Residential Fire: San Pablo (Contra Costa County), CA

Fire Behavior Case Study

Introduction

Developing mastery of the craft of firefighting requires experience. However, it is unlikely that we will develop the base of knowledge required simply by responding to incidents. Case studies provide an effective means to build our knowledge base using incidents experienced by others.

The deaths of Captain Matthew Burton and Engineer Scott Desmond in a residential fire were the result of a complex web of circumstances, actions, and events. This case study focuses on the fire behavior and related tactical operations involved in this incident. Readers are encouraged to read the Contra Costa County Fire Protection District Report and National Institute for Occupational Safety and Health (NIOSH) Death in the Line of Duty Report F2007-28 for additional information.

Aim

Firefighters and fire officers recognize and respond appropriately to the interrelated hazards presented by building construction and rapid fire progress in residential structures.

References

Contra Costa County Fire Protection District. (2008). *Investigation Report: Michele Drive Line of Duty Deaths.* Retrieved February 13, 2009 from http://www.cccfpd.org/press/documents/MICHELE%20LODD%20REPORT%207.17.08.pdf

National Institute for Occupational Safety and Health (2009). *Death in the Line of Duty Report 2007-28*. Retrieved May 5, 2009 from http://www.cdc.gov/niosh/fire/pdfs/face200728.pdf.

Learning Activity

Review the incident information and discuss the questions provided. Focus your efforts on understanding the interrelated factors influencing the outcome of the incident including building construction, fire behavior, and tactical operations. Even more important than understanding what happened in this incident is the ability to apply this knowledge in your own tactical decision-making.

The Case

This case study was developed using the Contra Costa County Fire Protection District investigative report and NIOSH Death in the Line of Duty Report 2007-28 and video taken by a Firefighter assigned to Quint 76 (Q76), the first alarm truck company.

Early on the morning of July 21, 2007, Captain Matthew Burton and Engineer Scott Desmond were performing primary search of a single family dwelling in San Pablo, California. During their search, they

were trapped by rapidly deteriorating conditions and died as a result of thermal injuries and smoke inhalation. Two civilian occupants also perished in the fire.

Figure 1. 149 Michele Drive-Alpha/Delta Corner

Note: Contra Costa Fire Protection District (Firefighter Q76) Photo, *Investigation Report: Michele Drive Line of Duty Deaths.* This photo illustrates conditions shortly after 0159 (Q76 time of arrival).

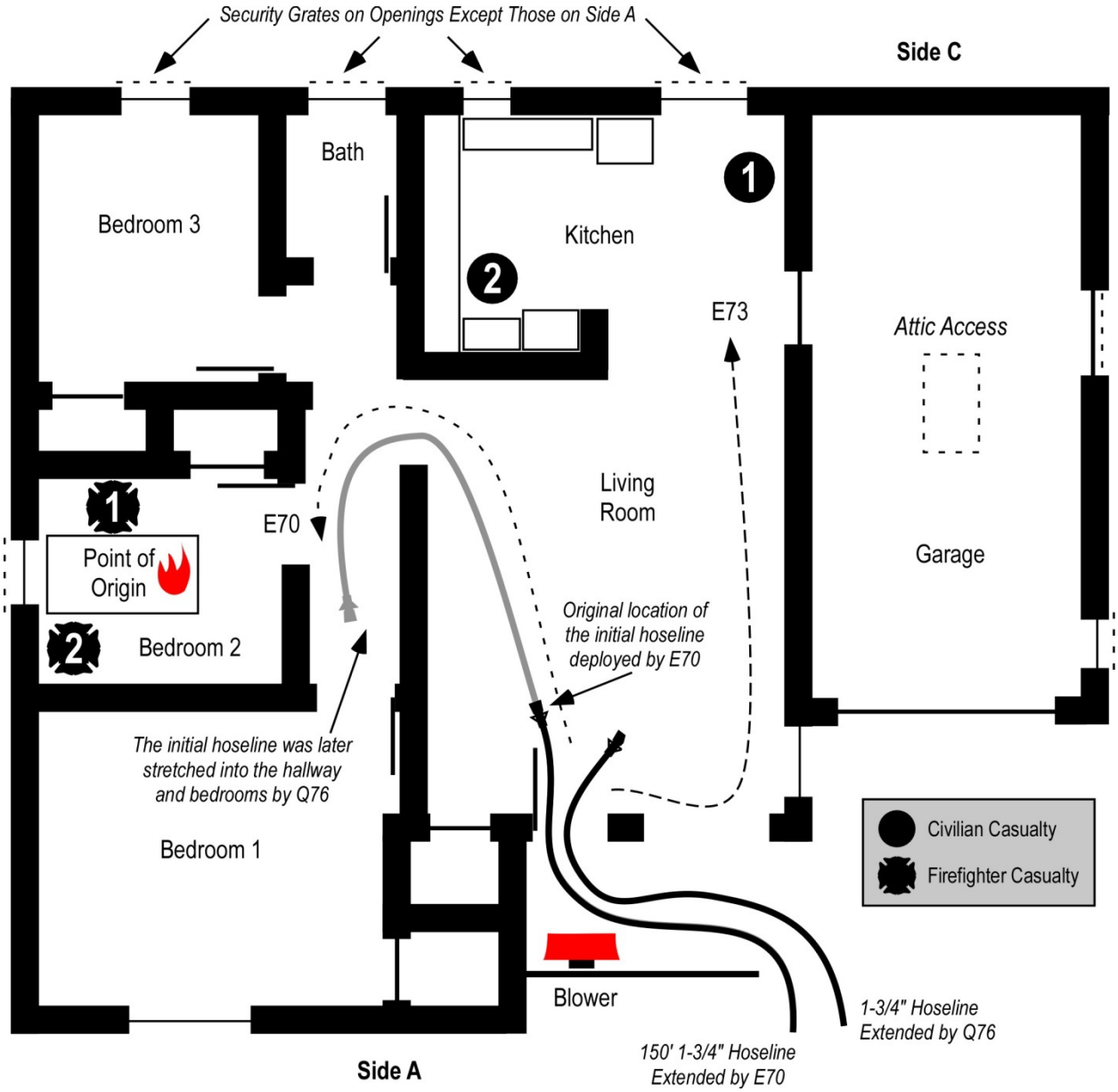
Building Information

The fire occurred in a 1,224 ft^2 (113.7 M2), one-story, wood frame dwelling with an attached garage at 149 Michele Drive in San Pablo (Contra Costa County), California. The house was originally built in 1953 and remodeled in 1991 with the addition of a pitched rain roof over the original (flat) roof.

