
1000 FREDERICK LANE, MORGANTOWN, WV 26508 • 304.285.5916

# *Volunteer Firefighter Dies after Becoming Lost during a Residential Structure Fire – Pennsylvania*

## Executive Summary

On Sunday, July 4, 2021, a 35-year-old volunteer firefighter (Engine 21-2) died after becoming lost and transmitting a Mayday in the attic of a single-family dwelling. Box 34162 was transmitted at 22:33 hours with a report of a roof on fire. Ladder 21, Engine 21, Engine 26, Ladder 26, Engine 25-1, and Ladder 28 were dispatched. Ladder 21 arrived at 22:40 hours and advised Dispatch they had a single family dwelling, 2-story, Type V construction, with heavy black smoke from the roof. Small flames were also visible in the soffit of the Side Charlie/Side Delta corner. Deputy 21 was the officer in charge of Ladder 21 and established himself as the incident commander (IC). Ladder 21 deployed a 1¾-inch hoseline to the interior (PAR 3), making their way to the attic to locate the fire. Engine 21 responded with Chief 21 (chauffeur), lieutenant, and firefighter (Engine 21-2). Engine 21 arrived on-scene at 22:44 hours and laid a 5-inch supply line from a hydrant to Ladder 21. Engine 21-2 made the hydrant connection and charged the supply line. Chief 21 assumed IC at approximately 22:46 hours. Deputy 21 was assigned as Operations and remained outside. Ladder 21-1 radioed to Operations that they had heavy heat and smoke conditions in the attic but could not locate the fire. They could not find the fire because it was in the knee walls and voids. Engine 25-1 (PAR 6) arrived on-scene at 22:44 hours with two of their firefighters assigned to vent the roof via Ladder 21's aerial. Engine 21-2 and two firefighters from Ladder 26 entered the structure at approximately 22:55 hours. They were assigned to relieve Ladder 21's crew in the attic, who were exiting the building due to being low on air. Rescue 22's crew was tasked with checking for extension. They split their crew to go to the 2nd and 3rd floors. Engine 26's crew stretched the line to the rear. They also stretched a second 1¾-inch hoseline to Side Charlie for exterior fire attack. At 22:45 hours, Ladder 28 arrived on-scene and laddered Side Delta to gain access to the roof and cut two ventilation holes in the roof. The roof became spongy, conditions were deteriorating, and Ladder 28 was removed from the roof. At approximately 23:00 hours, Engine 21-2 transmitted a Mayday. At this time, a Rescue 22 crew was almost to the top of the attic steps. There was high heat and zero visibility but no fire in the finished section of the

**Photo 1: Fire venting along the roofline.**
***(Courtesy of the fire department)***

***Volunteer Firefighter Dies after Becoming Lost during a Residential Structure Fire – Pennsylvania***

attic. There was fire showing in the unfinished section of the attic, where Rescue 22 found Engine 21-2. Engine 21-2's end of service time indicator (EOSTI) sound facilitated Engine 21-2 to be located and out of the attic at 23:06 hours. Engine 21-2, who was conscious at the time, was transported to the local trauma center where he later died. The fire was extinguished at 00:05 hours. At 01:49 hours, all fire companies were clear of the scene.

## Contributing Factors

- *Scene size-up and risk assessment*
- *Personnel accountability system*
- *Crew integrity*
- *Attic fire into knee walls and void spaces*
- *Mayday operations*
- *Rapid intervention crew/team*
- *Communicating critical incident benchmarks*
- *Incident command*
- *Communications*

## Key Recommendations

*Fire departments should ensure:*

- *Initial and ongoing size-ups and risk assessments are conducted throughout the incident.*
- *Use of a functional personnel accountability system to identify the location and function of all personnel operating at an incident.*
- *Company officers and firefighters maintain crew integrity when operating in the hazard zone.*
- *A rapid intervention team/crew is dedicated, assigned, and in place before interior firefighting operations begin and throughout an incident.*
- *Fire department operations include Standard Operating Procedures (SOPs)/Standard Operating Guidelines (SOGs) for attic fires, including those that involve knee walls and void spaces.*
- *Firefighters and fire officers are trained in Mayday operations.*
- *Critical incident benchmarks are communicated to the IC throughout the incident.*
- *ICs immediately establish divisions/groups with a supervisor to communicate conditions and provide accountability.*

*Public Safety Answering Points (PSAPs)/9-1-1 Communications Centers (federal, state, regional/county, and local) should ensure:*

- *Communication SOPs and equipment are in place for dispatchers to support fireground operations and the IC, including the ability to monitor and record all radio traffic during fireground operations.*

# *Volunteer Firefighter Dies after Becoming Lost during a Residential Structure Fire – Pennsylvania*



For further information, visit the program at www.cdc.gov/niosh/firefighters/fffipp/ or call 1-800-CDC-INFO (1-800-232-4636).


1000 FREDERICK LANE, MORGANTOWN, WV 26508 • 304.285.5916

# *Volunteer Firefighter Dies after Becoming Lost during a Residential Structure Fire – Pennsylvania*

## Introduction

On Sunday, July 4, 2021, a 35-year-old volunteer firefighter died after becoming lost and transmitting a Mayday in the attic of a single-family dwelling. NIOSH investigators representing the Fire Fighter Fatality Investigation and Prevention Program (FFFIPP) conducted a field investigation June 10–16, 2022, with the township fire department and involved fire companies. During the field investigation, NIOSH investigators conducted 45 interviews with the fire chief, chief officers, and firefighters who responded to the incident. The NIOSH investigators met with the lead detective from the township police department, the fire department fire marshal, and the fire investigators from the Pennsylvania State Police. NIOSH investigators reviewed the township fire department's SOPs and toured the fire structure (which was in the process of being renovated), the township's fire training center, and the county's dispatch center. NIOSH investigators evaluated Engine 21-2's structural firefighting turnout gear and self-contained breathing apparatus (SCBA). The SCBA was transported to the National Personal Protective Testing Laboratory (NPPTL) in Morgantown, WV for evaluation and testing.

## Fire Department

The township fire department is comprised of seven independent volunteer fire companies and the fire department administrative office. The fire department Operations Division consists of seven firehouses. The fire department serves 63,633 residents across 23.64 square miles in the township and 4,492 residents in a 0.5 square mile area of a neighboring borough. Members of the seven fire companies responded to approximately 2,500 calls for fire suppression, rescue services, and other types of calls in 2021. The township has an Insurance Services Office (ISO) rating of Class 3. The fire companies are staffed by approximately 200 active volunteer firefighters and officers, supplemented by career personnel. All stations have full-time employee (FTE) career firefighters and part time firefighters. At the time of the incident, there were 20 FTEs and 25 part-time employees. Part-time career firefighters work Sundays, the second Saturday of each month, and cover sick/vacation shifts. FTEs can work part-time at another fire company. The department administration consists of the fire chief, four deputy fire marshals, and an administrative assistant.

## Training, Education, and Professional Development

The Commonwealth of Pennsylvania has no mandated training requirements for firefighters. Each fire department is responsible for establishing the training requirements for each position/rank in their department. The fire companies in this township follow the Pennsylvania State Fire Academy curriculum provided through the local Public Safety Training Center. The Pennsylvania State Fire

## *Volunteer Firefighter Dies after Becoming Lost during a Residential Structure Fire – Pennsylvania*

Academy entry level fire training curriculum for new firefighters consists of four courses. These include Level 1: *Introduction to the Fire Service* (16 hours); Level 2: *Fire Ground Support* (32 hours); Level 3: *Exterior Fire Fighter* (40 hours); and Level 4: *Interior Fire Fighter* (48 hours).

Engine 21-2 (deceased firefighter) was a volunteer firefighter who had two years of fire service experience. He completed over 766 hours of training and held numerous certifications as NFPA 1001 Fire Fighter I and Fire Fighter II; and NFPA 1072 Hazmat Awareness. The other fire service training and certifications he completed were related to special operations training (e.g., confined space, rope rescue, etc.).

Deputy 21 (the initial IC) was the volunteer deputy chief of Company 21 who had 25 years of fire service experience. He held certifications as NFPA 1001 Fire Fighter I and Fire Fighter II; NFPA 1041 Fire Service Instructor I; NFPA 1021 Fire Company Officer I; NFPA 1561 Incident Safety Officer. He also completed training and certifications related to fire dynamics, strategy and tactics, incident command, and Mayday operations.

