FIREFIGHTER FATALITY INVESTIGATION

Firefighter Scott Deem
San Antonio Fire Department

Investigation FFF FY 17-02

San Antonio, Texas • May 18, 2017

STATE FIRE MARSHAL'S OFFICE

Prevent • Educate • Protect

1910

State Fire Marshal's Office
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The subsequent investigation of this incident provides valuable information to the fire service by examining the lessons learned, to prevent future loss of life and property.

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Acknowledgements

The Texas State Fire Marshal wishes to thank the following entities and individuals for their cooperation and assistance in the investigation of this incident:

San Antonio Fire Department
San Antonio Police Department
Bureau of Alcohol, Tobacco, Firearms and Explosives
Bexar County Medical Examiner's Office

The Houston Fire Department provided the below staff as part of the Texas Metro Team Firefighter Fatality Review Team. The team conducted the review of the operations and tactics, and provided recommendations. We commend these individuals for their commitment to the review of this incident, in pursuit of firefighter safety for the Texas and National Fire Service:

District Chief Kelly Baudat
Captain Robert Logan

These experts provided documentation, research material, or a review of the investigation findings and recommendations:

National Institute for Occupational Safety and Health (NIOSH)
National Institute of Standards and Technology (NIST)
Daniel Madrzykowski, Underwriters Laboratories (UL)
Chief Alan V. Brunacini
Chief Don Abbott

The unexpected death of Chief Brunacini did not allow him to conduct a final review. Chief Abbott provided that review and additional comments. The agencies involved in this report would like to thank Chief Brunacini and Chief Abbott for their dedication to improving firefighter safety in the National Fire Service.

A review of the report was conducted by representatives of the Texas Fire Service. These stakeholders are:

Texas Commission on Fire Protection
Texas State Association of Firefighters
Texas A&M Forest Service
State Firefighters' and Fire Marshals' Association
Texas A&M Engineering and Extension Service (TEEX)
Texas Fire Marshals' Association
Texas Chapter of the International Association of Arson Investigators

Chief Alan V. Brunacini

Alan Brunacini joined the Phoenix Fire Department in 1958. He served in every department position. He was promoted to fire chief in 1978 and retired in 2006. He graduated from the Fire Protection Technology program at Oklahoma State University, and earned bachelor's and master's degrees from Arizona State University. He was past chairman of the Board of the National Fire Protection Association (NFPA) and the NFPA Fire Service Occupational Safety Committee (Standard 1500). He was the immediate past chairman of the NFPA Career Fire Service Organization and Deployment Committee (Standard 1710). His two firefighter sons own and operate the local command level Blue Card Hazard Zone Management Program. They present workshops, seminars, and conferences to fire departments throughout the country. He authored *Fire Command*, *Command Safety*, *Timeless Tactical Truths*, *Essentials of Fire Department Customer Service* and *The Anatomy and Physiology of Leadership*.

Chief Don Abbott

Don Abbott recently retired after serving nine years as project manager of the Command Training Center, Phoenix Fire Department. Before working for the Phoenix Fire Department, Chief Abbott owned and operated Command Emergency Response Training (CERT). The company taught emergency response, incident command, and disaster management through tabletop exercises. Abbott retired from the Indianapolis Fire Department as an Assistant Chief of Operations, Special Operations and Training after 24 years of service. He was named *Fire Engineering* magazine's "Instructor of the Year" in 2006 and "Innovator of the Year" in 2004.

Executive Summary

On May 18, 2017, at 9:12 p.m., the San Antonio Fire Department (SAFD) responded to a structure fire located in the 6700 Block of Ingram Road, San Antonio, Texas (Ingram Plaza/Spartan Box Gym) that was reported by a passerby. SAFD Ladder 35 (L35) and Engine 35 (E35) arrived on scene and observed smoke inside the Spartan Box Gym. Firefighters made forcible entry into the business through the front doors. E35 crew was assigned suppression and L35 firefighters Scott Deem and Brad Phipps were assigned to search the Spartan Box Gym.

During their search, Firefighter (FF) Deem and FF Phipps located the fire and called for a hose line. Conditions rapidly worsened and FF Phipps declared a "Mayday." Efforts were focused on their rescue. Several Rapid Intervention Teams (RIT) made entry in an attempt to locate the firefighters. FF Robert Vasquez became separated from his Rapid Intervention Team while searching for Firefighters Phipps and Deem.

FF Phipps and FF Vasquez were located and extricated. FF Phipps sustained life threatening injuries and was transported to San Antonio Military Medical Center (SAMMC). FF Vasquez suffered minor injuries and was transported and later released from an area hospital.

Continued attempts to contact FF Deem or to hear a Personal Alert Safety System (PASS) device were unsuccessful. Conditions worsened and rescue operations were halted. Defensive tactics were utilized to suppress the fire. A secondary search was conducted and FF Deem was eventually found deceased inside the gym.

FF Phipps was released from the hospital on August 1, 2017, to continue his recovery at home.

The Texas State Fire Marshal's Office Firefighter Fatality Coordinator was notified of the incident and responded and the SFMO State Response Team was dispatched.

This death is classified as a Line of Duty Death (LODD) and based on a thorough analysis. The circumstances surrounding the death of FF Deem, severe injury of FF Phipps, and

injury of FF Vasquez were preventable. The actions leading to the findings in this report collectively led to the tragedy at this incident. The goal of this report is to challenge the San Antonio Fire Department to meet national fire service best practices identified in the recommendations to minimize risk exposure to the men and women of the SAFD. That path will honor the memory of FF Deem and take a good fire department to an even higher level of performance.