This single story structure was of Type V, platform frame construction. The building was originally constructed with 4” x 8” (102 mm x 203 mm) beams supporting a flat roof with 2” x 6” (51 mm x 152 mm) tongue and groove planking with a built-up overlay consisting of several layers of tar and gravel. The pitched roof was constructed of 2” x 8” (51 mm x 203 mm) rafters covered with plywood and

asphalt composite shingles. The ridge of the pitched roof was parallel to Side A. The gable ends on Sides B and D were constructed of plywood and fitted with a small gable vent.

Figure 2. Floor Plan-149 Michelle Drive



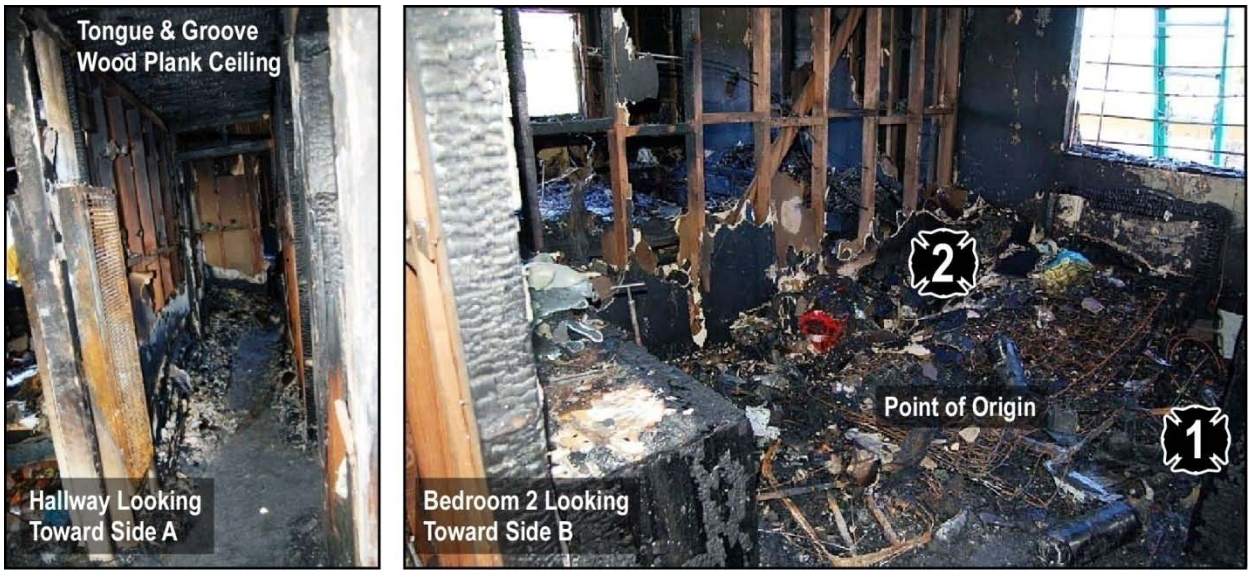
Note: This floor plan is based on data provided in the Contra Costa Fire Protection District Investigation Report and is not drawn to scale. The position of exterior doors and condition of windows as illustrated is based on the narrative or photographic evidence. Interior doors are shown as open as illustrated in the report. Fire service casualties are designated as follows: 1) Captain Burton, 2) Engineer Desmond.

All windows with the exception of the Living Room and Bedroom 1 (see Figure 2) were fitted with security bars (see Figure 3). The front door was the primary exit. In addition, an additional exit was

provided from the kitchen through the garage to the exterior on Side D. The exterior door on Side D was fitted with a security grate.

Figure 3. View of Side C from the B/C Corner

Figure 4. Hallway and Bedroom 2



Note: Figures 3 & 4 adapted from Contra Costa Fire Protection District Photos (brightness and contrast adjusted to provide increased clarity).

Interior walls were gypsum board with wood veneer paneling on some of the walls (e.g., living room). All ceilings with the exception of the kitchen were exposed 2" x 6" (51 mm x 152 mm) tongue and groove planking (see Figure 4). The kitchen ceiling was covered with gypsum board. Ceiling height was 8' (2.4 M).

Figure 5. Living Room

Note: Adapted from Contra Costa Fire Protection District Photos, Investigation Report: Michele Drive Line of Duty Deaths.

The Fire

Investigators determined that the fire likely originated on or near the east end of the bed in Bedroom 2 (see Figures 2 & 3). The likely source of ignition was improper discard of smoking materials. Developing into growth stage, the fire progressed from Bedroom 2 into the hallway (see Figures 2 & 4) leading to the living room, dining area, and kitchen (see Figures 2 & 5). It is likely that the door on Side A was closed at the time of ignition, but was opened by an occupant exiting some time after discovery of the fire.

