dies Conducting Roof Operations at a Commercial Structure Fire - Pennsylvania**

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incident. Due to the importance of responder safety, resource status should be assigned to a dedicated member as the size and complexity of the incident dictates. A number of positions could function in this role including a staff aide, staff assistant, chief officer, or other defined member. As the incident escalates and tactical level management components (e.g., divisions or groups) are assigned the resource status officer (accountability officer) works with the division or group supervisors to maintain an on-going tracking and accountability of members.<sup>29</sup>

At this incident, in order to maintain an effective span of control, the Incident Commander divided the incident into three divisions (Alpha, Bravo, and Delta), Roof Division, plus exposures. A division supervisor was placed in charge of each division with the company officers reporting to their respective division supervisor. Accountability issues developed when the companies operating interior were being pulled out of the building and “Command” was trying to locate companies to ventilate the roof. Also, several companies were split (e.g., Rescue 1, Squad 47) into two crews and operated in different parts of the fire building operating in different functions. Additional 2<sup>nd</sup> Alarm companies were being assigned to fire-fighting operations. Moreover, when the captain from Ladder 27 fell from the roof, there was confusion between the tactical level management components and “Command” to identify the number of downed fire fighters.

The involved fire department provides each operational battalion chief a chief’s aide or staff aide. When a battalion chief is assigned as division/group supervisor at an incident, the chief’s aide should be assigned as resource status for that particular division or group. This would also ensure that the battalion chief is not working alone while tasked with maintaining the accountability and safety within their assigned division or group. (See **Recommendation #11**)

### ***Recommendation #9: Fire departments should ensure that all members engaged in emergency operations receive annual proficiency training and evaluation on fireground operations.***

Discussion: In order to ensure for the proficiency and competency of fire department members, the fire department should conduct annual skills evaluation to verify minimum professional qualifications. This annual evaluation should address the qualifications specific to the member’s assignment and job description. This process should be structured in a manner that skills are evaluated on a recurring cycle with the goal of preventing skills and abilities degradation and ensuring for the safety of members. Proficiency evaluation and training provides an opportunity to ensure that all fire officers and fire fighters are competent in the knowledge, skills, and abilities in fireground operations.

NFPA 1500, *Standard for a Fire Department Occupational Safety and Health Program* requires a fire department to establish and maintain a training, education, and professional development program with the goal of preventing occupational deaths, injuries, and illnesses. This ensures members are trained and competencies are maintained in order to effectively, efficiently and safely execute all responsibilities.<sup>13</sup> This process is consistent with the organizational statement that establishes the existence of the fire department, the services the fire department is authorized and expected to perform, the organizational structure, and the job descriptions and functions of fire department members.<sup>13</sup>

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The primary goal of all training, education and professional development programs is the reduction of occupational injuries, illnesses, and fatalities. As members progress through various job duties and responsibilities, the department should ensure the introduction of necessary knowledge, skills, and abilities to members who are new in their job titles as well as ongoing development of existing skills.<sup>13</sup>

NFPA 1410, *Standard on Training for Initial Emergency Scene Operations*, defines basic evolutions that can be adapted to local conditions and serves as a method for the evaluation of minimum acceptable performance during initial fireground operations.<sup>30</sup> Proficiency training for fireground operations and emergency incidents should be conducted annually. This training should include, but not be limited to scene size-up, situational awareness, use of the incident management system, personnel accountability system, strategy and tactics, search and rescue, hoseline operations, ladder operations, ventilation, thermal imaging cameras, fireground communications, use of rapid intervention teams, and “Mayday” operations.

Due to budget restraints the fire department had eliminated proficiency training at the department’s fire academy. After this incident, the fire department was in the process of re-establishing company in-service training at the department’s fire academy. The scheduling for this training allowed 3 companies to be placed out of service at the department’s fire academy for approximately 2.5 – 3 hours to conduct various types of fireground proficiency training. The process was scheduled to occur 3 times each shift in order to allow companies to attend this proficiency training.