Chief 21 (the IC) was the volunteer fire chief of Company 21 who had 36 years of fire service experience. He completed over 653 hours of training and held numerous certifications as NFPA 1001 Fire Fighter I and Fire Fighter II; NFPA 1041 Fire Service Instructor I; NFPA 1021 Fire Company Officer I; and NFPA 1561 Incident Safety Officer. He also completed training and certifications related to fire dynamics, strategy and tactics, incident command, and Mayday operations.

## Building Construction

The building was a single-family residential occupancy structure built on a slightly sloping accessible lot in a residential setting. Built in 1937, the old colonial style home was classified as frame structure with a combination of a predominate square-stone rubble and ashlar masonry perimeter wall. The structure had integrated exterior perimeter wall wood framing with beveled clapboard siding, and fully dimensional wood frame interior walls. This structure was 2,814 square feet with 1,834 square feet of living space spread over 2½ stories with a full basement.

The 1st floor of the structure consisted of a living room, dining room, and kitchen (**see Diagram 1**). The 2nd floor of the structure consisted of three bedrooms and two bathrooms. There was a 2nd floor door that opened to a wooden deck off the rear of the structure (**see Diagram 2**). The basement was partially finished. A large stone masonry chimney and fireplace were located within the living room and located on Side Bravo of the house. The primary roof over the 2nd floor was a gabled style raftered-constructed roof with a half-story space. Another smaller gabled style raftered-constructed roof was located on the opposite end and consisted of a small, embedded dormer and room. The concealed roof attic space did not have a ½-story space. A single large dormer was framed into the rear roof of the ½-story space with the rear roof having a continuous roof deck.