Dispatch Information

Occupants discovered the fire and notified a private alarm company via two-way intercom at 0134. The alarm company notified the Contra Costa Regional Fire Communications Center of receipt of a fire alarm from 149 Michelle Drive at 0136 using the non-emergency telephone number. The alarm company did not indicate that they had talked to the resident who had reported a fire, but simply that they had received a fire alarm. The caller was placed on hold due to a higher priority 911 call. The dispatcher returned to the call from the alarm company at 0142 to obtain the address and callback information. Two attempts were made to call the incident location prior to dispatch of Engine 70 at 0144 to investigate the alarm. Contra Costa County Fire Protection District (CCCFPD) Engine 70 responded at 0145.

Shortly after Engine 70 responded, the communications center received a cell phone call from the female occupant at 149 Michelle Drive. This call was originally received by the California Highway Patrol and transferred to Contra Costa County Regional Fire Communications Center. The caller reported a residential fire and indicated that she had not been able to get her husband out of the building. Between the time that she spoke to the dispatcher and arrival of Engine 70, the female occupant reentered the building to attempt to rescue her husband (leaving the door on Side A open).

At 0146, the dispatcher upgraded the response to a residential fire and added two additional engines, a quint (as the truck company), and a battalion chief. Subsequent to the upgrade to a residential fire, additional 911 calls were received reporting a residential fire at 149 Michelle Drive.

Resources dispatched on the first alarm were as follows: Engine 70 (already responding on the initial dispatch for a residential alarm), Engine 69 (CCCFPD) as well as Rodeo-Hercules Fire Protection District Quint 76, and Battalion 7. Richmond Fire Department Engine 68 was requested for automatic aid response through the Richmond Communications Center to fill out the first alarm assignment. Pinole Fire Department Engine 73 cleared a medical call a short distance away from the incident location and added themselves to the first alarm assignment. With the addition of Engine 73, the dispatcher canceled response of Engine 68 through Richmond Dispatch.

Note: Engine 73 was using an apparatus normally assigned at Station 74 which was marked with the designation *Engine 74*. This created some confusion during initial incident operations.

Weather Conditions

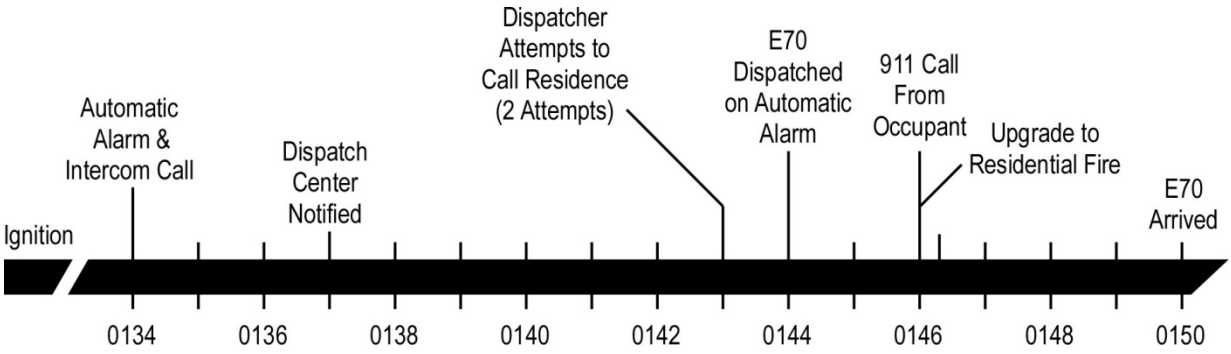
Conditions were clear, temperature was approximately 61° F (16° C), with a south to southeast (Side D to Side B) wind at between 2 and 6 mph (3.2 and 9.7 kph).

Conditions on Arrival

Shortly prior to arrival, Engine 70 reported "smoke showing a block out" and was advised by the dispatcher that the female occupant had been trying to get her husband out of the house and that it was uncertain if she had been successful. Engine 70 arrived at 0150, reported heavy smoke and fire from a single-story residential structure (flames and smoke were exiting from the open front door and large

living room window on Side A), and established Command. As illustrated in Figure 6, there was a significant delay from discovery of the fire until arrival of E70 which resulted in significant fire development prior to intervention.

Figure 6. Timeline from Ignition to Arrival



Note: Refer to Contra Costa Fire Protection District, Investigation Report: Michele Drive Line of Duty Deaths for additional information regarding factors influencing the dispatch delay.

Firefighting Operations

Based on the report of trapped occupants, E70 immediately placed a 150' preconnected 1-3/4" (45 M 45 mm) line into service using apparatus tank water. The officer of E70, seeing what he believed to be E74 arriving he passed command to the E74 officer. Unfortunately, the second arriving engine was E73 (using apparatus normally assigned to Station 74 and marked E74).

Note: This incomplete passing of command resulted in loss of command, control, and coordination of tactical operations until the arrival of BC7 at 0202 and formally assumed command at 0205. All tactical operations prior to 0205 were the result of independent action by first alarm companies.

The crew of E70 (officer and firefighter) initiated fire attack through the door on Side A and advanced 3'-5' (0.9-1.5 M) through the door and quickly knocked down flaming combustion in the living room and through dispatch, requested the first arriving truck to establish vertical ventilation. Retrieving a thermal imaging camera (TIC) from the apparatus, the crew of E70 began a left hand search (towards the bedrooms), but left the hoseline just inside the door on Side A.

E73 hand stretched 200' of 5" (127 mm) supply line to a nearby hydrant. As he returned from the hydrant the firefighter from E73 observed a large volume of smoke from Side B. E73 officer tasked E70 engineer with placing a blower at the door on Side A. E73 (officer and firefighter) entered through the door on Side A and began a right hand search (taking the opposite direction from E70). E73 encountered poor visibility, but moderate temperature. While E73 conducted the search, E73 engineer shut off the natural gas service to the house.