***Recommendation #10: Ensure that the Incident Commander assigns a safety officer as early in the incident as possible. Consideration should be given to the appointment of assistant safety officer(s) if the incident escalates.***

Discussion: With the advent of the Incident Command System, the goal was to ensure that the Incident Commander was responsible for the safety and welfare of all members and other first responders that were on-scene at an incident.<sup>31</sup>

The following items shall be considered regarding the appointment of a safety officer:

- The safety officer must be assigned as early in the incident as possible.
- The safety officer reports directly to the Incident Commander.
- The safety officer reconns the incident to identify existing or potential hazards and informs the Incident Commander.
- The safety officer recommends to the Incident Commander any changes to the Incident Action Plan as a result of the ongoing surveys.
- At an emergency incident where the safety officer judges activities unsafe or an imminent hazard, the safety officer shall have the authority to alter, suspend, or terminate those activities. The safety officer shall immediately inform the Incident Commander of any actions taken to correct imminent hazards at the emergency scene.
- At an emergency incident where a safety officer identifies unsafe conditions, operations, or hazards that do not present an imminent danger, the safety officer should take appropriate action through

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the Incident Commander to mitigate or eliminate the unsafe condition, operations, or hazard at the incident scene.

- When operating in forward or otherwise hazardous positions, the safety officer must be attired in appropriate personal protective equipment (PPE), including self-contained breathing apparatus (SCBA), radio communication equipment, and be accompanied by another responder. [22, 33](#)

Upon arrival at the incident, the designated safety officer should meet with the Incident Commander to confirm the safety officer assignment and to be integrated into the personnel accountability system. Upon confirmation, the safety officer should obtain the following information:

- overall situation status and resource status,
- the Incident Action Plan,
- identification of known hazards and concerns plus the establishment of control zones especially collapse zone(s).
- the status and location of rapid intervention crews.
- ensures the establishment of the Rehabilitation Group.
- confirms that established radio communication channels have been established (Command Channel, Tactical Channels). [22,31,32](#)

Based upon the size and complexity of the incident, such as a commercial structure with accessibility problems, the Incident Commander should consider the appointment of assistant safety officers. Types of incidents that might require expansion of the safety officer role include the following:

- incidents covering a large geographical area (e.g., commercial structure fire) that include numerous divisions or groups.
- incidents where significant acute or chronic responder health concerns require coordination and input to the Planning Section (responsible for accounting for the organizational structure, availability of resources, deployment of resources, and the situation status reports),
- incidents requiring interface with local, state, federal, or other health and safety representatives,
- multi-agency incidents where Unified Command is established,
- incidents where Area Command is established. [31, 32, 34, 35](#)

Assistant Safety Officers (ASOs) assigned to branches, divisions, or groups can be addressed according to their area of responsibility. For example, an Assistant Safety Officer assigned to "Alpha Division" can be addressed as "Alpha Division Assistant Safety Officer." The Assistant Safety Officers assigned to divisions or groups report to and follow direction from the Safety Officer who is part of the Command Staff. The Assistant Safety Officer works with the supervisory person in the assigned division or group to ensure safety conditions are being met. [31, 32, 34, 35](#)

At this incident, a safety officer was dispatched on the 2<sup>nd</sup> Alarm. Per the fire department's incident management procedures, the 4<sup>th</sup> due Battalion Chief is assigned the safety officer function. Battalion 2 was dispatched at 1805 hours and arrived on scene at 1825 hours. This was 3 minutes after the emergency radio activation by Rescue 1 "Roof" and Ladder 27 "Roof". This function should be front-loaded into the incident management system when an *All Hands Assignment* is dispatched.

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Metropolitan-size fire departments should consider one or more full-time dedicated Safety Officer(s) who are on duty and can routinely respond to working fires (e.g., full time shift safety officer). In smaller departments, every officer should be prepared to function as the safety officer when assigned by the Incident Commander. A full-time dedicated safety officer provides the expertise of an individual that focuses on scene safety versus tactical and task level functions. The dedicated safety officer gives the department a venue of putting a risk manager on scene in a very short response time.<sup>22, 32</sup> Having a safety officer on scene at defined incidents allows the Incident Commander to delegate the safety function to a trained and competent member of the department. The dedicated safety officer adds a higher level of proficiency and experience to assist the Incident Commander, division or group supervisors, fire officers, and fire fighters.<sup>32, 34, 36, 37</sup> The presence of a safety officer does not diminish the responsibility of individual fire officers and fire fighters for their own safety and the safety of others.