The State Fire Marshal's Office recommends that fire departments incorporate the following into department policies and procedures:

- Match fire suppression tactics to the structure and conditions *(Page 37)*
- Ensure proper ventilation and PPV fan usage *(Page 40)*
- Incident Command and Risk Management *(Page 43)*
- Prevent freelancing *(Page 48)*
- Improve accountability *(Page 50)*
- Evaluate and train on Mayday procedures *(Page 52)*
- Ensure pre-fire plans are in place *(Page 54)*
- Conduct fire code inspections of all commercial buildings using a risk analysis approach (*Page 55*)
- Provide easy access to current versions of SOPs/SOGs *(Page 57)*
- Adopt "cultural change" with a greater emphasis on firefighter accountability and safety *(Page 58)*
- Follow recommended Practice for Fire Service Training Reports and Records *(Page 60)*

This intent of this report is to honor Firefighter Scott Deem. By taking the lessons learned from this tragic incident, others may benefit from enhanced training and safety.
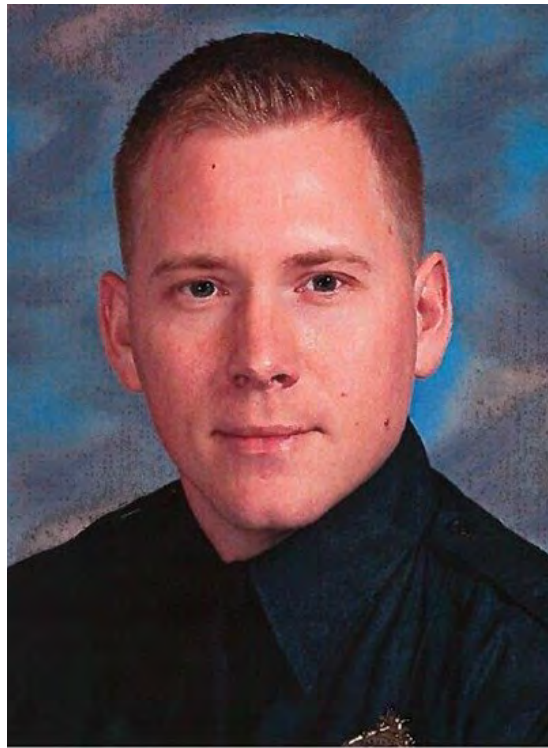
Firefighter Scott P. Deem, 31
San Antonio Fire Department

Introduction

The State Fire Marshal's Office (SFMO) was notified on May 18, 2017, by San Antonio Fire Department that Firefighter Scott Deem had died in the line of duty.

SFMO commenced the firefighter fatality investigation under the authority of Texas Government Code Section 417.0075(b), which reads:

> *If a firefighter dies in the line of duty or if the firefighter's death occurs in connection with an on-duty incident in this state, the state fire marshal shall investigate the circumstances surrounding the death of the firefighter, including any factors that may have contributed to the death of the firefighter.*

SFMO Investigator Lt. Brian Fine was assigned to investigate the firefighter fatality. The San Antonio Fire Department and other agencies assisted throughout the investigation of the incident.

San Antonio Fire Department

On June 6, 1854, a group of 20 young San Antonians met and organized the first volunteer fire department. They called it the Ben Milam Company. The company was composed of only a bucket brigade, but had a lot of vim, vigor, and determination to do something to protect life and property against the demon "Fire."

In 1858, the Ben Milam Company purchased their first hand-operated fire engine which made the local fire department one of the best in the entire Southwest. However, around 1859, with the burning of Eckenroth's store, it became apparent that the city's firefighting facilities were still not sufficient to cope with conflagrations.

In 1891, San Antonio boasted a population of 37,363 people. In March of that year, a permanent, paid fire department was organized. Two 700 gallons-per-minute steam pumpers, 5 hose carriages, 2 hook-and-ladder trucks, and assorted wagons and carts were provided. Some 45 firefighters were hired.

Today, San Antonio Fire Department (SAFD) has 53 stations serving an area of 493.7 square miles with a population of approximately 1.4 million. SAFD provides fire protection as well as Emergency Medical Services (EMS) with 1714 uniformed personnel. The SAFD possesses the following apparatus:

- Number of Engines - 53
- Number of Ladders - 15
- Number of Platforms - 5
- Number of EMS units (full-time) - 33, 1 additional unit during peak hours.

Fire department trainees attend cadet school at the SAFD Academy located at 300 South Callaghan Road. Training is approximately five and a half months. In addition to fire suppression training, cadets attend EMT-B school. This is a five week program administered through the University of Texas Health Science Center system.

The SAFD responds to a wide variety of incidents. Following are the call-for-service numbers for the past three years.

	Total Incidents	Fire Responses	EMS Responses	Total Responses
FY 2017 (OCT - MAR)	93,366	100,073	81,683	181,756
FY 2016	180,831	182,891	161,855	344,746
FY 2015	172,625	166,737	162,900	329,637

Firefighter Scott Deem

Scott Deem was hired on January 3, 2011. He served the San Antonio Fire Department for six years in the capacity of a Firefighter/EMT-B. His duty assignment was Ladder 35 A-Shift. He was married with a son and daughter. His wife was expecting their third child at the time of his death.

Shift prior to the event

FF Deem came on duty at 9:00 a.m. the day of this incident and was assigned the Firefighter Two position on Ladder 35. The station completed assigned duties and ran several calls during his tour of duty before the fire incident that is the subject of this report.

Medical history

FF Deem had no significant medical history that contributed to his death.

The following information is provided by the State Fire Marshal's Office, San Antonio Fire Department, San Antonio Police Department, Bureau of Alcohol, Tobacco, Firearms and Explosives, and the Bexar County Medical Examiner's Office.

Building Structure and Systems

The fire occurred in the Ingram Plaza Shopping Center located in the 6700 block of Ingram Road, San Antonio, Texas.

Photograph courtesy of Google Earth

Photograph courtesy of Google Earth

The stores that were primarily involved with the investigation are listed as:
(See page 29 for diagram.)

- Texas Thrift Main Store (North Side Production Area)
- Texas Thrift Store Storage Unit "Wedge" – 6778 Ingram Road
- Spartan Box Gym – 6780 Ingram Road
- Computer Repair Plus – 6782 Ingram Road
- Unleased empty unit – 6790 Ingram Road

The remaining businesses north of the unleased empty unit sustained smoke and heat damage because of the shared attic space. These spaces were:

- Jimenez Physical Therapy – 6794 Ingram Road
- Carolyn's Salon – 6796 Ingram Road
- Barber Shop – 6798 Ingram Road
- Texas Driving School – 6800 Ingram Road
- Makeup Vanity Pro – 6802 Ingram Road

The businesses to the south of Texas Thrift Store were not affected or damaged by smoke or heat.