E69 arrived at 0157 and prepared to perform vertical ventilation. The officer performed a size-up while the engineer obtained a chain saw and the firefighter placed a 14 ladder to provide access to the roof at the A/D corner. E70 engineer, asked the E69 officer about placing a blower to the front door (as previously ordered by the officer of E73) and he answered in the affirmative. The engineers from E70 and E73 placed a blower into operation 3' (0.9 M) from the front door due to a half wall that partially enclosed the porch.

Note: No information is provided in the report regarding air track prior to or following pressurization of the building. The only substantive exhaust opening at the time the blower was placed into operation was the window in the living room immediately adjacent to the door on Side A.

E73 located the first civilian casualty, a female occupant in the kitchen (see Figures 2 and 5). As they removed the victim, both visibility and temperature increased dramatically. As they move the victim through the living room, they observed rollover coming from the hallway leading to the bedrooms (see Figures 2 and 5). The E73 officer briefly operated the hoseline left in the living room by E70 to control flaming combustion in the upper layer. The blower was turned 90^{o} to permit removal of the victim, but was then returned to its original operating position. E69 officer assigned the E69 firefighter to assist E73 with patient care on Side A.

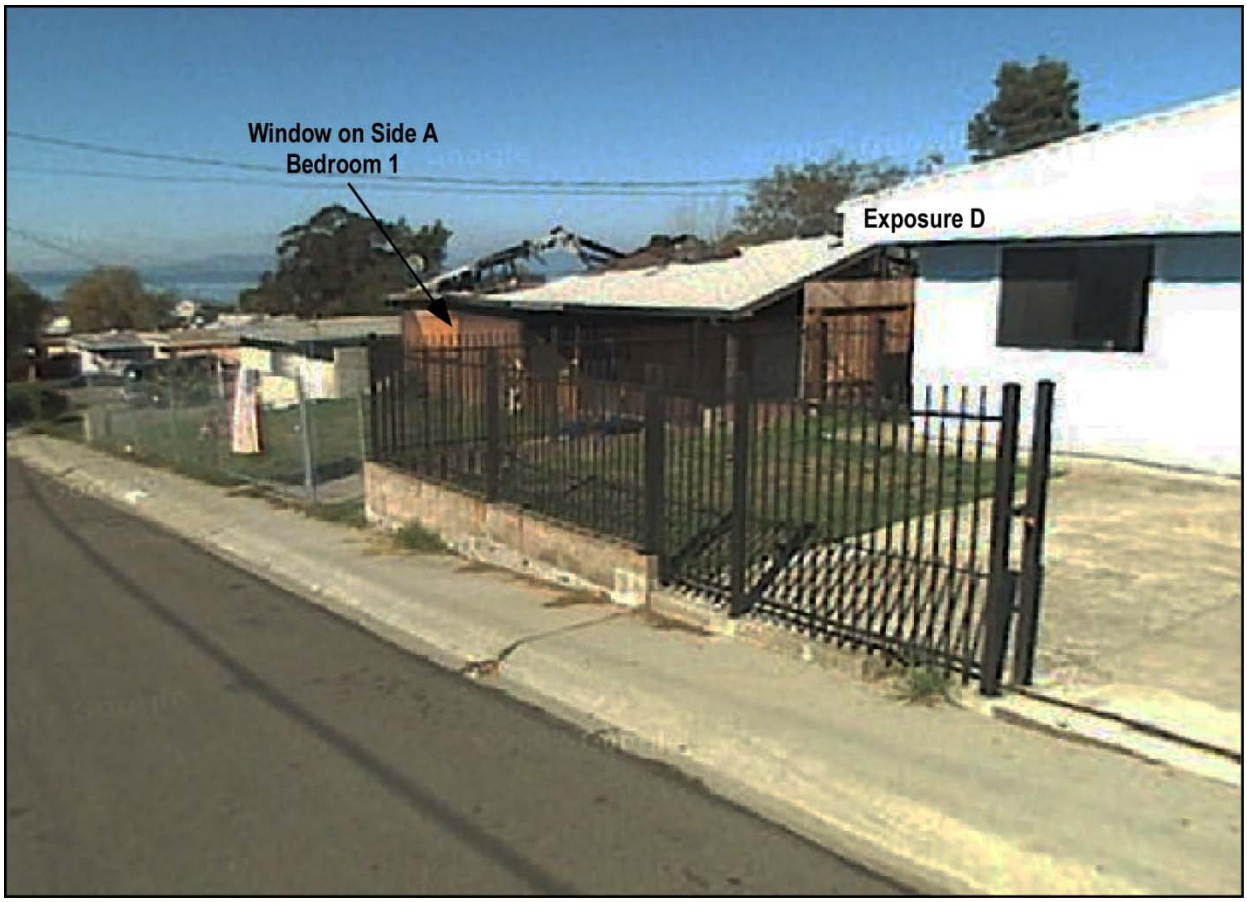
The E69 officer and engineer proceeded to the roof and began making a vertical ventilation opening on Side A roof, over the hallway. At 0159 Q76 arrived and while the officer was donning his breathing apparatus (BA), the window in Bedroom 1 failed suddenly followed by a significant increase in flaming combustion from the windows in Bedroom 1 and 2 on Sides A and B.

The firefighter from E73 who was providing emergency medical care to the civilian fire victim observed that the window in Bedroom 1 which had been cracked with some discharge of smoke, failed violently with glass blowing out onto the lawn and a large volume of flames venting from the window for a period of 10 to 15 seconds.

Figure 6. Extreme Fire Behavior

Note: Adapted from eight seconds of video was shot by Q76 firefighter from in front of Exposure D, looking towards the A/D corner of the fire building.

Figure 7. Post Fire Photo from in Front of Exposure D



Note: This screenshot from Google Maps Street View is from a similar angle as the video taken by Q76 firefighter and is provided to provide a point of reference and perspective for the video.