# *Volunteer Firefighter Dies after Becoming Lost during a Residential Structure Fire – Pennsylvania*

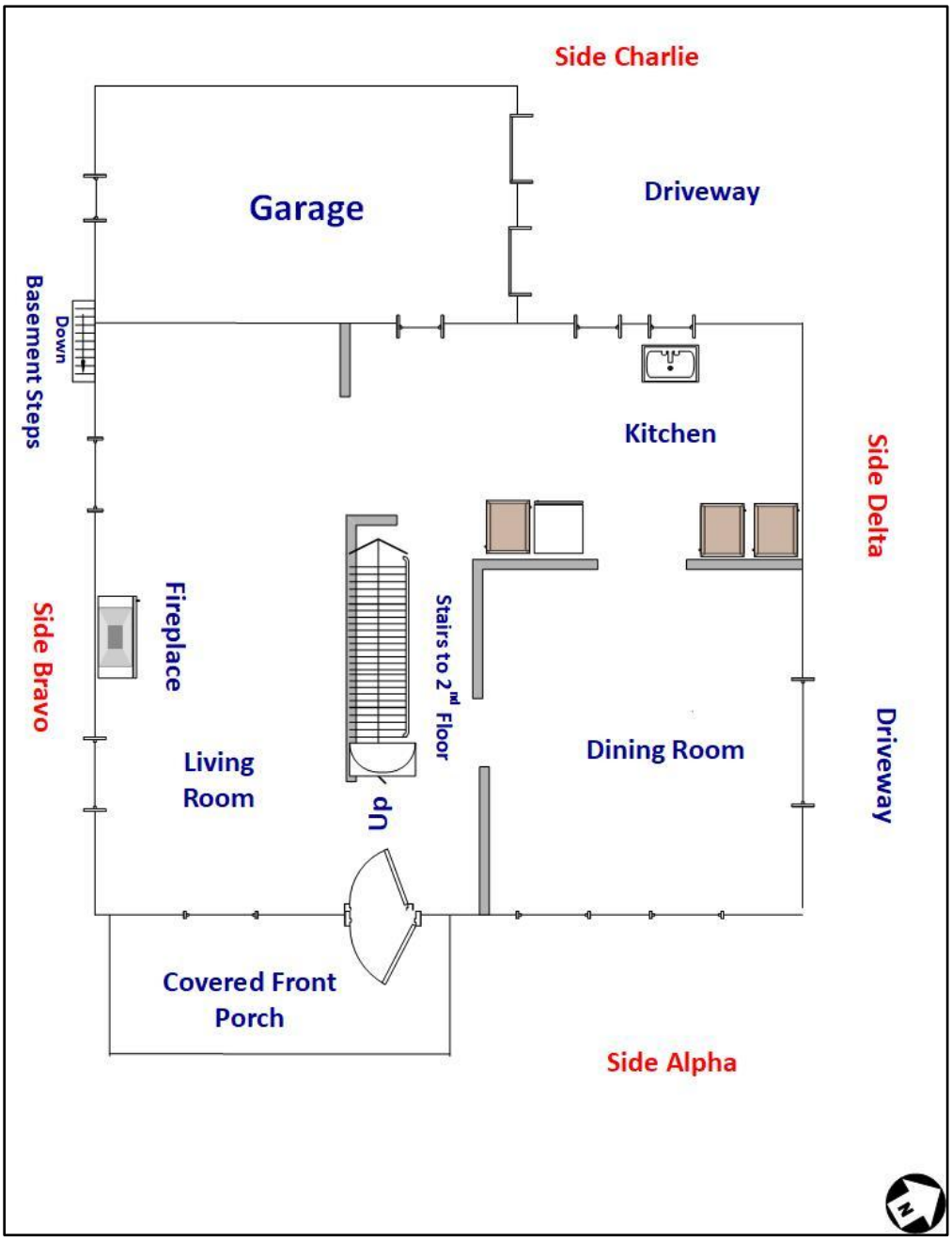


**Diagram 1. The floor plan of the 1st floor of the fire building.**
**(*Prepared by NIOSH*)**

## *Volunteer Firefighter Dies after Becoming Lost during a Residential Structure Fire – Pennsylvania*

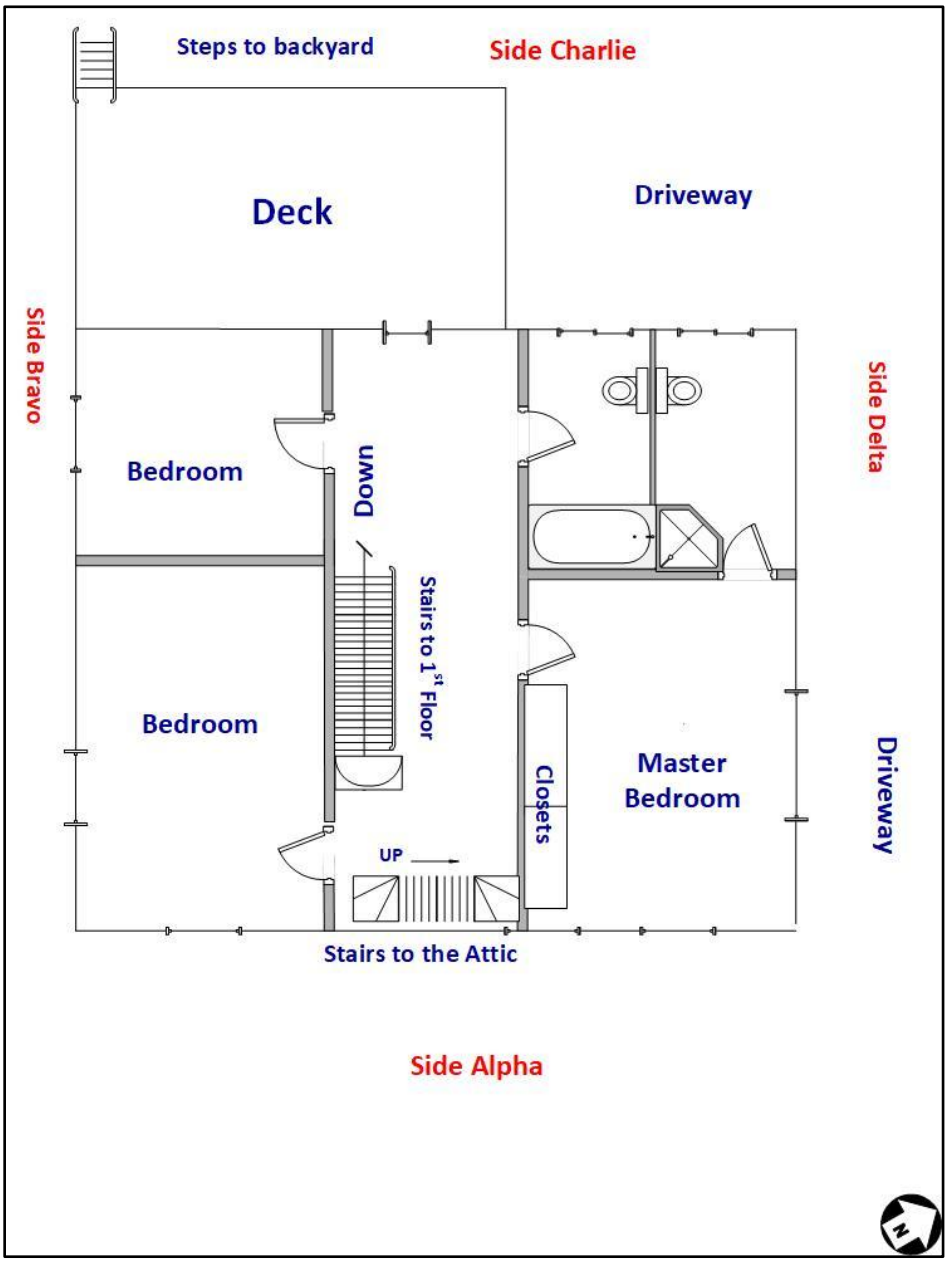


**Diagram 2. The floor plan of the 2nd floor of the fire building.**
**(*Prepared by NIOSH*)**

The attic had been converted into a bedroom with a full bath. An unfinished part of the attic on Side Bravo separated the room by a finished stud wall and half door. There was a closet beside the half door, which was accessed by a full door. A bedroom with a full bathroom was at the northern end (Side Delta) of the structure. The bedroom in the attic was accessed via a "U-shaped staircase **(see Photo 2 and Diagram 3**).

# *Volunteer Firefighter Dies after Becoming Lost during a Residential Structure Fire – Pennsylvania*

**Photo 2. The small bedroom in the attic facing Side Bravo.**
**(*Courtesy of the fire department*)**

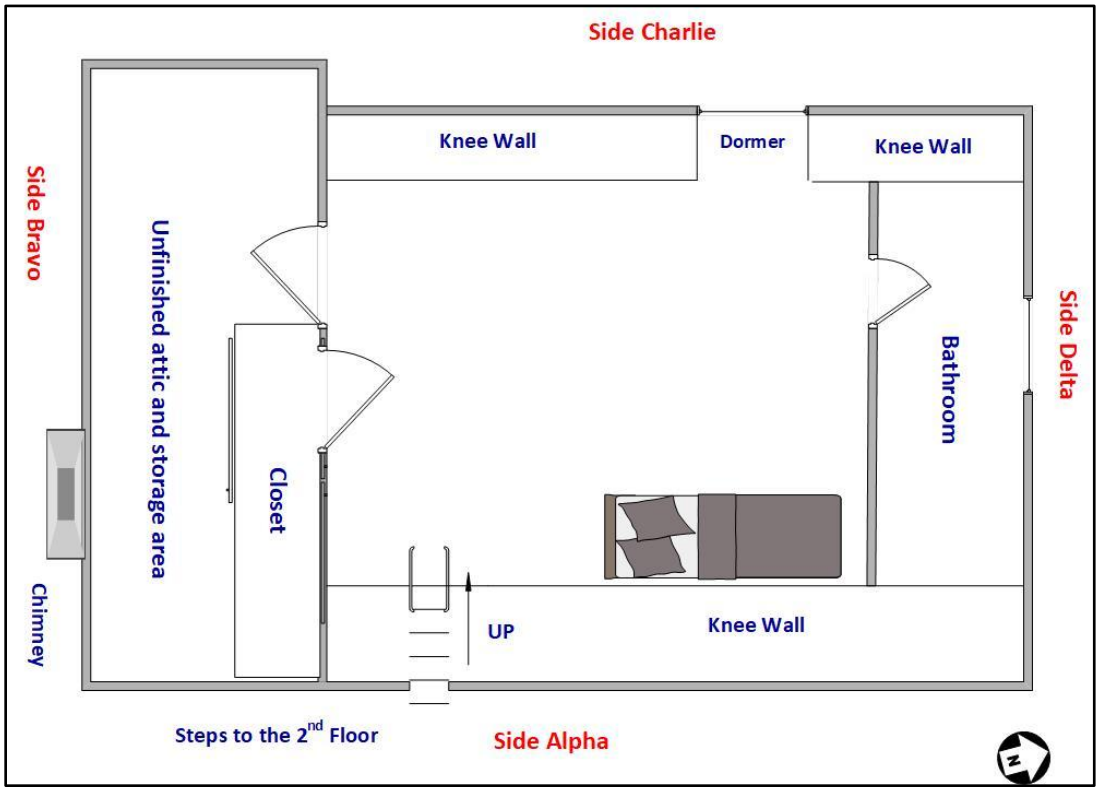


**Diagram 3. The floor plan of the attic of the fire building.**
**(*Prepared by NIOSH*)**

***Volunteer Firefighter Dies after Becoming Lost during a Residential Structure Fire – Pennsylvania***

## Apparatus, Staffing, and Communications

The 1st Alarm assignment for Box 34162 was dispatched at 22:34:21 hours. The following companies were dispatched.

| 1st Alarm | Company |
|---|---|
| Ladder 21 | 21 |
| Engine 21 | 21 |
| Ladder 26 | 26 |
| Engine 26 | 26 |
| Engine 25 | 25 |
| Engine 25-1 | 25 |
| Ladder 28 | 28 |
| Rescue 21 | 21 |

The county's Emergency Communications Division is a Public Safety Answering Point for police, fire, emergency medical services (EMS), and emergency management throughout the county. The Emergency Communications Division has 128 telecommunicators, 12 supervisors, 12 technical staff, and 14 administrative employees. The emergency communications center receives 9-1-1 emergency phone calls placed from locations within the county and receives non-emergency phone calls. The center provides call processing and dispatch services for 92 fire departments, 20 EMS squads, 50 police agencies, and other various county agencies. Four telecommunicators are assigned to fire dispatch on each shift.

Radio communications are maintained through a multi-frequency system, which utilizes transmission and reception equipment located at the communications center and numerous other sites throughout the coverage area. There are 30 radio towers located throughout the county that provide 95% radio coverage. The 800 MHz portable radios are equipped with an emergency alert button (EAB), which operates only channels that connect to a repeater system. Fire apparatus mobile radios are 800 MHz, and chief officers were assigned 800 MHz portable radios. Firefighters of the township fire department were equipped with ultra-high frequency (UHF) portable radios. These UHF portable radios were not equipped with an EAB, and transmissions are not recorded.

## Timeline

Not all incident events are included in this timeline. The times were determined by reviewing the dispatch records, audio recordings, witness statements, the National Fire Incident Reporting System (NFIRS) incident reports, and other available information. This timeline also lists the dispatch communications and fire department response. The timeline lists critical fireground communications and fireground operations.

## *Volunteer Firefighter Dies after Becoming Lost during a Residential Structure Fire – Pennsylvania*

| Time | Fireground Operations, Response, and Details |
|---|---|
| **July 4, 2021** | |
| **22:33 Hours** | • Initial 9-1-1 call received for a fire on the roof. Address given was a house on a street directly behind the actual house on fire. |
| **22:34 Hours** | • Another caller advised Dispatch of the correct address for the actual house on fire.<br>• Dispatch transmitted Box 34162 for a 1st Alarm assignment for a residential structure fire. Ladder 21, Engine 21, Engine 26, Ladder 26, Engine 25-1, and Ladder 28 dispatched. |
| **22:35 Hours** | • Dispatch advised responding companies that the electric panel was sparking, and the roof was on fire.<br>• A 9-1-1 caller confirmed that the house on fire was evacuated. |
| **22:40 Hours** | • Ladder 21 arrived on-scene. |
| **22:41 Hours** | • Ladder 21 reported a 2-story, single family dwelling with heavy smoke showing from the roof.<br>• Deputy Chief 21 assumed IC and requested a working fire dispatch.<br>• Dispatch transmitted the *Working Fire Dispatch* for Box 34162.<br>• Engine 23 (dispatched as rapid intervention crew (RIC)), Engine 24, Rescue 22, and Air 24 dispatched. |
| **22:42 Hours** | • Ladder 21 stretched a 1¾-inch hoseline to attic (PAR 3). |
| **22:43 Hours** | • Ladder 21 reported no visible fire in the attic. |
| **22:44 Hours** | • Engine 21 arrived on-scene. Engine 21 laid a 5-inch supply line from a hydrant to Ladder 21.<br>• Engine 25-1 arrived on-scene. |
| **22:45 Hours** | • Engine 25-1's crew is split per Deputy 25.<br>• Deputy 25 and a firefighter were ordered to vent the roof. Two firefighters from E25-1 were ordered to the attic.<br>• Engine 21-2 firefighter took a 20-foot ladder off Ladder 21 and went to Side Charlie.<br>• Engine 26 arrived on-scene and ordered to stretch a 1¾-inch hoseline to Side Charlie.<br>• Ladder 28 arrived on-scene and ordered to vent the roof from Side Charlie. |
| **22:46 Hours** | • Rescue 21 arrived on-scene. |