The two main areas of involvement were the Spartan Box Gym and the Thrift Store storage area referred to as the "Wedge" due to the triangular shape.

The Spartan Box Gym is a single-story building classified as an existing business occupancy. Features of fire protection are limited to portable fire extinguishers. Illuminated exit signs are noted. The building has an east wall that is composed of windows with aluminum framing and a double outward swinging glass door. The windows and door make up the entire east side of the building. The upper part of the east wall is masonry construction. The north and south walls were constructed with 2x4 wood studs covered in sheetrock. The interior north wall had an additional "dry erase" type board covering its length. There is a suspended ceiling noted with insulation. The ceiling joists are of I-beam construction. The fire walls that separate businesses have penetrations that allowed the fire and smoke spread to neighboring units. There is a six foot outward swinging metal double door on the west side of the building. The roof is a metal decked roof with wood on top, covered with tar paper and a tar asphalt sealant. The floor consists of concrete flooring covered with synthetic workout type mats.

The Thrift Store storage area is described as having an east wall composed of windows with aluminum framing and one outward swinging glass door. The windows and door make up the entire east side of the building. The upper part of the east wall is masonry construction. The north wall was constructed with 2x4 wood studs covered in sheetrock. The south wall was of masonry construction with a "false wall" made of wood 2X4s covered with sheetrock. There is a suspended ceiling. The ceiling joists were of I-beam construction. The fire wall that separated the wedge from the gym has penetrations that allowed fire and smoke to spread between units. There is a six foot outward swinging metal double door on the west side of the building. The roof is a metal decked roof with wood on top, covered with tar paper and a tar asphalt sealant. The floor consists of uncovered concrete slab.

Suppression and alarms systems

None of the involved occupancies had a fire suppression system installed. Portable fire extinguishers were present in various occupancies. The Thrift Store had a fire alarm system that detected the smoke and activated, subsequently alerting the employees. When the occupants exited the Thrift Store because of the alarm, the SAFD was already on scene at the Spartan Box Gym.

Fire Investigation

On May 18, 2017, at 9:12 p.m., the San Antonio Fire Department responded to a structure fire located in the 6700 Block of Ingram Road (Ingram Plaza/Spartan Box Gym) that was reported by a passerby, Jasmine Avalon. Fire department personnel arrived on scene and observed smoke inside the Spartan Box Gym and made forcible entry into the business through the front doors located on the east side. Firefighters Scott Deem and Brad Phipps were the initial search team to enter the Spartan Box Gym. During their search, Firefighter Phipps declared a "Mayday" and all efforts were focused on their rescue. Firefighter Deem was eventually found deceased inside the gym, with Firefighter Phipps sustaining life threatening injuries. Firefighter Robert Vasquez was also seriously injured when he became separated from the Rapid Intervention Team (RIT) searching for Firefighters Phipps and Deem.

Based on the information available at this time, which includes witness interviews and observations, a systematic fire scene examination, inspection of physical evidence, analysis of burn patterns, and review of empirical testing data, it was determined at least one area of origin was established inside the rear storage room of the Spartan Box Gym. Natural causes were eliminated because a lightning strike report generated for the date and times of the fire did not reveal any positive or negative strikes in the area and witnesses did not report any severe weather at the time of the fire. Accidental electrical causes were eliminated through the use of arc mapping and examination of the circuits by electrical engineers. Other accidental causes, including careless discarding of smoking materials, were eliminated through witness interviews and statements. Analysis of fire scene and witness statements determined the structure did have utility services and was not occupied at the time of the fire.   The cause of the fire was determined to be incendiary and arson charges were filed against the owner of the Spartan Box Gym. Please see the final origin and cause report that will be available pending further court action.

The fire investigation was conducted in accordance with applicable sections of NFPA 921, NFPA 1033, and other applicable treatises.

All times are based on radio recordings and dispatch logs. There is a minimal margin of error regarding the times that does not affect the sequence of events or the outcome. The radio traffic is paraphrased unless quotation marks are shown.

The weather at the time of the fire was clear and the temperature was 80F. The wind speed was 14 mph with gusts at 24 mph, moving from east to west. The average relative humidity was 80%, as reported from the weather station located at Kelly Air Force Base (KSKF). The weather station at San Antonio International Airport (KSAT) reported the conditions at 8:51 PM as: 81F, 69% humidity, winds from the southeast at 25.3 mph with gusts to 32.2 mph.

May 18, 2017

9:12 PM   The San Antonio Fire Department responded to a structure fire located in the 6700 Block of Ingram Road, San Antonio, Texas (Ingram Plaza/Spartan Box Gym) that was reported by a passerby, Jasmine Avalon.

9:17 PM   SAFD Ladder 35 (L35) and Engine 35 (E35) arrived on scene. L35 Captain assumed command and initial size up reported that smoke was showing through the roof of a large strip center and that L35 and E35 were investigating. He requested all companies to continue and advised Dispatch that a second alarm may be needed.

9:18 PM   E26 arrived.

9:19 PM   L35 Captain requested a second alarm due to the size of the strip mall and potential for spread.

9:20 PM   E27 arrived.

Unknown   E35 Firefighter (FF) 2 and L35 FF Deem made forcible entry into the business through the front doors. E35 FF2 and E35 FF1 pulled a 1 ¾" pre-connect to the front door of the gym and made entry. FF2 reported visibility

was low and he advanced the line while on his knees. FF1 was a short distance behind him, helping advance the line. E35 Lieutenant was near the doorway feeding line to FF1 and FF2.

L35 FF Deem and L35 FF Phipps were assigned to search the gym. L35 made entry and started a right hand search. FF Phipps stated visibility was poor and they were moving by touch. FF Deem and FF Phipps passed E35 FF1 and FF2.