The E73 officer reentered the building and initiated fire attack using the hoseline left in the living room. E70 engineer stretched a second 150' 1-3/4" (45 M 45 mm) line to the front door. The second line was stretched into the building by Q76. Immediately after entering through the door on Side A, the Q76 met E73 officer who was exiting with low air alarm activation. Q76 took over the initial hoseline and worked their way down the hallway leading to the bedrooms, leaving the second line in the living room (see Figure 2) Q76 encountered poor visibility and high temperature with flames extending out of Bedrooms 1 and 2 and rollover in the hallway.

Shortly after exiting the building E73 officer advised E73 engineer that he was "out of air" [he was likely in a low air condition with low air alarm sounding rather than completely out of air] and expressed concern regarding E70's air status.

Battalion 7 (BC7) arrived at 0202 and attempted to make face-to-face contact with Command (E70) as he had not heard E70 attempt to pass command to E74. At 0203, BC7 confirmed that a medic unit was responding and requested that the medic upgrade from Code 2 to Code 3[1]. BC7 then attempted to contact E70 on the tactical channel and asked other crews operating at the incident about the status of E70. At 0205, BC7 ordered a second alarm and attempted to contact E70 on non-assigned tactical channels (in the event that their radios were inadvertently on the wrong channel). The second alarm added three engines (E74, E75, and E73) and a battalion chief (BC71) to the incident.

While BC7 was attempting to locate E70, Q76 was operating in the hallway and bedrooms in an effort to control the fire. They knocked the fire down in Bedroom 2 and controlled the rollover extending from Bedroom 1 down the hall. Q76 officer scanned Bedroom 2 with a TIC, but did not observe any victims. Q76 then advanced to Bedroom 1.

E69 completed a 6' x 6' (1.8 M x 1.8 M) ventilation opening in the roof on Side A, two thirds of the way from their access point at the A/D corner to Side B. Immediately after making the opening, they observed minimal smoke discharge (and were able to see items stored in the attic and the attic floor (original roof). They attempted to breach the attic floor, but were unable to do so (as it was constructed of 2" x 6" (51 mm x 152 mm) tongue and groove planks).

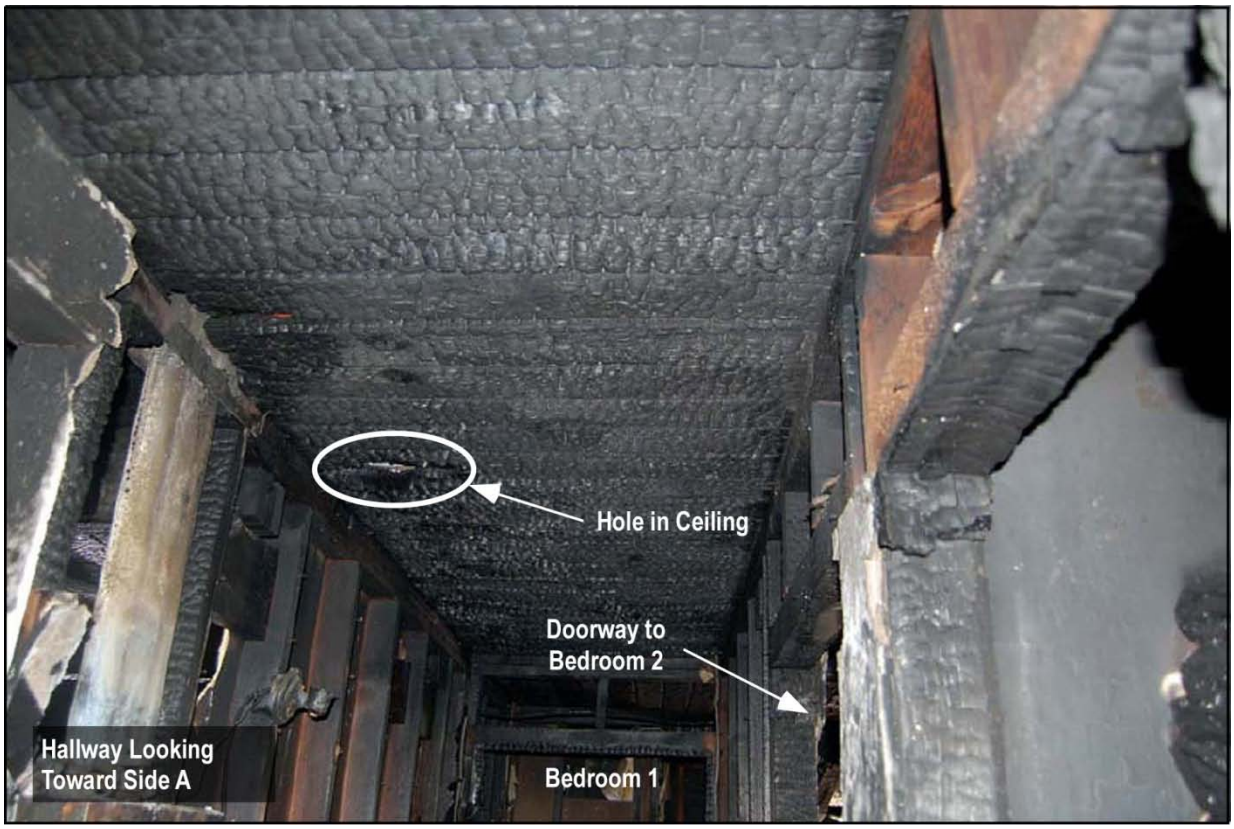
At 0206, after repeated unsuccessful attempts to contact E70, BC7 transmitted a report of a missing firefighter and assumed Command. Command requested an additional engine (E68) be added to the second alarm assignment. Battalion 64 (BC64) added himself to the incident and advised dispatch.