## *Volunteer Firefighter Dies after Becoming Lost during a Residential Structure Fire – Pennsylvania*

| Time | Fireground Operations, Response, and Details |
|---|---|
| | • Chief 21 advised Dispatch that Chief 21 had assumed IC. Deputy 21 was assigned Operations. Chief 21 advised all companies that he was IC. |
| **22:48 Hours** | • Engine 25-1 firefighters exited the structure. Due to the number of firefighters on the 2nd floor, the E25-1 firefighters were reassigned to help vent the roof with other members of E25-1.<br>• Chief of the Department arrived on-scene and received a briefing from IC. |
| **22:49 Hours** | • Rescue 22 (PAR 8) arrived on-scene and assigned by Operations to hook the ceilings on the 2nd floor and the attic. The crew of Rescue 22 was split to accomplish both. |
| **22:51 Hours** | • Engine 25 arrived on-scene and assigned to tasks on the outside of the house.<br>• Ladder 26 arrived on-scene.<br>• The officer of Ladder 26 assumed the role of resource status. Two firefighters from Ladder 26 remained at the apparatus. Two firefighters were assigned to the attic by Operations.<br>• The other firefighter was assigned with Engine 21-2 to go to the attic.<br>• Chief 25 arrived on-scene and reported to the command post. |
| **22:53 Hours** | • The initial attack crew (a lieutenant and two firefighters) from Ladder 21 exited the structure through the front door.<br>• Engine 24 arrived on-scene and assigned by IC to Side Charlie to assist Ladder 28 with venting the roof. |
| **22:55 Hours** | • Two firefighters from Ladder 26 and Engine 21-2 entered the house through the front door. One of the Ladder 26 firefighters did not enter due to SCBA issues.<br>• ***15 minutes into the incident.*** |
| **22:56 Hours** | • Pipeline 28 arrived on-scene.<br>• Engine 23 arrived on-scene. |
| **22:58 Hours** | • Engine 21-2 transmitted that there was dense smoke and high heat in the attic. Engine 21-2 and a firefighter from Ladder 26 entered the unfinished area of the attic.<br>• A firefighter from Engine 24 was operating off a ground ladder at the rear dormer window. The firefighter opened the roof at the knee wall and encountered visible fire. The firefighter started knocking down fire with a hoseline from his position. |
| **22:59 Hours** | • Rescue 22 entered the structure. |

## *Volunteer Firefighter Dies after Becoming Lost during a Residential Structure Fire – Pennsylvania*

| Time | Fireground Operations, Response, and Details |
|---|---|
| | ○ An assistant chief and lieutenant from Rescue 22 went to the attic.<br>○ A captain and two firefighters from Rescue 22 went to the 2nd floor. |
| **23:00 Hours** | • Engine 21-2 called a Mayday. |
| **23:01 Hours** | • The assistant chief and lieutenant from Rescue 22 made it to the attic.<br>○ The assistant chief called out, but there was no response.<br>○ They found the hoseline in the attic, but no one was on the nozzle. |
| **23:02 Hours** | • Engine 21-2 makes an additional radio transmission stating he was by the chimney on Side Bravo.<br>• The transmission is missed by everyone on the fireground except for Rescue 22's driver, who walks across the front yard and tells Chief of the Department that the firefighter said he is on Side Bravo by the chimney. |
| **23:03 Hours** | • Rescue 22 backed down the stairs to the 2nd floor.<br>○ They met with Deputy 21 about the Mayday. |
| **23:04 Hours** | • Rescue 22 entered the attic.<br>○ Fire was coming out of the half door opening.<br>○ Crews try to block the fire with an unknown object.<br>○ A member of Rescue 22 flowed water into the half door opening in order to keep the fire from entering the room. |
| **23:05 Hours** | • The assistant chief from Rescue 22 called for silence. An EOSTI was heard sounding in the unfinished area of the attic. |
| **23:06 Hours** | • Two members of Rescue 22 and a member of Engine 23 initiated the rescue of Engine 21-2.<br>○ Multiple members of Engine 23 staged on the attic stairs. |
| **23:08 Hours** | • Multiple members of Rescue 22 and Engine 23 moved Engine 21-2 to the 2nd floor. |
| **23:09 Hours** | • Engine 21-2 moved to the 1st floor and out of the house. |
| **23:10 Hours** | • ***30 minutes into the incident.*** |
| **23:12 Hours** | • Engine 21-2 treated by fire and EMS members on the front lawn. |
| **23:25 Hours** | • ***45 minutes into the incident.*** |

## *Volunteer Firefighter Dies after Becoming Lost during a Residential Structure Fire – Pennsylvania*

| Time | Fireground Operations, Response, and Details |
|---|---|
| **23:37 Hours** | • Engine 21-2 transported to the local trauma center. |
| **July 5, 2021** | |
| **00:05 Hours** | • IC advised Dispatch that the fire was extinguished. |
| **01:49 Hours** | • All fire companies cleared the scene |

# Personal Protective Equipment

At the time of the incident, Engine 21-2 was wearing structural firefighting turnout gear plus his SCBA. On June 13, 2022, NIOSH investigators evaluated the structural protective ensemble and SCBA. The protective hood and left-hand glove had no visible thermal damage. The turnout coat sustained thermal damage to the left shoulder area, right shoulder area, and the right front around the pocket. The drag rescue device was not deployed. The turnout pants had no visible heat damage. Both pant legs were cut open during patient care. The firefighter was also wearing a radio pouch with a strap with a Motorola UHF portable radio, which was still operational. The structural firefighting turnout gear was not considered a contributing factor to the fatality in this incident. NIOSH investigators conducted no further evaluation or testing of the turnout gear.

The firefighter was wearing a NIOSH Approved® MSA Model G1, 30-minute, 4500 psi SCBA. The SCBA was taken to NIOSH's NPPTL in Morgantown, West Virginia for evaluation and testing. Testing was conducted on June 30, 2022, and July 12, 2022. NIOSH determined that there was no need for corrective action with regards to the approval holder or users of SCBAs manufactured under the approval numbers granted to these products [NIOSH 2022a]. The evaluation, NPPTL Report Number TN-25965, is available on the NIOSH website.

# Weather Conditions

At 21:54 hours, the weather was fair with an approximate temperature of 73°F. The dew point was 65°F and the relative humidity was 76%. The winds were calm and there had been a trace of precipitation in the last six hours [Weather Underground 2021].

# Investigation

At 22:33 hours, the county Emergency Communications Division received a 9-1-1 call for a house on fire. The initial reported address was for a house directly behind the house on fire. Approximately one minute later, a 9-1-1 caller advised the correct address for the house on fire. The county fire dispatcher transmitted a 1st Alarm Assignment for Box 34162 at 22:33 hours with a report of a roof on fire. Ladder 21, Engine 21, Engine 26, Ladder 26, Engine 25-1, and Ladder 28 were dispatched. At 22:35 hours, Dispatch advised responding companies that the electrical panel was sparking and the roof was on fire.

## *Volunteer Firefighter Dies after Becoming Lost during a Residential Structure Fire – Pennsylvania*

Ladder 21 arrived on-scene at 22:40 hours and advised Dispatch they had a single-family dwelling, 2-story, Type V construction, with heavy black smoke pushing from the attic windows. Small flames were also visible in the soffit of the Side Charlie/Side Delta corner. Deputy 21 was the officer in charge of Ladder 21 and assumed IC. He requested a working fire dispatch. At 22:41 hours, Dispatch transmitted a *Working Fire Dispatch* for Box 34162 with the following companies dispatched: Engine 23 (dispatched as RIC), Engine 24, Rescue 22, and Air 24.