E26 was assigned to search the business to the north of the gym, later identified as the computer store.

During post incident interviews E35 FF2 stated he ran into an obstruction and could hear L35 on the other side. It was later determined he veered to the right and ran into the north wall. The firefighters he was hearing were E26 firefighters in the adjacent occupancy. E35 crew backed out and re-entered using a right-hand pattern.

Interviews confirm Positive Pressure Ventilation Fans (PPV) were placed in the gym entry and turned on by L35 driver at the request of Command.

9:21 PM   E44 arrived on scene at the rear of the building and reported flames through the roof. E44 advised they can force the doors and get water on it.

9:22 PM   Dispatch advised 10 minutes into the incident, from time of dispatch.

9:23 PM   Battalion Chief 3 (BC3) assumed command.

9:24 PM   L35 FF Phipps reported via radio they had located the fire in the attic.

9:26 PM   Command advised E44 to open the doors but not to put water on it because crews were inside and he did not want to push it down on them.

Unknown	Based on statements provided after the incident, L35 began pulling ceiling tiles in order to gain access to the fire. Conditions suddenly changed: L35 had no visibility and heat rapidly increased.
	E35 reported they advanced the line along the right wall and ran into several obstructions, which were later determined to be exercise equipment along the north wall. E35 reported using the Thermal Imaging Camera (TIC); the screen showed all white, indicating a high temperature reading. E35 stated the conditions suddenly worsened with a rapid increase in temperature and decrease in visibility. FF2's statement was "it was like someone poured asphalt over me. It got very dark and very hot." E35 attempted to cool down the environment by opening the nozzle. FF2 stated it had little to no effect on the heat and E35 backed out. *Note: this is the first account of any water being flowed and the amount, per E35 was a couple of two- to three-second bursts with a 1 ¾" line.
9:27 PM	Command told E35, E26, E27 and L35 to exit the building until ventilation is started. Command requested a Personnel Accountability Report (PAR).
9:28 PM	L35 called "Mayday." The "Mayday" call automatically triggered the next higher alarm. On this scene it triggered a third alarm.
	FF Deem and FF Phipps attempted to exit the structure but were overcome by the fire and became separated.
Unknown	E35 received supply from hydrant.
9:29 PM	Command ordered an evacuation and requested an evacuation tone.
9:30 PM	L35 transmitted several more times but was unreadable. FF Phipps later stated he heard the PPV fans and started moving toward them.
9:30 PM	E27 reported PAR and Command assigned E27 as RIT to locate L35.

9:32 PM   BC8 assigned RIT with E35, E26 and E27.

E44 confirmed the back door was open and Command requested all back doors be opened. Aerial Platform (AP32) was setting up platform and advised it was about to receive water supply from E32.

Conditions early in the fire. Second alarm arriving.
Screenshot of video taken from arriving news helicopter. Courtesy of KENS 5.

9:33 PM   E26 reported PAR.

Command assigned AP11 to assist E26 with RIT. FF Vasquez was on the crew for AP11.

Command attempted contact with L35 and received no response.

9:34 PM   The weather station at San Antonio International Airport (KSAT) reported the conditions as: 79F, 74% humidity, winds from the southeast at 18.4 mph with gusts to 26.5 mph.

9:34 PM   BC8 advised Command he had assumed command of RIT, had E27 and E35 Officer with him, and needed more people. Command advised AP11 was en route to assist. BC8 reported FF1 and FF2 were still inside and they did not know where they were. BC8 reported it was getting very hot with heavy smoke and that they were on the leeward side of the building. Command confirmed that L35 FF1 and FF2 were missing. BC8 confirmed and stated L35 Captain had made entry with E27 to locate them. Command advised BC8 that E26 is inside for RIT and had a PAR approximately three minutes ago.

9:37 PM   E27 stated they have one, were bringing him out, and needed EMS to the front. BC8 advised Command they have one firefighter being brought out to EMS and that it looked like he had taken a lot of heat.

Conditions at time FF Phipps is removed.
Screenshot of video taken from arriving news helicopter. Courtesy of KENS 5.

9:38 PM	BC8 advised Command that E27 brought one firefighter out and AP11 was going in for the other one.
9:39 PM	E44 advised they had four doors open and smoke was getting heavier.
9:39 PM	AP32 advised flames through the roof. BC8 advised he had E26 with him and AP11 was going in with four as RIT.
9:40 PM	Command advised not to send anyone in until they had everyone out. Command advised L35 and AP32 to put water on the roof and not to use a heavy stream. *Note: No water was actually flowed onto the structure. BC8 asked Command if they were putting water on the fire and was advised they were putting some to keep it knocked down. BC8 advised he had crews inside and flames at the front door. BC8 asked if 360° has been done and Command advised he did it himself and E44 now had back doors open.
9:40 PM	Command advised L35 and AP32 to hold off on the water.
9:41 PM	Command told L35 and AP32 to place fans in the front to push the smoke out the back.
9:41 PM	BC8 advised they had hand lines at the front. BC8 advised Command not to send anyone over to him unless they were brought by him or assigned to him, in order to reduce confusion.
9:42 PM	Dispatch advised 30 minutes into the incident.
9:42 PM	L35 advised he spoke with one of the victims (FF Phipps) and they went in to the right. BC8 advised next team would go in to the right.
9:43 PM	Command advised they were 30 minutes in and they had accountability for everyone except one person.

9:44 PM   RIT 1, which consisted of AP11, E11, and R11, requested the windows be broken out; they had zero visibility and needed to get some of the smoke out. Command replied that back doors were open and he would send a crew up to bust the windows now.

9:44 PM   E44 requested a saw to get additional back door open.

9:45 PM   RIT 1 advised about 60 feet in, or half way to the side, doing right-hand search. BC8 asked if they needed another line in there. RIT 1 advised fire overhead and a lot of smoke, all the heat seemed to be concentrated in the Alpha (front) opening.

9:46 PM   AP32 Engineer reported a gas line had just burst on the roof in the Charlie-Delta corner.