As E69 exited the roof they heard a loud pop and observed flames exiting the roof ventilation opening a distance of 8'-10' (2.4-3.0 M). After knocking down the fire in Bedroom 1 Q76 moved back to Bedroom 2. Failure of the gypsum board on the wall between Bedrooms 1 and 2 allowed operation of the stream from their hoseline into both bedrooms.

While at the doorway of Bedroom 2, Q76 observed a substantial volume of fire in the attic through a small hole in the hallway ceiling (see Figure 7) and attempted to apply water into the attic. However, their stream was ineffective.

[1] Code 2 is a non-life threatening medical emergency requiring immediate response without the use of red lights or siren. Code 3 is a a medical emergency requiring immediate response with red lights and siren.

Figure 8. Hallway Ceiling.



Note: Adapted from Contra Costa Fire Protection District Photos, Investigation Report: Michele Drive Line of Duty Deaths. Brightness and contrast adjusted to increase clarity.

After exiting the roof, E69 proceeded counter clockwise around the building to Side C where they removed window screens and broke out several panes of glass, but did not observe an appreciable discharge of smoke. Continuing around the B/C corner, E69 observed flames from the window of Bedroom 2 and the attic.

At 0208 Command (BC7) repeatedly attempted to contact E70 by radio on the tactical channel. Unsuccessful, he requested an additional Code 3 ambulance and advised that the status of the missing firefighters was unknown.

E69 met with Command (BC7) and was assigned to continue primary search for the second reported occupant. E69 firefighter and engineer began the search while the officer replaced his SCBA cylinder. As they entered, they picked up a hoseline (second 1-3/4" (45 mm) hoseline) and used it to extinguish small areas of fire as they moved towards the kitchen. Q76 handed off their TIC to E69 as they exited the building with low air alarms sounding.

Q76 replaced SCBA cylinders and was tasked with search for E70 on the exterior. While conducting this search, they observed flames 10'-15' (3.0-4.6 M) in length issuing from the gable vent on Side B.

After E69 officer rejoined his crew in the kitchen, they located the second civilian casualty who was determined to be diseased (see Figure 2). Command (BC7) ordered E69 to defer removing the victim and continue searching for E70.

Firefighter Rescue Operations

E69 walked through the interior of the dwelling looking for E70 and used a hoseline to knock down fire still burning in the closet of Bedroom 2. E69 advised command that E70 was not inside, but was instructed to conduct a second search of the interior.

At 0127, Command (BC7) asked dispatch to conduct a "head count" [personnel accountability report (PAR)]. Second alarm resources arrived between 0218 and 0221.

E69 reentered the building and conducted a thorough search for E70. At 0221, Command (BC7) ordered companies to "evacuate" [withdraw from] the building. Based on the urgency of his assignment to locate E70, E69 officer decided to continue the search into Bedroom 2. At approximately 0222, E69 located Captain Burton (fire service casualty 1) under debris on the right side of the bed (see Figure 2). His facepiece was still in place and his low air alarm was ringing slowly. E69 attempted to remove the Captain, but were only able to move him to the doorway to Bedroom 2 before smoke conditions worsened and visibility decreased. Near exhaustion, one member of the crew experience low air alarm activation and became disoriented requiring assistance to exit to the door on Side A.

Command (BC7) assigned Q76 to assist with the search. As E69 exited, they advised Q76 that they had located one member of E70 in the bedroom. After exiting, E69 advised Command (BC7) that they had located one member of E70 and that he appeared to be diseased and that they were having difficulty in removing him. Q76 quickly located Captain Burton inside the doorway of Bedroom 2 and removed him to Side A at 0228. E73 attempted resuscitation, but quickly determined that the Captain's injuries were fatal.

BC64 and E76 officer continued the search in Bedroom 2 and located Engineer Desmond (fire service casualty 2) on the left side of the bed (see Figure 2). E72 assisted in controlling the fire in Bedroom 2 and the removal of the second member of E70 on a backboard. Engineer Desmond was removed from the building at approximately 0224. After both members of E70 were removed, crews removed the deceased civilian occupant.

Incident Timeline

The following timeline contains data from the Contra Costa County Fire Protection District *Investigation Report: Michele Drive Line of Duty Deaths.* While the timeline in the district report is detailed, many observations and events occurred concurrently and the time at which many events occurred could not be determined. The following timeline makes an effort describe the sequence of operations and provide reasonable time estimates based on integration of the timeline included in the district report and typical time required to complete the tactical operations involved.

The clock icon is used to identify events for which the investigation report identified a specific time (rounded to the closest full minute). Events which were estimated based on the narrative, photographic evidence, or other information are shown in italic text.

Note: As this case study focuses on fire behavior and the influence of tactical operations, this timeline does not include all radio transmissions or actions by the firefighters and officers involved. In addition, the timeline is intended to provide a general sequence and flow of operations and may differ slightly from the events as they occurred. Readers are encouraged to review the investigative report for additional information.

Figure 9. Incident Timeline

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
	0134	Automatic alarm for 149 Michele Drive received by a private alarm company. A female occupant confirmed a fire at that location via two-way intercom.
	0135	
	0136	
	0137	Contra Costa Regional Fire Communications Center received a call from the alarm company reporting a fire alarm at 149 Michele Drive. The caller was placed on hold to take a higher priority 911 call.
	0138	
	0139	
	0140	
	0141	
	0142	

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
	0143	The dispatcher attempted to contact the residence at 149 Michele Drive but received a busy signal. On a second attempt the dispatcher received no answer.
	0144	E70 was dispatched to investigate the residential fire alarm.
The female occupant exited the house and called 911 on her cell phone to report the fire (observation by bystanders).	0145	Contra Costa Regional Fire Communications Center received a 911 call transferred from the California Highway Patrol. The caller was the female occupant of 149 Michele Drive who reported a residential fire and that her husband was still in the building
The female occupant reentered the house in an attempt to rescue her husband, (observation by bystanders) *Note: It is likely that the occupant left the door open when she reentered.*	0146	The dispatcher upgraded the incident to a residential fire, adding two additional engines, a quint, and battalion chief.
	0147	
	0148	E69, Q76, and BC7 were dispatched and automatic aid response from E68 requested through the Richmond Communications Center. Engine 70 advised by dispatch that they had received multiple calls and upgraded the incident to a residential fire. *Note:* No mention of persons reported in the update.