### ***Recommendation #11: Fire departments should develop a training program for staff aide (staff assistants).***

Discussion: The function of a staff aide (e.g., chief's aide, emergency incident technician, field incident technician, or staff assistant) is an essential component of the incident management system.<sup>38</sup> Functions of the staff aide include maintaining the tactical worksheet; maintaining personnel accountability of all members operating at the incident (resource status and situation status); monitoring radio communications on the dispatch, command, and fireground channels; control information flow by computer, fax, or telephone; and access reference material and pre-incident plans.<sup>22, 39, 40</sup> NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety* states in Chapter 8 – *Command Safety*, that the staff aide is assigned to facilitate the tracking and accountability (resource status) of the assigned companies or crews.<sup>22</sup>

Some fire departments use fire fighters as staff aides and other fire departments use fire officers to serve as a staff aide for a command officer. Regardless of the rank of the staff aide, the staff aide has to be trained in the duties and responsibilities in order to proficiently function and meet the expectations of the Incident Commander. These job functions include:

- size up of the incident
  - ✓ address of incident,
  - ✓ type of incident,
  - ✓ name of incident
  - ✓ resources assigned and responding to the incident,
  - ✓ life hazard,
  - ✓ additional resources needed,
  - ✓ exposure problems,
  - ✓ location of the Command Post;
- maintaining communications with the dispatch center or fire department communications center
  - ✓ Dispatch Channel
  - ✓ Command Channel,
  - ✓ Tactical Channels,

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- situation status (what is the incident doing)
  - ✓ are we making progress on this incident,
- resource status (what are they doing)
  - ✓ personnel accountability system (e.g. PASSPORT System) – accountability board or tactical worksheet
  - ✓ how, what, and where are companies operating,
  - ✓ who is in Staging,
- Staging
  - ✓ Staging Area Manager,
  - ✓ separate tactical channel,
- tactical worksheet
  - ✓ teletype printout can be used as initial ICS 201,
  - ✓ transfer immediately upon arrival to the department’s tactical worksheet and document companies by assignment or location (personnel accountability system)
  - ✓ diagram the incident starting with Side A or Side Alpha,
  - ✓ document divisions and groups with assigned supervisor,
  - ✓ document response of other resources on scene (e.g., law enforcement, other fire departments). [40.41](#)

As the incident expands, officers could be assigned as a division supervisor or group supervisor. The assigned officer will proceed to the division or group, evaluate and report conditions to the Incident Commander. If directed by the Incident Commander, the assigned officer will assume responsibility for directing resources and operations within their assigned area of responsibility. Division/group supervisors assigned to operate within the hazard zone must be with a second individual, which would be the staff aide. The staff aide can assist the division/group supervisor by maintaining accountability of the resources assigned that particular division/group. The division/group supervisor and the staff assistant will be required to be equipped with the appropriate protective clothing and equipment for their area of responsibility. [22.29](#)

At this incident, the Incident Commander utilized staff aides for communications and personnel accountability (resource status) at the Command Post. Another staff aide was assigned the role as Staging Area Manager. The Incident Commander initially divided the incident into three divisions (Alpha, Bravo, and Delta) plus a roof division. During the recovery of the victim, a rescue group was formed. Each division/group supervisor operated alone and without their respective staff assistants.

The department has a protocol that once the Incident Commander can function with the assigned battalion chiefs, the staff aides are sent back to their battalion. A qualified captain within the battalion moves into the role of acting battalion chief. There is no defined protocol as to when the staff aide is to restore the battalion chief function.

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*Additionally,*

***Recommendation #12: Code setting organizations and municipalities should require the use of sprinkler systems in commercial structures, especially ones having high fuel loads and other unique life-safety hazards, and establish retroactive requirements for the installation of fire sprinkler systems.***

Discussion: This recommendation focuses on fire prevention and minimizing the impact of a fire if one does occur. The National Fire Protection Association (NFPA) *Fire Protection Handbook* states “Throughout history there have been building regulations for preventing fire and restricting its spread. Over the years these regulations have evolved into the codes and standards developed by committees concerned with fire protection. The requirements contained in building codes are generally based upon the known properties of materials, the hazards presented by various occupancies, and the lessons learned from previous experiences, such as fire and natural disasters.”<sup>42</sup> Although municipalities have adopted specific codes and standards for the design and construction of buildings, structures erected prior to the enactment of these building codes may not be compliant. Such new and improved codes can improve the safety of existing structures.<sup>42</sup> Sprinkler systems are one example of a safety feature that can be retrofitted into older structures. Sprinkler systems can reduce fire fighter fatalities since such systems can contain and may even extinguish fires prior to the arrival of the fire department.

The structure involved in this incident was constructed of Type III ordinary construction and consisted of a three-story mercantile/residential occupancy with a full basement. According to city records from the Department of License and Inspections, the structure was built in 1919. The structure consisted of brick walls with wooden floors and a flat wooden roof. The contents represented a heavy fire load.