9:49 PM   FF Phipps was transported to San Antonio Military Medical Center (SAMMC), San Antonio by SAFD Medic 27 (M27).

9:50 PM   Command asked BC8 if RIT got any relief with the windows being out. BC8 advised they were taking a beating and were on the leeward side, and advised they may want to send people in on the Charlie side. BC8 advised when AP11 came out he would be replacing them with E27 and E32.

9:51 PM   Safety asked Command for someone to take a look at the roof and assess it. Command advised they would lower a ladder and Safety could do the assessment.

9:52 PM   BC8 requested Conditions, Actions, Needs (CAN) report from AP11. Report was given but mostly unreadable. BC8 replies he was only able to copy "heavy smoke and something against the wall."

9:53 PM   AP32 Engineer gave a roof report. He advised the air conditioners had been on fire for the past 15 to 20 minutes and were beginning to sag.

9:53 PM   BC8 advised he had AP11 inside doing right-hand search and would like to send E32 in to do left-hand search and keep E27 out for RIT. Command advised to go ahead and do that.

9:54 PM   Charlie side reported to Command that they now had everything open that they could open. They had heavy fire on the roof with equipment visible on the roof. They were not sending anyone in.

9:55 PM   BC8 reported E11 just exited the building. They made it to the back room and had heavy fire. They needed another hand line. BC8 was sending E32 in with another hand line to knock out the fire and sending E27 in to do the left -hand search. BC8 requested another crew for RIT. Charlie sector advised crews available for RIT and Command reassigned them to come to the front as RIT. Command asked if RIT could make entry from the rear and was advised the openings were venting really well with a lot of smoke and heat coming out. Charlie recommended stacking the front with PPVs and making the attack from the front. Command advised to bring the crews to the front.

9:56 PM   BC8 advised he had E11 and AP11 out and needed assistance with changing bottles. He was making sure they had PAR.

9:56 PM   Command confirmed RIT (BC8) had 11, 32, 26, 27 and E35. BC8 advised E32 going right, E27 going left and he has not seen E35. Command contacted E35 and they advised they were in Rehab.

9:57 PM   BC8 advised a lot of smoke on this side and appeared to have good ventilation.

9:57 PM   E32 advised they had down firefighter and bringing him out.

9:58 PM   BC8 advised once they had the firefighter out he was decommissioning this side, and that they were on the leeward side and did not need to be firefighting on this side. BC8 recommended fire attack from the Bravo or Charlie side and to get someone up in the basket, and that the wind was

coming pretty hard. Command advised once everyone was out they would hit it with the aerials.

9:59 PM BC1 advised he had Bravo side Thrift Store, and Command advised he was sending him companies. He requested Truck Company with interior ladders.

10:00 PM Command advised L35 and AP32 to prepare to flow water once the firefighter was out. Command advised them to sweep the roof, but not use a straight stream and to open it up a little bit. No water was flowed at this time.

10:02 PM Command advised RIT (BC8) that if E32 had the firefighter then other crews needed to exit. BC8 told E27 to back out.

10:02 PM Charlie advised Command that conditions were deteriorating in the rear.

10:03 PM AP32 advised Command they had significant increase in flames on the roof top. Command asked RIT if everyone was out. BC8 advised they were still working on getting out and provided report of crews he has. As he was speaking they exited with the firefighter and he reported this to Command. Command asked RIT to get PAR.

10:03 PM Command got PAR from E27; no response from E35.

10:04 PM Safety stated they had the firefighter out and he wanted to do an evacuation tone; the fire was flashing over. Command stated it was flashing here by L35.

10:04 PM Evacuation tone sounded.

10:05 PM Flashover reported.

Conditions at time flashover is reported. View from Charlie side.
Screenshot of video taken from arriving news helicopter. Courtesy of KENS 5.

10:05 PM   Command to E35 requested PAR, E35 responded with PAR. E27 reported PAR. Command requested PAR on AP11, E11, and R11 from RIT (BC8).

10:06 PM   Command advised AP32 and L35 to put water on the fire.

10:06 PM   RU11 reported Par on 11's.

10:07 PM   RIT (BC8) advised Command that the firefighter brought out was from AP11, not from E35 (actually L35). He advised Command they still had someone inside. He advised conditions were not viable and they needed to move some apparatus or they would lose them. He stated it was too hot to go back in.

10:08 PM   Command advised they were putting water on it to protect the apparatus and he did not want to give up on the firefighter inside. BC8 advised he would have the engines start using their deck guns on it. Command advised him to

make it happen. BC8 requested a third evacuation tone.

10:08 PM   Command requested second evacuation tone and the tone was transmitted. Fire suppression transitioned to defensive tactics.

10:10 PM   Fourth Alarm requested, as reported by Computer Aided Dispatch (CAD) records.

10:11 PM   AP32 reported structural collapse on the Alpha-Bravo corner. Command relayed to BC8 who acknowledged Alpha-Delta corner and was corrected by Command to Alpha-Bravo corner. BC8 acknowledged Alpha-Bravo corner.

10:12 PM   BC8 requested that all company officers on the Alpha side meet between L35 and E35 to organize assignments.

10:13 PM   FF Vasquez was transported to University Hospital, San Antonio, by SAFD Medic Unit 42.

10:14 PM   BC8 advised Command he was sending R11, E11, AP11, E32 and E27 to Rehab.

10:14 PM   E33 advised a lot of trapped smoke in the Thrift store but the fire wall was intact and no fire.

10:17 PM   E37 advised bulk of the fire was behind a wall on the Charlie side and that the ground monitors could not reach it. He suggested an attack from the Charlie side.

Dispatch advised 60 minutes into the incident.

10:18 PM   RIT advised Command that he was on the Charlie side earlier and the fire would burn up to a wall and then run out of things to burn. RIT advised there were no exposures and not to commit resources to that side; Command agreed.

10:20 PM   Unknown unit—Fire was still defensive at this time, rehabbing and keeping everyone outside.

10:22 PM   Command requested a report from AP32. AP32 reported flare ups on the roof near the middle. Command asked how much of the roof was left. AP32 reported the roof was collapsed on the Alpha-Bravo corner and ready to collapse near the Alpha-Delta corner near an air conditioning unit.