Ladder 21 stretched a 1¾-inch hoseline (PAR 3) to the interior, making their way to the attic to locate the fire. Engine 21 responded with Chief 21 (chauffeur), Engine 21-1, and Engine 21-2 (deceased firefighter). Engine 21 arrived on-scene at 22:44 hours. Engine 21 laid a 5-inch supply line from a hydrant to Ladder 21. Engine 21-2 made the hydrant connection, charged the supply line, and then walked the supply line. Engine 21-1 joined Ladder 21's crew. Chief 21 assumed IC at approximately 22:46 hours. Deputy 21 was assigned as Operations and remained outside in the driveway. Ladder 21-1 radioed to Operations that they had heavy heat and smoke conditions in the attic, but could not locate the fire.

Once Engine 21-2 got to Engine 21, he was assigned to throw ground ladders to the 2nd floor on Side Alpha. Engine 21-1 went to the attic and worked with Ladder 21 (PAR 4). The chauffeur of Engine 21 was Chief 21. Chief 21 helped the chauffeur of Ladder 21 establish a water supply for Ladder 21.

Engine 25-1 (PAR 6) arrived on-scene at 22:44 hours and split their crew. Two firefighters were assigned to vent the roof via Ladder 21's aerial. Two firefighters from Ladder 26 joined Engine 21-2 and were assigned to firefighting operations in the attic. Deputy 25 and a firefighter went to the roof via Ladder 21's aerial. They vented the roof on Side Alpha on the roofline with two vent holes while working off the aerial of Ladder 21.

Engine 24's crew was directed to the rear of the building to assist with opening the roof and pulled the second 1¾-inch hoseline. At the 20-minute mark, IC reported to Dispatch a working attic fire with two hoselines in service. At 22:45 hours, Ladder 28 arrived on-scene and parked nose-to nose to Ladder 21. Ladder 28 took an assortment of ground ladders from Ladder 21 and laddered Side Delta to gain access to the roof. Side Charlie was laddered to gain access to the roof, 2nd floor, and a window to the attic. Side Alpha was laddered with the aerial ladders from Ladder 21 and Ladder 28. The crews from Engine 25-1 cut two 4ft x 4ft ventilation holes in the roof on Side Alpha. Heavy smoke was pushing out of the ventilation holes and the roof became spongy and conditions were deteriorating. Ladder 28 was removed from the roof. At 22:48 hours, two members of Engine 25-1 entered the house and went to the 2nd floor and met Engine 21-1 and Ladder 21 on the stairs to the attic. Due to the number of firefighters in this area, the two firefighters from Engine 25-1 left the 2nd floor and exited the house. Chief of the Department arrived on-scene and met with IC.

At 22:49 hours, Rescue 22 arrived on-scene and were PAR 8, which included two junior firefighters. Before exiting, Ladder 21 firefighters found heat in the unfinished section of the attic behind the half door. The lieutenant from Ladder 21 was using the thermal imager but the screen malfunctioned and went blank. The knee wall on Side Charlie of the attic was very hot. The crew used a 1¾-inch hoseline to cool the knee wall, but it quickly heated up again. The crew checked the unfinished area again and

## *Volunteer Firefighter Dies after Becoming Lost during a Residential Structure Fire – Pennsylvania*

flowed water, but the heat came back. The smoke in this area turned from grey to black. The attic was getting very hot with no fire showing. The crew of Ladder 21 left the attic and took the hoseline to the 2nd floor. Ladder 21 was out of the house, but Engine 21-1 was still inside on the second floor at 22:53 hours.

At approximately 22:55 hours, Engine 21-2 plus two firefighters from Ladder 26 started to enter the house through the front door and go to the attic. One firefighter from Ladder 26 had an issue with his SCBA and never entered the house. The two firefighters took the hoseline on the 2nd floor to the attic. At 22:57 hours, Engine 21-1 exited the structure. Ladder 26 firefighter walked down the steps to fix his hood before they went into the unfinished attic space. He realized he had an issue with his hood the moment he got onto the third floor, walked back downstairs, fixed it and reentered the third floor. At 22:58 hours, Engine 21-2 radioed IC that there was heavy thick smoke and high heat in the attic. At this time, Engine 21-2 and Ladder 26 firefighter crawled into the unfinished area of the attic. At 22:59 hours, Rescue 22 was split with a captain and two firefighters going to the 2nd floor and an assistant chief and lieutenant going to the attic (**see Diagram 4**).

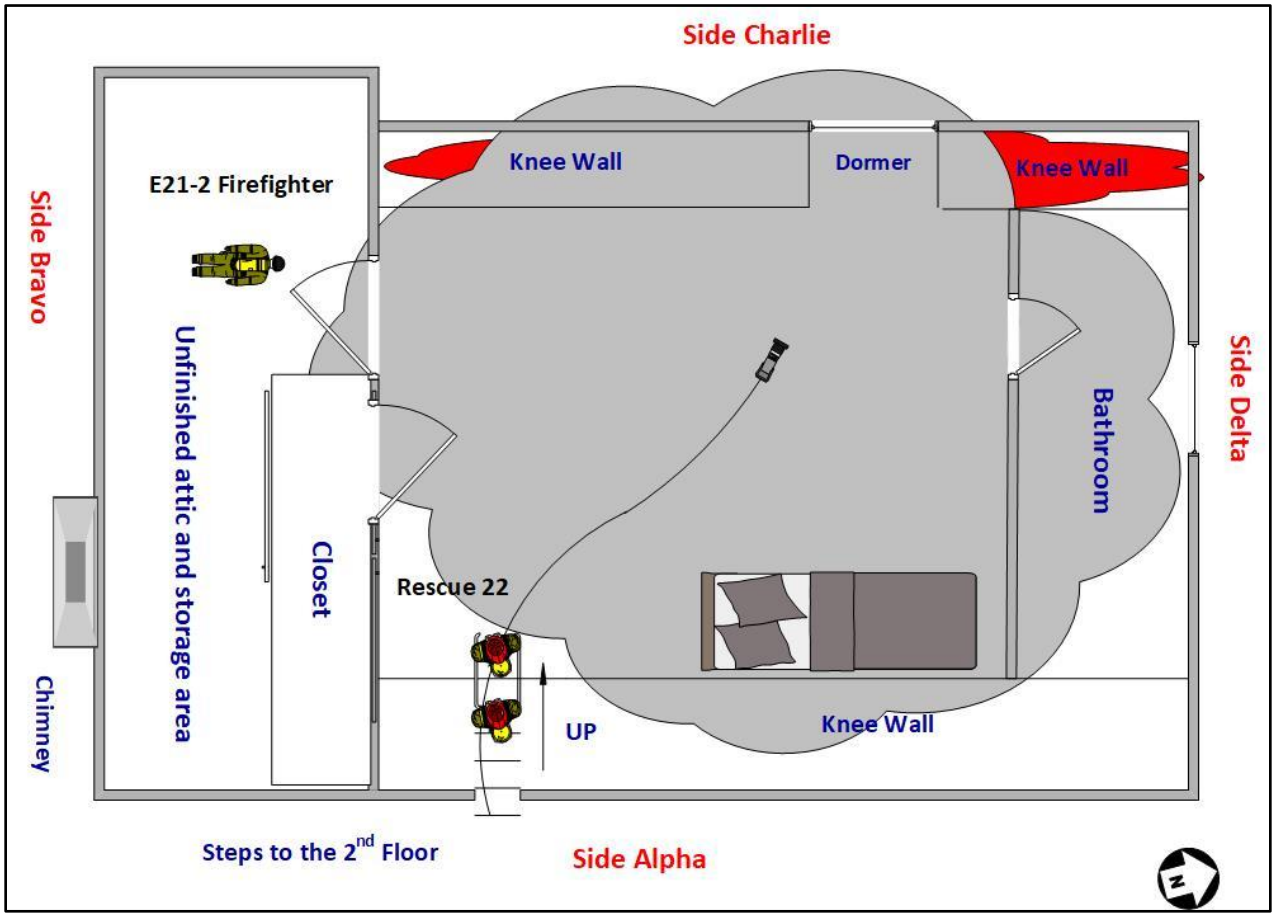


**Diagram 4. Location of Engine 21-2 in the unfinished area of the attic.**
**(*Prepared by NIOSH*)**

## *Volunteer Firefighter Dies after Becoming Lost during a Residential Structure Fire – Pennsylvania*

At approximately 23:00 hours, Engine 21-2 transmitted a Mayday over UHF Channel 7. Engine 21-2 had been inside the structure approximately five minutes before calling the Mayday. After the Mayday was transmitted, Engine 21-2 radioed he was on Side Bravo near the chimney. This would have placed him in the unfinished area of the attic. Chief 21 was still in IC. IC assigned Chief of the Department to manage the Mayday. All fireground operations were assigned to UHF Channel 1 and the Mayday remained on Channel 7.