Fire development beyond the incipient stage presents one of the greatest risks fire fighters are exposed to during fireground operations. This risk exposure to fire fighters can be dramatically reduced when fires are controlled or extinguished by automatic sprinkler systems. NFPA statistics show that most fires in sprinklered buildings are controlled by the activation of one or two sprinkler heads prior to fire department arrival.<sup>42</sup> An automatic fire sprinkler system also reduces the exposure risk to fire fighters during all phases of fireground operation and allows the safe egress of building occupants before the fire department arrives on scene. Finally, by controlling fire development, the risks associated with the potential for structural collapse and during overhaul operations are greatly reduced, if not eliminated.

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### **Investigator Information**

This incident was investigated by Murrey Loflin, Matt Bowyer, Paul Moore, and Jay Tarley with the Fire Fighter Fatality Investigation and Prevention Program, Surveillance and Field Investigations Branch, Division of Safety Research, NIOSH located in Morgantown, WV. An expert technical review was provided by Deputy Chief Edward Ferrier of the Fire Department of New York. A technical review was also provided by the National Fire Protection Association, Public Fire Protection Division.

### **Additional Information**

#### **National Institute for Standards and Technology and Underwriters Laboratory**

Modern Fire Behavior website contains information including training videos showing the findings from NIST and UL research conducted in cooperation with the Fire Department of New York on Governor's Island in 2012.

<http://www.firecompanies.com/modernfirebehavior/governors%20island%20online%20course/story.html>.

Flashover TV sponsored by FireRescue.com includes a series of training presentations by NIST researcher Dan Madrzykowski.

<http://flashovertv.firerescue1.com/videos/1875870-nist-and-ul-research-on-fire-dynamic-case-studies-part-4/>

Information on completed fire-fighting research studies available at the National Institute of Standards and Technology website at [http://www.nist.gov/el/fire\\_research/firetech/index.cfm](http://www.nist.gov/el/fire_research/firetech/index.cfm)

The information on completed fire-fighting research studies available at the UL Firefighter Safety Research Institute website at [www.ULfirefightersafety.com](http://www.ULfirefightersafety.com).

#### **IAFC Rules of Engagement for Firefighter Survival**

The International Association of Fire Chiefs (IAFC) is committed to reducing fire fighter fatalities and injuries. As part of that effort the nearly 1,000 member Safety, Health and Survival Section of the IAFC has developed DRAFT "*Rules of Engagement for Structural Firefighting*" to provide guidance to individual fire fighters, and incident commanders, regarding risk and safety issues when operating on the fireground. The intent is to provide a set of "model procedures" for structural fire-fighting to be

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made available by the IAFC to fire departments as a guide for their own standard operating procedure development. [http://www.iafcsafety.org/downloads/Rules\\_of\\_Engagement](http://www.iafcsafety.org/downloads/Rules_of_Engagement).

### **IAFF Fire Ground Survival Program**

The purpose of the International Association of Fire Fighters (IAFF) Fire Ground Survival Program is to ensure that training for “Mayday” prevention and “Mayday” operations are consistent between all fire fighters, company officers and chief officers. Fire fighters must be trained to perform potentially life-saving actions if they become lost, disoriented, injured, low on air or trapped. Funded by the IAFF and assisted by a grant from the U.S. Department of Homeland Security through the Assistance to Firefighters (FIRE Act) grant program, this *comprehensive fire ground survival training program* applies the lessons learned from fire fighter fatality investigations conducted by the National Institute for Occupational Safety and Health (NIOSH) and has been developed by a committee of subject matter experts from the IAFF, the International Association of Fire Chiefs (IAFC) and NIOSH.

<http://www.iaff.org/HS/FGS/FGSIndex.htm>

### **NFPA 1561, Standard on Emergency Services Incident Management System and Command Safety (2014 edition)**

The primary focus of the revision to NFPA 1561 in the 2014 edition is develop requirements directly aimed at reducing and eliminating fireground injuries and fireground deaths of fire department members. The most apparent change addition to this edition has been the document title to include “Command Safety” and the creation of a new chapter, *Command Safety*. This chapter is intended to provide a foundation on how to incorporate the incident management system at all emergency incidents especially *Type V* and *Type IV* incidents.

The chapter on “Command Safety” clearly defines the requirements for the Incident Commander to meet including establishing a fixed Command Post, personnel accountability, the use of staff aides, rapid intervention crews, and the appointment of a safety officer and assistant safety officer(s)(as needed) plus the expectations and authority of the safety officer. There are annexes that cover *Functional Assignments for High-Rise Building Incidents, Development of Subordinate Officers or Implementing a More Efficient Management System, Incident Management for the Fire Service on Type 5 or Type 4 Incidents, and Structural Fire Fighting — Risk Assessment and Operational Expectation*.

NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety (2014 edition)* can be purchased from the National Fire Protection Association at <http://www.nfpa.org>.

## **Disclaimer**

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### Appendix One Fire Department Standard Operating Procedures Table of Contents

SOP Number	Title	Division	Month	Year
0	OP/Directive/EMS Procedure Index	R&P	April	2001
1	River Emergencies (Operation Rescue)	SOC	September	1999
2	Hazardous Chemicals & Material/Site Control	HMAU	November	2000
3	Borderline Response-Alarm Outside the City	R&P	November	2003
4	Block Inspection Procedure	FCU	July	2003
5	Marine Units, Staffing & Response	SOC	January	1993
6	Confined Space Emergencies	SOC	July	2010
7	Expressway Procedures	R&P	March	2008
8	Investigation of Alarm Systems	FCU		Proposed
9	Bridge	DIV#1/B	March	2009
10	Bridge	DIV#1/B	November	1999
11	Response to Bomb Threats	FMO	May	2008
12	Railroads	R&P	March	1998
13	Northeast Airport	AMO	October	2009
14	Task Force	DIV#1/A	May	1999
15	Inspection of Domestic & Private Fire Hydrants	R&P	March	2005
16	Water Supply for Firefighting	DIV#2/A	August	2010
17	Water Emergencies	R&P	March	2005
18	Fire Investigation Procedures	FMO	June	2006
19	Incident Command System	SO	November	2007
20	Bridge	DIV#1/B	February	1990
21	Community Outreach Procedure	FPD	April	2004
22	Cease Operations Procedure	FMO	March	2007
23	Critical Incident Debriefing	ERO	December	2005
24	Radiological Incident Procedure	HMAU	November	2010
25	Utilization of Helicopters for Medical Transport	AMO	October	2004
26	Subway & Subway Elevated Procedures	R&P	March	2001
26A	PATCO High Speed Lines	R&P	October	2000
27	Riots & Civil Disturbances	DIV#1/D	November	2004
28	Energized Electrical Wires & Electrical Equipment	PFA	November	2008
29	Clandestine Drug Operations	HMAU	April	2005
30	International Airport	AOO	June	2009
31	Petroleum Properties & Chemical Plants	HMAU	January	2009
32	Bridge	DIV#2/B	April	2005
33	High Rise Emergency Procedure	PFA	December	2004
34	LNG/LPG Emergencies	HMAU	April	2005
35	Multiple/Mass Casualty	EMS	August	2008
36	Prisons and Correctional Facilities	DIV#2/C	March	2009
37	Self-Contained Breathing Apparatus & PASS Device	SO	October	2004
38	Rapid Intervention Teams	PFA	December	2001
39	Carbon Monoxide Detector, Procedure for Use of	EMS	November	2003
40	Incident Safety Officer	SAFETY	January	2005

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## **Career Captain Dies Conducting Roof Operations at a Commercial Structure Fire - Pennsylvania**

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### **Appendix Two Incident Commander's Tactical Worksheet for "Mayday"**

#### **INCIDENT COMMANDER'S TACTICAL WORKSHEET FOR "MAYDAY"**

- MAYDAY - MAYDAY - MAYDAY Message is Transmitted;**
- Announce *EMERGENCY RADIO TRAFFIC* only;**
- Acknowledge Company/Member transmitting the Mayday – Obtain LUNAR information:**

**LOCATION** \_\_\_\_\_  
**UNIT** \_\_\_\_\_  
**NAME** \_\_\_\_\_  
**ASSIGNMENT AND AIR SUPPLY** \_\_\_\_\_  
**RESOURCES NEEDED** \_\_\_\_\_

- If no answer after two attempts conduct a PAR of all operating companies on the fire ground to isolate company/member;**
- Deploy RIC to reported or last known location/assignment;**
- Request an additional alarm;**
- Request an additional TAC channel for fire operations TAC\_\_\_\_**
- Assure that companies not assigned to the rescue or near the rescue change to the new fire operations channel and conduct a PAR;**
- Maintain fire-fighting positions. Withdraw only if necessary;**
- Establish a Rescue Group with a Safety Officer;**
- Review the Building Pre-Plan if available;**
- Establish a Backup RIC to replace the deployed RIC;**
- Establish a forward staging area for the Rescue Group and provide support with adequate staffing and equipment;**
- Request additional EMS Resources/ALS Ambulances;**
- Request Specialized Resources if needed – Technical Rescue;**
- Conduct a PAR if an emergency evacuation is ordered (due to structural stability or fire conditions);**
- Conduct a PAR after the rescue operation is completed;**
- Announce the end of the Mayday;**