10:23 PM   Unknown unit reported to Command that most of the smoke was in the Thrift store but the firewall was still holding. Command advised if possible, exit the rear and open a door but not to go on the other side of the firewall. Unknown unit acknowledged and stated they were working with L17.

10:23 PM to 11:13 PM   Defensive tactics continued utilizing deck guns, ground monitors, hand-lines aerial platforms.

10:31 PM   Dispatch advised 80 minutes into the incident.

10:41 PM   Dispatch advised 90 minutes into the incident.

10:52 PM   Dispatch advised 100 minutes into the incident.

11:04 PM   Dispatch advised 110 minutes into the incident.

11:13 PM   Command ordered all engines to shut down and requested silence for two minutes. All available firefighters were told to line up in front of Spartan Box Gym to listen for a PASS Device. No device was heard.

11:16 PM   Defensive operations resumed.

11:22 PM   Command reported bulk of the fire was knocked down. Defensive operations continued.

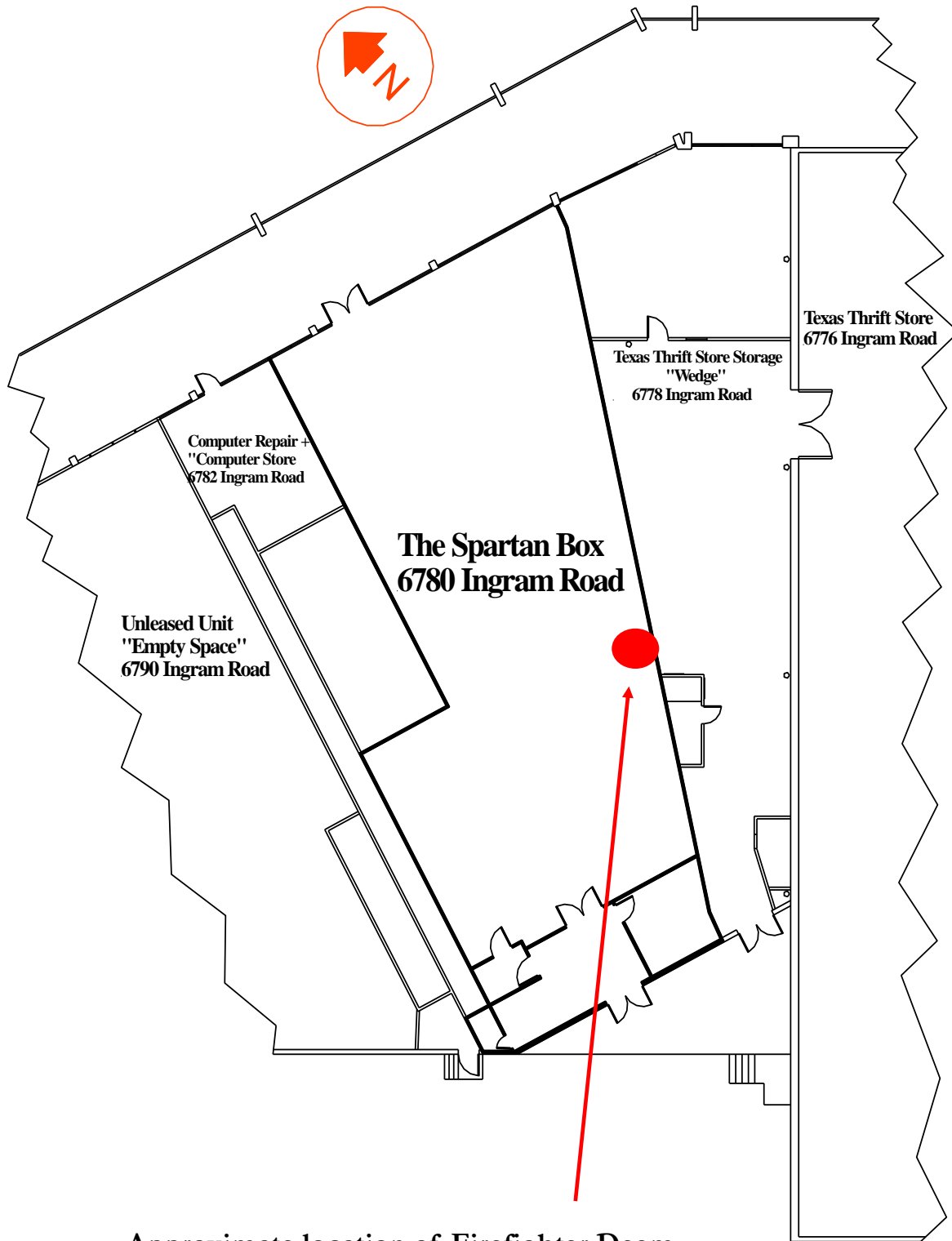Dispatch advised 130 minutes into the incident.

11:31 PM   Suppression crews observed FF Deem inside the Spartan Box Gym.

11:32 PM   BC3 was going to establish a plan for recovery but that duty was reassigned. Fire suppression was suspended in order to document the scene and recover FF Deem.

12:30 AM   FF Deem was transported to Bexar County Medical Examiner's Office by SAFD M32 with E19 escorting.

12:36 AM   Fire ground operations resumed.

N

Texas Thrift Store
6776 Ingram Road

Texas Thrift Store Storage
"Wedge"
6778 Ingram Road

Computer Repair +
"Computer Store
6782 Ingram Road

The Spartan Box
6780 Ingram Road

Unleased Unit
"Empty Space"
6790 Ingram Road

Approximate location of Firefighter Deem

0   5   10   20

FEET

Inside of Spartan Box Gym at time of recovery.
Photo courtesy of SAFD AB

Collapse of Texas Thrift Store storage area, referred to as "the Wedge."
Photo by Deputy State Fire Marshal Sgt. H. Mahlmann

Exterior "Alpha" side of Spartan Box Gym, post fire.
Photo by DSFM Sgt. H. Mahlmann

Interior of Spartan Box Gym, post fire. Location where Firefighter Deem was located.
Photo by DSFM Lt. B. Fine

Equipment Evaluation

The Personal Protective Equipment (PPE) worn by Firefighters Deem, Phipps and Vasquez were examined to ensure compliance with current NFPA standards.