A crew from Rescue 22 made it to the top of the attic steps when the Mayday was transmitted. There was high heat and zero visibility but no visible fire in the attic. There was a 1¾-inch hoseline in the attic, but no one was staffing the hoseline. They called for the fire fighter, but there was no answer. The assistant chief of Rescue 22 backed down the stairs to the 2nd floor. He talked with Operations (Deputy 21) about the Mayday. At 23:04 hours, the assistant chief and three firefighters from Rescue 22 went back in the attic, where fire was showing from the unfinished area. At 23:05 hours, a firefighter from Engine 23 went to the attic. The assistant chief from Rescue 22 called for quiet. An SCBA EOSTI was sounding from the unfinished attic area. They found Engine 21-2 facing towards the half-door. At 23:06 hours, the crew in the attic initiated the rescue of Engine 21-2. At 23:08 hours, the crew had Engine 21-2 out of the unfinished attic area and to the 2nd floor. At 23:09 hours, the crew had Engine 21-2 on the 1st floor and then out of the house.

The Mayday was cleared at 23:14 hours by IC. Chief of the Department assumed IC of Box 34162 at 23:19 hours. Engine 21-2, who was conscious, was treated on scene by fire and EMS and then transported to the local trauma center at 23:37 hours. IC advised Dispatch the fire was knocked down at 00:05 hours on July 5. Engine 21-2 was declared deceased at 00:54 hours. At 01:49 hours on July 5, all fire companies cleared the scene.

## Fire Origin and Cause

The fire origin and cause investigation were conducted by the fire department's fire marshal office, local law enforcement, the Bureau of Alcohol, Tobacco, Firearms and Explosives, Pennsylvania State Police, and the county district attorney's office. The investigation included an examination of the fire scene and interviews of the occupants, firefighters, and law enforcement. The fire originated on the exterior, in and around the east wall, Side Alpha/Bravo corner. The fire cause was classified as accidental.

## 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 an injury or fatality. NIOSH investigators identified the following items as key contributing factors in this incident that ultimately led to the fatality:

- Scene size-up and risk assessment
- Personnel accountability system
- Crew integrity
- Attic fire into knee walls and void spaces
- Mayday operations

- Rapid intervention crew/team
- Communicating critical incident benchmarks
- Incident command
- Communications

## Cause of Death

According to the county's Office of the Coroner, an examination was performed on Engine 21-2. The cause of death was listed as multiple thermal burns plus smoke and soot inhalation. The manner of death was accidental.

## Recommendations

Fire departments should ensure:

***Recommendation #1: Initial and ongoing size-ups and risk assessments are conducted throughout the incident.***

Discussion: At this incident, a complete 360-degree size-up and risk assessment were not conducted. This information was not included in the initial radio report.

Continuous communication supports effective risk assessments. It also allows the IC and all personnel operating at an incident to be aware of changing conditions and adjust to avoid hazards or mitigate risks. A 360-degree is an important component of the scene size-up and can be used in the risk assessment. The International Association of Fire Chiefs' Rules of Engagement for Structural Firefighting recommends that the first rule for ICs is to rapidly conduct or obtain a 360-degree situational size-up of the incident. Many incidents contain obstacles that prevent the viewing of all sides of a structure. When 360-degree reconnaissance is achieved, it provides the IC and personnel knowledge of the building layout, construction, access/egress points, fire location and direction of spread, and obstacles or hazards [NIOSH 2017].

A dedicated incident safety officer (ISO) can perform initial and ongoing size-ups throughout the incident. Expectations and authority for the ISO include determining hazardous incident conditions, advising the IC to modify control zones or tactics to address corresponding hazards, communicating fire behavior and forecasting growth, and estimating building/structural collapse hazards. The ISO also has the authority to stop or suspend incident operations based on imminent threats to firefighter safety [NFPA 1550 2024]. The ISO should be separate from the IC, operations, or accountability positions so they can focus on their responsibilities and the primary objective of continually assessing all on-scene hazards to firefighter life and safety [NIOSH 2025].

***Recommendation #2: Use of a functional personnel accountability system to identify the location and function of all personnel operating at an incident.***

## *Volunteer Firefighter Dies after Becoming Lost during a Residential Structure Fire – Pennsylvania*

Discussion: In this incident, there were multiple crews that reassigned themselves to various tasks or assignments. This was not communicated to the IC nor were crews accounted for during fireground operations.

A personnel accountability system is a system that readily identifies both the location and function of all members operating at an incident scene [NFPA 1550, 2024]. This system is implemented during an incident to collect and maintain the status and location of the resources working in, or potentially working in, an immediately dangerous to life and health (IDLH) environment. All members operating at an incident are responsible for understanding and participating in this system. The IC is responsible for but may delegate certain responsibilities to another person such as the ISO. An integral part of the accountability system is to make sure that the firefighters who are assigned and operating in the hazard zone are accounted for throughout the incident. A properly initiated and enforced personnel accountability system can help support firefighter safety and survival [NIOSH 2024]. A robust functional personnel accountability system can identify:

- Members operating in the hazard zone
- Where members are in the hazard zone
- Conditions in the hazard zone
- Actions used in the hazard zone
- Paths of access and egress in and out of the hazard zone (i.e., exits)
- RICs and their assignments

Additional methods and tools are also available for resource accountability, including:

- Tactical worksheets
- Command boards
- Apparatus riding lists
- Company responding boards
- Electronic bar-coding systems
- Accountability tags or keys

***Recommendation #3: Company officers and firefighters maintain crew integrity when operating in the hazard zone.***

Crew integrity is essential to fireground accountability. NFPA 1550, *Standard for Emergency Responder Health and Safety*, states in Paragraph 10.5.6 that company officers shall maintain an ongoing awareness of the location and condition of all company members. Paragraph 10.5.7 states that, where assigned as a company, members shall be responsible to remain under the supervision of their assigned company officer [NFPA 1550 2024]. It is the responsibility of every firefighter and company officer to always stay in communication or contact with crew members by visual observation, voice, or touch while operating in the hazard zone. All firefighters should maintain the unity of command by operating under the direction of their company officer. The ultimate responsibility for crew integrity

and ensuring no members get separated or lost rests with the company officer. A Mayday should be called if any member cannot be accounted for during a personnel accountability report [NIOSH 2024].

The International Association of Fire Chiefs' Safety, Health, and Survival Section redefined the Rules of Engagement for Structural Fire Fighting. One of the objectives is for firefighters to enter a burning building as a team of two or more members and another is that no firefighter be alone at any time while operating in or exiting a building. These objectives align with the definition of crew integrity (i.e., staying together as a team of two or more) [IAFC 2012].

***Recommendation #4: A rapid intervention team/crew is dedicated, assigned, and in place before interior firefighting operations begin and throughout an incident.***

Discussion**:** Rescue 22 rescued Engine 21-2 from the unfinished section of the attic. Engine 23 was initially dispatched as RIC, and they arrived on-scene just as the Mayday was declared.

Effective RIC operations are dependent on proactive efforts. Upon arrival, the RIC officer, accompanied by one member of the RIC, will get a report from the IC and then should perform an incident scene survey while the remaining RIC members assemble the RIC equipment. During the 360-degree survey, the RIC officer and members should look for ways in and out of the structure, including window configurations, fire escapes, and construction features. The RIC officer should note the feasibility for placement of ground ladders for rescue or escape purposes. The RIC officer has a responsibility to set up and secure a suitable secondary egress for interior crews [Rowett 2018; Toledo Fire & Rescue Department 2012]. After these tasks are completed, the RIC equipment is put in place and the RIC officer informs the IC that a 360-degree survey is complete and the RIC is ready to intervene, if necessary. The entire RIC should stay in an area immediately accessible to the building for rapid deployment and maintain radio contact with the IC. The RIC officer should brief all RIC members with the results of the incident scene survey [Toledo Fire & Rescue Department 2012]. The RIC officer and members coordinate with the IC to formulate rescue plan contingencies and to monitor radio and fireground conditions. RIC 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 IC [NIOSH 2024; NFPA 1407 2020].

***Recommendation #5: Fire department operations include SOPs/SOGs for attic fires, including those that involve knee walls and void spaces.***

Discussion: At this incident fire attack and roof ventilation were not coordinated. Roof ventilation occurred before water was on the fire from the exterior and interior. Due to the construction of the roof, this allowed the fire to be better ventilated. NFPA 1700 includes validated research on fighting fires in single family dwellings that have attics and knee walls.