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
	0149	E68 dispatched to the residential fire at 149 Michele Drive. E73 advises dispatch that they have cleared a medical incident 0.5 mile (0.8 km) from the residential fire and add themselves to the first alarm.
E70 reports smoke showing from one block out.	0150	Dispatch advises E70 that the resident was still trying to get her husband out, unknown if she was successful.
Smoke and flame showing from the door and living room window on Side A.	0151	E70 arrived, transmitted a size-up report “heavy smoke and fire from a single story residential structure, establishing Michele IC. E70 transmitted a supplemental report that two persons were reported inside and that they were making entry with a 1-3/4” line.
Smoke and flame pushing from the door and window, the couch in the living room was on fire (firefighter E73).	0152	E73 arrived (in reserve apparatus marked E74). E70 passed Command to E74 (not assigned to the incident). *E70 deployed a 150’ 1-3/4” (45 M 45 mm) line to the doorway on Side A.*
Steam and light colored/white smoke showing from the building.	0153	*E70 advanced 3’-5’ (0.9-1.5 M) into the living room and knocked down visible fire.* *E73 hand stretched a 5” (127 mm) supply line 200’ (61 M) to a hydrant.*
	0154	E70 communicated to dispatch requesting the first due truck to perform vertical ventilation.

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
	0155	AMR Medic 228 dispatched (Code 2) to the residential fire. *E70 exited the structure and retrieved a TIC from the apparatus and reentered, initiating a left hand search.*
Heavy smoke showing from Side B (observed by E73 FF returning from the hydrant). *Just inside the door, the smoke was thick (optically dense) and temperature was high (observed by E73).*	0156	*E73 officer directed E70 engineer to place a blower at the door on Side A. E73 entered the residence and started a right hand search (without a hoseline)* *E73 engineer shut off the natural gas service, but was unable to shout off the electrical service.*
Thick black/gray smoke pushing from the window of Bedroom 1 on Side A and a large volume of fire from Side B (observed by E69).	0157	E69 arrived and prepared to perform vertical ventilation. *E70 engineer asked the E69 officer about placing the blower at the door on Side A (previously ordered by E73 officer). He answered in the affirmative.* *E69 firefighter placed a 14' ladder to the roof at the A/D Corner.* *E70 and E73 engineers positioned the blower 3' (0.9 M) from the front door due to a short wall enclosing the porch.*

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
Temperature and visibility increase noticeably as E73 reaches the kitchen. Rollover extends from the hallway into the living room (observed by E73) *Smoke conditions negligible in the living room (observed by E69).*	0158	*E73 locates an unresponsive female victim in the kitchen and remove her to the doorway on Side A.* *E73 officer briefly operated the nozzle of the initial hoseline (approximately 5' inside the doorway) to darken flames extending from the hallway into the living room.* *After retrieving his flashlight from the kitchen, the E73 officer moved the blower 90^{o} to allow the victim to be removed from the porch. After the victim was removed the blower was repositioned.*
	0159	Q76 arrived. *E69 went to the roof to perform vertical ventilation.*
Bedroom window on Side A had been cracked and venting smoke failed suddenly (glass blew out onto the lawn) with a large volume of fire pushing from the window for 10-15 seconds. (Observed by E73 firefighter who was performing patient assessment on Side A). *Sudden increase in flaming combustion from the bedroom windows on Sides A and B (captured on video by Q76 FF).* *Firefighters reported that the rapid fire progress sounded like a tire exploding (possibly failure of the window on Side A).*	0200	*E73 officer reentered through the door on Side A to attack the fire in the hallway using the hoseline originally deployed by E70 and E70 engineer pulled a second 150' 1-3/4" (45 M 45 mm) line to the door on Side A.*

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
	0201	*Vertical ventilation being performed by E69 (Observed by Q76).* *Q76 advanced the second 1-3/4" (45 mm) line into the building. E73 officer exited with his low air alarm sounding after handing the initial hoseline off to Q76. E73 officer expressed concern to his firefighter that E70 would be low on air as well.* *Q76 darkened the fire down in the hallway and Bedroom 2, and scanned this room with a TIC, but did not observe the crew of E70.*
	0202	BC7 arrived and made face-to-face contact with E70 engineer to determine the location of E70 officer and was advised that the crew was inside.
Light smoke exited from the vertical ventilation opening and a small volume of flame was visible from the area of the gable vent on Side B (E69) *Poor visibility and high temperature with flames at the ceiling (rollover) in the hallway with a large volume of fire in Bedrooms 1 and 2 (Q76)*	0203	BC7 confirmed that a medic unit was responding and upgraded its response to Code 3. *E69 completed a 6' x 6' (1.8 M x 1.8 M) ventilation opening in the roof but was unable to breach the original roof/ceiling to vent the interior of the building.*[2] *Q76 knocked down the fire in Bedroom 2 and pushed the fire down the hallway, advancing into Bedroom 1.*

[2] This is the earliest time that the vertical vent could have been completed based on an estimated time of five minutes to access the roof, cut a 6' x 6' (1.8 M x 1.8M) hole, remove the roof covering and sheathing, and unsuccessfully attempt to push down the ceiling/original flat roof.