FF Deem was found wearing full PPE, including Self-Contained Breathing Apparatus (SCBA) and his helmet liner. The shell was missing. The helmet had been intact upon FF Deem's entry. The SCBA frame and bottle were removed and secured by SAFD Arson Bureau.

FF Deem's PPE, with the exception of his SCBA, was examined and photographed at the Bexar County Medical Examiner's Office prior to and during the autopsy. At the time of examination FF Deem appeared to have his PPE in proper configuration for interior firefighting operations.

FF Deem's bunker gear sustained heavy thermal damage and was compromised by flame and heat. This included the SCBA face piece. Department records were reviewed regarding the issuance and maintenance of FF Deem's PPE and were found to be in compliance with NFPA standards.

FF Deem's SCBA air pack frame and bottle were examined at the scene. The bottle and frame had sustained major thermal damage which compromised the outer layers of the bottle and the electronics of the PASS device. The SCBA was later released to the National Institute for Occupational Safety and Health (NIOSH) for testing. The damage to the electronics prevented NIOSH from being able to obtain data. The SCBA was then sent to the manufacturer, Scott Safety, to see if repairs could be made to recover the data stored in the SCBA. Results are pending at the time of this report. Department records were reviewed regarding the issuance and maintenance of FF Deem's SCBA and were found to be in compliance with NFPA standards.

FF Phipps' PPE was secured the night of the incident by SAFD. An examination of the gear was conducted at the scene. The bunker gear sustained thermal damage to the reflective striping and discoloration at the shoulders. The shell for his helmet was missing and had been intact upon his entry; the liner was intact but had visible thermal damage.

FF Phipps' SCBA face piece clear lens was discolored due to thermal exposure. The air pack bottle was discolored due to thermal exposure. The air pack was released to NIOSH for examination and data recovery. At the time of this report the data has not been provided to SFMO.

Department records were reviewed regarding the issuance and maintenance of FF Phipps' PPE and SCBA and were found to be in compliance with NFPA standards.

FF Vasquez's PPE was examined by investigators at the scene. The PPE and SCBA showed no signs of significant damage or failures. Department records were reviewed regarding the issuance and maintenance of FF Vasquez's PPE and SCBA and were found to be in compliance with NFPA standards.

The Rapid Intervention Team (RIT) bag which contained the SCBA that FF Vasquez switched to was examined at the scene. There were no signs of failure or damage. The RIT face piece was dislodged from FF Vasquez during extrication and was later found in the scene. The mask showed no signs of damage or failure.

Department records were reviewed regarding the issuance and maintenance of the RIT bag SCBA and were found to be in compliance with NFPA standards.

Communications

Radios

San Antonio Fire Department utilizes a 15- to 20-year-old Harris Radio system. The system is a Harris proprietary Enhanced Digital Access Communication System (EDACS) and operates on the 800 MHz frequency. The only channels that are encrypted are the ones operated by specialized units, i.e., SWAT. Each apparatus has a mounted radio as well as a handheld radio for each firefighter position on the apparatus. Handheld radios are Harris P7100 models. Handhelds are provided with a lapel microphone. The majority of normal operating channels are recorded.

Dispatch

SAFD Dispatch is manned by firefighters who all have the rank of Engineer and at the time of this incident hold paramedic certifications. SAFD Dispatch utilizes ProQA as its Emergency Medical Dispatch (EMD) software.

911 calls are received by the San Antonio Police Department. If the call involves a fire or medical emergency, the call is routed to SAFD Dispatch. Typically, the call-taker at the SAFD Dispatch initializes the dispatch and then routes the call to a dispatcher. During large incidents the call-taker becomes a "tactical dispatcher" assigned only to that incident. Other dispatchers provide support as needed.

Dispatch and fire apparatus utilize a Computer Aided Dispatch (CAD) system which provides Mobile Data Terminals (MDT) in each apparatus. Equipment in the field is able to view call details, unit status, maps and routing, instant messaging, pre-plans, and Hazmat. Deviations in the unit's route are logged automatically. An "electronic fence" is set up around each fire station and hospital. This automatically updates the unit's status. Dispatch has the ability to create electronic fences around an incident. One was created around this incident. Units may also manually update their status through the MDT.

Dispatchers assist the Incident Commander by requesting status updates every ten minutes. SAFD Dispatch is also responsible for sending alert and evacuation tones.

May 18, 2017

Firefighter Vasquez was treated and released from University Hospital after being treated for smoke inhalation and exhaustion.

Firefighter Phipps was admitted to San Antonio Military Medical Center (SAMMC) Emergency Room. FF Phipps was then admitted to the Intensive Care Burn Unit with extensive burns. FF Phipps remained in the ICU until late July 2017 when he was released to continue treatment and therapy from home.

May 19, 2017

An autopsy was conducted on FF Scott Deem by Kimberly Molina, MD, with the Bexar County Medical Examiner's Office, San Antonio, Texas. The autopsy concluded the cause of death was from conflagration injuries. The manner is homicide.

Findings and Recommendations

Recommendations are based upon nationally recognized consensus standards and safety practices for the fire service. Fire departments and firefighting personnel should know and understand nationally recognized consensus standards. Fire departments should create, maintain, and educate personnel on SOGs and SOPs to ensure effective, efficient, and safe firefighting/emergency/training operations.

Although the following recommendations may not have prevented the death of Firefighter Deem or the injuries to Firefighters Phipps and Vasquez, the State Fire Marshal's Office offers these recommendations to reduce the risk of firefighter deaths during suppression operations. All fire departments should be aware of the content of the following standards and are encouraged to develop programs based on them to increase the level of safety for fire department personnel.