Using the attic of a structure for living space creates unique compartmentation not found on lower levels of a residential structure. The interior living space is surrounded on multiple sides by void spaces separated only by drywall and possibly insulation during a structure fire, it is

possible for fire to enter void spaces and surround crews conducting interior operations before they notice a rise in temperatures or see any signs of fire.

Any penetration into the void space from the interior creates a flow path, allowing fire to spread into the interior and exposing the crews. This fire spread may not occur immediately following the opening of the wall or ceiling, as the void space fire is likely ventilation limited. Thus, firefighters may breach a separation and then continue further into the structure. Even though there is a delay between making the breach and the change in conditions, once initiated, the transition to untenable conditions in the area of operation occurs in seconds. The location of the attic creates several difficulties for the fire service. Firefighters must decide whether to fight the fire from inside the structure, from the outside, or a combination of the two. Fires in attic space can be challenging to attack due to specific design and construction features of various types of residential design. Attic spaces are common throughout the United States and present unique challenges to the fire service. Specifically, the presence of knee walls and collar ties create void spaces for fire to travel around [Kerber and Zevotek 2014].

NFPA 1700, *Guide on Structural Fire Fighting* defines a knee wall "as a short wall, typically under 3-ft (1 meter) in height, used to create a room, such as a living space within an attic, and whose creation results in a void space behind the knee wall and the underside of the roof" [NFPA 1700 2021]. Knee wall construction often provides the potential for ideal fire growth, with air entering low at the eave line and combustion gases exiting the peak through mushroom vents, ridge vents or gable vents. Due to the roof construction at this residence, the fire was not vent limited. At the same time, the relatively large open space behind the knee wall allows for the heating of large amounts of fuel to near its ignition point. Subsequent ventilation, either by breaching the interior barrier or by venting at the roof, provides the necessary flow path to rapidly grow the fire to flashover. When the barrier between the void spaces and the occupied space fails or is breached, crews operating on the interior may find themselves trapped between the new flow path and their means of egress. Conditions change even more rapidly if windows in the attic are opened or taken out, a common tactic employed to improve visibility and assist the crews in locating the fire and/or victims. Open windows provide even more air to mix with and ignite the rich fuel coming out of the knee walls [Kerber and Zevotek 2014].

The most effective water application takes into consideration the construction of the attic, using the natural channels created by the rafters or trusses to direct the water onto most of the surfaces. Application of water through open eaves along the entire eave line allows water to impact over 2/3 of the attic space. The same tactical concept can be used when solid eaves are encountered, or an interior stream placement is chosen. Opening a trough along this wall exposes the roof deck in much the same way as opening up the eaves. Applying water utilizing the same path the fire took to enter the void space may be the most effective method at slowing fire growth. If the fire starts on the outside of the structure or enters the knee wall due to auto exposure through an exterior window, a successful fire attack will rely on controlling the source fire. Water application to the knee wall will not be effective until the source below it is controlled with direct water application. Once the source fire is controlled, crews can more readily and safely gain access to the void spaces, extinguishing any active fire in the void and wetting all exposed surfaces. This method prevents regrowth of the fire [Kerber and Zevotek 2014].

## *Volunteer Firefighter Dies after Becoming Lost during a Residential Structure Fire – Pennsylvania*

Removing the soffit and flowing water along the eave line of these structures is the most effective way to gain the upper hand on a fire that is venting through the roof. After the fire ventilates through the roof, increased air is entrained through the eaves and burning is increased. An eave attack puts water on these burning surfaces by flowing it up one side of the attic to the peak, and then running down the other side. As water wets the sheathing, it also rains down on the burning gases and other burning contents in the attic, extinguishing even more fire.

***Recommendation #6: Firefighters and fire officers are trained in Mayday operations.***

Firefighters should be trained and have confidence in how to call a Mayday when in danger [IAFF 2010]. Any delay in calling a Mayday reduces the chance of survival and increases the risk to other firefighters trying to rescue the "downed" firefighter. When a Mayday is transmitted, ICs have a narrow window of opportunity to locate the lost, trapped, or injured member(s). The IC needs to restructure the strategy and tactics to include a priority rescue [NFPA 1550 2024]. A Mayday tactical worksheet can serve as a tailored guide to any fire department's Mayday procedures such as a reminder to prompt the firefighter to activate their emergency alert button (EAB) for priority radio transmissions and other important items such as personal alert safety system (PASS) activation, air status, and location information. Such a worksheet can be easily located on the back of a tactical worksheet to assist ICs in taking the necessary steps to clear the Mayday as quickly and safely as possible. This process is too important to operate from memory and risk missing a vital step that could jeopardize rescuing a firefighter who is missing, trapped, or injured [IAFF 2010; NIOSH 2024].

***Recommendation #7: Critical incident benchmarks are communicated to the IC throughout the incident.***

Fireground benchmarks are an essential element for accomplishing successful and safe outcomes. To ensure that the proper benchmarks are communicated at fireground incidents, fire departments should develop and maintain a consistent process for communicating critical benchmarks in the form of an SOP/SOG. The SOP/SOG should include effective hands-on classroom and practical training programs with annual live fire training, a defined department deployment model, an effective incident management system, adequate radio equipment (mobile and portable radios), and adequate radio channels (dispatch, tactical, and command channels) [NIOSH 2014a, NIOSH 2014b, NIOSH 2015, NIOSH 2018; NIOSH 2025b].

The first arriving fire department resource initiates the incident command process by giving a brief initial report. It is the responsibility of every firefighter to stay connected with crew members. Freelancing by any member, crew, or company is strictly prohibited. The ultimate responsibility for crew integrity and ensuring no members get separated or lost rests with the company officer, who maintains constant contact with their assigned members by visual observation, voice, or touch while operating in a hazard zone. If any of these elements are not adhered to, crew integrity is lost, and firefighters are placed at great risk. A company officer can track personnel in smoky conditions by calling out to crew members. This becomes necessary when conducting a PAR. Because it is possible to have crew members with the same first name, it is best to use the member's last name [NIOSH 2025b].

## *Volunteer Firefighter Dies after Becoming Lost during a Residential Structure Fire – Pennsylvania*

Because the IC is located at the Command Post (outside the hazard zone), interior crews should communicate the interior conditions to the IC as soon as possible. Interior conditions can change the IC's strategy and incident action. Interior crews can aid the IC in this process by providing reports of the interior conditions as soon as they enter the fire building and by providing regular updates, especially when benchmarks are met (e.g., "primary search complete, all clear" and "the fire has been knocked down"). Communication of critical incident factors and their possible consequences offer the basis for a standard incident management approach. Such an approach is the launching pad for effective incident decision making and successful operational performance. ICs should use the critical factors in their order of importance, as the basis for making the specific assignments that make up the incident action plan. ICs should not assume the action-oriented responders engaged in operational activities will stop what they are doing so they can feed the IC with a continuous supply of top-grade, objective information. It is the IC's responsibility to do whatever is required to stay informed [Brunacini 2002; NIOSH 2025b].

***Recommendation #8: Ensure ICs immediately establish divisions/groups with a supervisor to communicate conditions and provide accountability.***

Discussion: Within a division/group, firefighters advise their supervisor of work progress and provide accountability for crew members engaging in task level activities. The IC should assign divisions/groups to a supervisor early. This is especially important when firefighters are operating from tactical positions that the IC has little or no direct control over (e.g., out of sight). All requests for additional resources or assistance within a division/group are directed to the supervisor who is responsible for communicating with the IC. Supervisors can provide ongoing conditions, actions, needs (CAN) reports to the IC of all four sides and the interior of an incident which may influence tactics and strategy [SKCFTC 2023]. Division/group supervisors can also assist in providing personnel accountability reports when requested by the IC, ISO, or operations. When the IC does not establish divisions/groups with a supervisor, firefighters should follow established fireground operations reporting procedures while operating in the incident and hazard zone [NIOSH 2025a].