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
	0204	E73 officer reported to BC7 and asked about the status of E70, expressing concern that they would be out of air. BC7 again attempted to locate E70, asking other crews and via radio on the assigned tactical channel as well as unassigned channels.
	0205	BC7 ordered a second alarm, followed shortly thereafter by a report of a missing firefighter, formally assumed command, and requested dispatch to add an additional engine to the second alarm assignment. *Q76 officer scanned Bedroom 2 with a TIC but did not locate the crew of E70.*
Following a loud "pop", a large volume of fire began to push from the vertical ventilation opening with a flame length of 8'-10' (2.4-3.0 M) (E69)	0206	E74, E75, E72, BC71 were dispatched as part of the second alarm assignment. Medic 226 arrived.
	0207	E68 requested as part of the second alarm assignment through the Richmond Communications Center. BC64 self-dispatched and advised the Contra Costa Regional Fire Communications Center.
	0208	Command (BC7) repeatedly attempted to contact E70 officer and firefighter by radio. Command (BC7) requested an additional Code 3 Medic Unit and advised that the status of the missing firefighters was unknown.
No significant release of smoke was observed from the windows on Side C (E69)	0209	*E69 attempted horizontal ventilation on Side C, removing screens and breaking out several panes of glass.*

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
	0210	
Flames visible from the window of Bedroom 2 and gable vent on Side B (E69). *Flames observed in the attic through a small opening in the tongue and groove ceiling.*	0211	*Q76 applied water into the attic through a hole in the ceiling without significant effect.*
	0212	*Command (face-to-face) assigns E69 to continue primary search for the male occupant. Search is initiated by E69 firefighter and engineer (officer is changing air cylinders)*
	0213	*E69 relieves Q76 on the second 1-3/4" (45 mm) hoseline and extend the line towards the kitchen.* *Command assigns Q76 to search for E70 around the exterior of the building after replacing their air cylinders.*
Minimal heat and smoke in the living room and kitchen (E69).	0214	*E69 locates the male occupant in the kitchen (deceased). Command advises E69 to defer removal of the body and to continue the search for E70.*
	0215	*E69 walks through the interior in an effort to locate E70 and used first 1-3/4" (45 mm) hoseline (now in the hallway) to knock down flames in the closet of Bedroom 2.*
	0216	*E69 reports to Command that E70 is not inside the building. Command directs E69 to conduct another search.*

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
Large volume of fire in the attic with flames extending 10'-15' (3.0-4.6 M) out of the Side B gable vent (Q76) *Smoke in the hallway and bedrooms has banked down to approximately 3' (.9 M) from the ceiling, with good visibility below that level (E69)*	0217	Command requested that dispatch conduct a "head count" (personnel accountability report).
	0218	BC64 arrived. E74 arrived.
	0219	E75 arrived.
	0220	E68 arrived.
	0221	BC71 arrived.
Visibility on the interior decreased as the volume of smoke increased and level of the upper layer dropped (E69).	0222	*E69 located a firefighter casualty (Captain Burton) on the right side of the bed (facepiece on and low air alarm ringing slowly). E69 attempted to remove the casualty but was unable to do so due to low air and fatigue.* *Command assigned Q76 to assist in the search for E70.*
	0223	*Q76 advised by E69 that they had located a firefighter casualty in the bedroom.*
Flames increased on the wall between Bedrooms 1 and 2.	0224	*E76 began extrication of the firefighter casualty.*
	0225	*Additional personnel including E68 officer assisted in removal of the firefighter casualty to the living room and then to the yard on Side A.*
	0226	

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	0227	
	0228	*Captain Burton removed from the building. Initial medical assessment indicated that the member was deceased.*
	0229	
	0230	*BC64 and Q76 officer initiated a search for the second member of E70.*
	0231	
	0232	*Second firefighter casualty (Engineer Desmond) located in Bedroom 2. BC64 and E72 operated the 1-3/4" (45 mm) hoseline that was in the hallway to control the remaining fire in Bedroom 2.*
	0233	
	0234	Engineer Desmond was removed from the building and determined to be deceased.
	0235	Male civilian victim was removed from the building and defensive firefighting operations initiated to extinguish the remaining fire.

Questions

The following questions focus on fire behavior, influence of tactical operations, and related factors involved in this incident.

1. What stage(s) of fire and burning regime(s) were present in the building when E70 arrived? Consider potential differences in conditions in the living room, hallway, and bedrooms?

2. If you suspect that fire conditions in the living room were different than the hallway and bedrooms, why might this be the case? What evidence supports your position? What are your assumptions?

3. While limited information is available about the fire behavior indicators present during this incident, what Building, Smoke, Air Track, Heat, and Flame (B-SAHF) indictors did E70 observe when they arrived?

4. E70 immediately initiated fire control and search operations without conducting a 360^{o} reconnaissance. What B-SAHF indicators would you anticipate could have been observed on Sides B and C had this reconnaissance been conducted prior to making entry?

5. The E73 officer tasked E70 engineer with placement of a blower at the door on Side A (use of this tactic was reaffirmed by the E69 officer). What air track did this use of positive pressure create and what effect did this have on 1) conditions in the living room and kitchen and 2) in the hallway and bedrooms? Why do you think that this was the case?

6. What type of extreme fire behavior phenomena occurred in this incident? Do you agree with the Contra Costa County Fire Protection District report conclusion that this was a fire gas ignition or do you suspect that some other phenomenon was involved?

7. How did the conditions necessary for this extreme fire behavior event develop (address both the fuel and ventilation sides of the equation)?

8. What was the initiating event(s) that lead to the occurrence of the extreme fire behavior that trapped Captain Burton and Engineer Desmond? How did the use of positive pressure ventilation influence the occurrence of the extreme fire behavior (if in fact it did)?

9. What action could have been taken to reduce the potential for extreme fire behavior and maintain tenable conditions during primary search operations?

10. How did building design and construction impact on fire behavior and tactical operations during this incident?