PSAPs/9-1-1 Communications Centers (federal, state, regional/county, and local) should ensure:

***Recommendation #9: Communication SOPs and equipment are in place for dispatchers to support fireground operations and the IC, including the ability to monitor and record all radio traffic during fireground operations.***

Effective fireground radio communication is an important tool to ensure fireground command and control as well as helping to enhance fire fighter safety and health. The radio system must be dependable, consistent, and functional to ensure that effective communications are maintained, especially during emergency incidents. There are several ways to ensure that the incident commander can effectively manage fireground communications. One solution is to have a trained dispatcher monitoring the fireground radio channel. It is suggested that dispatchers meet the requirements of NFPA 1225, *Standard for Emergency Services Communications*. The dispatcher is in a secure environment, isolated from fireground distractions and noise and usually has access to playback technology to listen to hard-to-understand messages. This is dependent upon the ability to monitor and

record all radio traffic. The dispatcher should also have access to "identifier" information, which identifies the portable radio making the transmission [NIOSH 2017b; NIOSH 2022b]. PSAPs/9-1-1 Communications Centers should work with fire departments to ensure integrated operations and procedures that utilize their equipment and abilities.

## Post-Incident Fire Department Prevention Actions

After this incident, the fire department implemented changes to fireground operations. These changes were based on the department's after-action review and critique of fireground operations at Box 34162 on July 4–5, 2021.

- **Accountability:** The fire department training committee created a presentation on the department's accountability system to ensure all firefighters understand the challenges of adapting to a new personnel accountability system, explain the various roles in using the Passport Accountability System, and ensure that all firefighters understand their role in effective firefighter accountability while at the incident scene.
- **Regional Incident Command System:** The fire department training committee developed and presented to all fire companies in their region on the regional incident command system. The emphasis was to ensure that strategic level operations for local level response are consistent with the incident management SOP for Type V and Type IV incidents. Broadcasting the assumption of command notifies all resources who the incident commander is and their level of involvement in the tactical operation. This process stresses common terminology including building levels and supervisory positions.
- **Regional Low-Rise Response Procedure:** This new procedure was presented to the fire chiefs in all fire companies. The Regional Low-Rise Response procedure is for structures up to seven stories or 75 feet in height and includes commercial and non-commercial structures. As a part of this procedure, the fire department developed an assignment for the 3$^{rd}$ due engine serving as RIC on initial dispatch, followed by the 5$^{th}$ due company as RIC on a confirmed working fire, and an extra RIC company being dispatched as support.
- **Incident Command/Command by Committee:** This new procedure was presented to the fire chiefs in all fire companies. Company Chief Officers now respond on all buildings to assist with incident command. The command post is staffed with multiple Chief officers to assist the IC with Communications (Communications Aid), Accountability (Resource Aid), and 360-degree scene reports (Recon Aid).
- **Radio Communications:** The fire department migrated to the county 800 Mhz radio system for all fireground operations. Their updated Communications Policy specifies primary operations traffic take place on monitored and repeated channels.
- **Memorandum of Understanding (MOU):** Since this incident, the fire department and fire companies have implemented an MOU. The MOU details terms and conditions in performing fire services within the township, and incorporation of a strategic plan. The MOU is one of eleven planning elements identified in the strategic plan, to be implemented over a 5-year period. Included with the MOU is an organizational command chart based on the strategic plan.

***Volunteer Firefighter Dies after Becoming Lost during a Residential Structure Fire – Pennsylvania***

## References

Brunacini AV [2002]. Fire command: The essentials of local incident management system (IMS). Quincy, MA: National Fire Protection Association.

IAFC [2012]. Rules of engagement for structural firefighting: Increasing firefighter survival. Draft 10 developed by the Safety, Health and Survival Section International Association of Fire Chiefs.

IAFF [2010]. IAFF fire ground survival training program. Washington, DC: International Association of Fire Fighters.

Kerber S. and Zevotek R. [2014]. Fire service summary report: Study of residential attic fire mitigation tactics and exterior fire spread hazards on fire fighter safety. Columbia, MD: Underwriters Laboratories Fire Safety Research Institute.

NFPA [2020]. NFPA 1407, Standard for training fire service rapid intervention crews. Quincy, MA: National Fire Protection Association.

NFPA [2021]. NFPA 1700, Guide for structural fire fighting. Quincy, MA: National Fire Protection Association. Quincy, MA: National Fire Protection Association.

NFPA [2024]. NFPA 1550, Standard for emergency responder health and safety. Quincy, MA: National Fire Protection Association.

NIOSH [2014a]. Two career fire fighters die in a rapid fire progression while searching for tenants—Ohio. By Bowyer ME, Loflin ME, and Wertman SC. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, F2014-02.

NIOSH [2014b]. Shift safety officer falls through hole in floor into basement of vacant row house and dies from smoke inhalation – Maryland. By Merinar TR and Loflin ME. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, F2014-24.

NIOSH [2015]. Fire fighter falls through floor and dies at a residential structure fire—Ohio. By Loflin ME and Hales TR. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, F2015-19.

NIOSH [2017a]. NIOSH fire fighter fatality investigation helps incident commander choose strategy and tactics to control flow path and protect fire fighters. By Bowyer M., Loflin M., Merinar T., Miles S., Moore P., Wertman S., Orr B., and Webb S. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication 2017–200.

## *Volunteer Firefighter Dies after Becoming Lost during a Residential Structure Fire – Pennsylvania*

NIOSH [2017b]. Fire fighter falls through floor and dies at residential structure fire – Ohio. By Loflin ME and Hales T. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, F2015-19.

NIOSH [2018]. Firefighter dies after falling through a floor at a large area residential structure fire – Maryland. By Loflin ME, Hales TR, and Bowyer ME. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, F2018-13.

NIOSH [2022a]. PPE CASE: Evaluation of a self-contained breathing apparatus involved in a fatality while operating at a structure fire. By Andrews A and Tarley J. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, NPPTL TN-25965.

NIOSH [2022b]. Fire fighter dies after falling through a floor at a large area residential structure fire – Maryland. By Loflin M, Hales TR, and Bowyer M. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, F2018-13.

NIOSH [2024]. Volunteer firefighter killed after becoming trapped at an assisted living facility fire and two firefighters injured – New York. By Loflin M and Attwood W. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, F2021-10.

NIOSH [2025a]. Career firefighter dies in collapse involving lightweight construction with two separate maydays – South Carolina. By Attwood WR, Montague PR, and Richardson MR. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, F2023-07.

NIOSH [2025b]. Career candidate firefighter found unresponsive at a residential structure fire and dies 5 days later – Illinois. By Loflin ME and Saunders R. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, F2021-20.

SKCFTC [2023]. South King County Fire Training Consortium, Command Procedures: Structure Fires. Kent, WA. South King County Fire Training Consortium. March 2023.

Rowett A [2008]. The proactive RIT. Firehouse.

Toledo Fire & Rescue Department [2012]. Rapid intervention team (RIT) standard operating procedure C82. Toledo, OH: Toledo Fire & Rescue Department.

Weather Underground [2021]. Weather History. The Weather Underground. Date accessed: August 14, 2021.

***Volunteer Firefighter Dies after Becoming Lost during a Residential Structure Fire – Pennsylvania***

## Investigator Information

This report was written by Murrey E. Loflin (retired), Investigator, and Dr. Wesley R. Attwood, Investigator and Program Advisor, with the Fire Fighter Fatality Investigation and Prevention Program, Surveillance and Field Investigations Branch, Division of Safety Research, NIOSH. A subject matter expert technical review was provided by Carmen C. Alessi, Captain, Fairfax County (VA) Fire and Rescue Department.

## Additional Information

**NFPA 1700, Guide for Structural Fire Fighting (2021 edition)**

NFPA 1700, Guide for Structural Fire Fighting, 2021 edition, is the first NFPA document connecting fire dynamics research and its application to strategy, tactics, and best practices for firefighters controlling fires within a structure.

## Disclaimer

The information in this report is based upon dispatch records, audio recordings, witness statements, and other information that was made available to the National Institute for Occupational Safety and Health (NIOSH). Information gathered from witnesses may be affected by recall bias. The facts, contributing factors, and recommendations contained in this report are based on the totality of the information gathered during the investigation process. This report was prepared after the event occurred, includes information from appropriate subject matter experts, and is not intended to place blame on those involved in the incident. Mention of any company or product does not constitute endorsement by NIOSH, Centers for Disease Control and Prevention (CDC). In addition, citations to websites external to NIOSH do not constitute NIOSH endorsement of the sponsoring organizations or their programs or products. Furthermore, NIOSH is not responsible for the content of these websites. All web addresses referenced in this document were accessible as of the publication date. *NIOSH Approved is a certification mark of the U.S. Department of Health and Human Services (HHS) registered in the United States and several international jurisdictions.*