Finding 1

While the first officer in command recognized the potential of fire to later develop beyond the initially involved business, the fire suppression efforts appeared to be similar to tactics used on a residential fire, with small diameter attack lines deployed initially. Hose streams should have been introduced at the very beginning of firefighting operations to cool the heated environment of the structure. Wind factors were taken into consideration late into fire suppression efforts.

The weather conditions during the incident were:

8:51 p.m.: 81F, 69% humidity, winds from the southeast at 25.3 mph with gusts to 32.2 mph. (KSAT)

The weather at the time of the fire was clear, with a temperature of 80F. The wind speed was 14 mph, gusting to 24 mph, moving from east to west, and the average relative humidity was 80%. (KSAF)

9:34 p.m.: 79 F, 74% humidity, winds from the southeast at 18.4 mph with gusts to 26.5 mph. (KSAT)

Recommendation 1

Fire suppression tactics need to match the structure and conditions. Assessing structural elements along with weather and wind conditions that may influence fire travel and intensity is essential. Fire dynamics and behavior need to be considered before and re-evaluated during suppression efforts.

The National Institute of Standards and Technology (NIST) has conducted several research projects regarding the use of water to reduce heat and prevent flashover. NIST has also conducted several experiments and research projects regarding the effects of wind on fire development and ventilation.

In one such study, NIST found that a fog stream in the window decreased the corridor temperature by at least 20% and the corresponding heat flux measures by at least 30%. The solid streams experiments resulted in corridor temperature and heat flux reductions of at least 40% within 60 seconds of application.[1]

Interior attack:
- Large diameter hose in large structures.
- Open nozzle to hit seat of fire or HIGH Heat conditions directing into attic. The firefighter does not need to see the fire to open the nozzle if they are cooling interior environment (gases). Heavy or dark smoke are products of combustion ready to light off and must be cooled ASAP to prevent flashover.

While wildland fire manager and officer training includes weather conditions in their evaluation of incident conditions (size-up), typically structural firefighters and fire officers do not receive this type of training. Wildland firefighter training manuals dedicate almost half of their fire behavior chapter to weather, with significant sections on wind. Structural firefighter training manuals, which are approximately 1000 pages in length, dedicate a page or less to the interaction of wind and structural fire behavior. As a result, structure fires that may have been affected by wind conditions have typically not been recognized as such or well documented, with

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[1] **NIST Technical Note 1618, Fire Fighting Tactics Under Wind Driven Conditions: Laboratory Experiments January 2009.** Daniel Madrzykowski, Stephen Kerber

some notable exceptions. Buildings and topographical features alone or in combination deflect wind and as a result cause changes in wind speed and direction or localized wind effects around a building. In cities, this may be referred to as "building-spawned" wind. All buildings, regardless of size, can block wind, which may cause "local areas of amplified winds around corners and enhanced turbulence in building wakes." When wind hits the face of a structure it will seek the path of least resistance to move around it.[2]

In February 2008, a series of 14 experiments weas conducted in a seven-story building to evaluate the ability of positive pressure ventilation fans, wind control devices and external water application with floor below nozzles to mitigate the hazards of a wind driven fire in a structure. Each of the 14 experiments started with a fire in a furnished room. The air flow for 12 of the 14 experiments was intensified by a natural or mechanical wind. Each of the tactics were evaluated individually and in conjunction with each other to assess the benefit to firefighters, as well as occupants in the structure.

The results of the experiments provide a baseline for the hazards associated with a wind-driven fire and the impact of pressure, ventilation, and flow paths within a structure. Wind created conditions that rapidly caused the environment in the structure to deteriorate by forcing fire gases through the apartment of origin and into the public corridor and stairwell. These conditions would be untenable for advancing firefighters. Multiple tactics used in conjunction with each other were very effective at improving conditions for firefighter operations and occupant egress.

Fire departments that wish to implement the tactics used in this study will need to develop training and determine appropriate methods for deploying these tactics. Variations in the methods of deployment may be required due to differences in staffing, equipment, building stock, typical weather conditions, etc. However, there is uniformity in the physics behind the wind-driven fire condition and the principles of the tactics examined.[3]

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[2] **NIST Technical Note 1618, Fire Fighting Tactics Under Wind Driven Conditions: Laboratory Experiments January 2009.** Daniel Madrzykowski, Stephen Kerber

[3] **NIST Technical Note 1629 Fire Fighting Tactics Under Wind Driven Fire Conditions: 7-Story Building Experiments April 2009** Stephen Kerber, Daniel Madrzykowski

Wind-driven fire events:

> With high wind speeds, direction of attack becomes very important. Any openings can create a blow torch effect on the interior firefighting operations.

The UL report, *Analysis of Changing Residential Fire Dynamics and Its Implications on Firefighter Operational Timeframes,* focuses on residential fires, but the content is relevant to all firefighting operations. These experiments show living room fires have flashover times of less than 5 minutes when they used to be on the order of 30 minutes. Other experiments demonstrate the failure time of wall linings, windows and interior doors have decreased over time which also impact fire growth and firefighter tactics. Each of these changes alone may not be significant but the all-encompassing effect of these components on residential fire behavior has changed the incidents to which the fire service is responding.[4]

Fire dynamics can provide a fire officer or a firefighter with means to understand how a fire will grow and spread within a structure and how best to control that growth. Researchers have generated experimental results and computer models to explain how fire dynamics taken at the most basic level, the fire triangle, apply to the fire ground. Leadership will be required in every fire department to educate the fire service as a whole and implement needed changes to the current fire-fighting practices, which have been shown to make fire conditions worse before fire control and rescue can be achieved. Leadership is needed to embrace the knowledge of fire dynamics, employ a size-up of every fire scene, and then choose the fire-fighting tactics and task assignments based on that assessment. Now that research has elevated our understanding of fire dynamics within structures, fire service leaders must use the data to develop educational and training tools and to share information across the ranks and generations of firefighters. Standard operating procedures (SOPs) must be revised to incorporate our new understanding. All of the elements of training, certification, and practice must be coordinated to make the most effective use of the knowledge.[5]

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[4] **Analysis of Changing Residential Fire Dynamics and Its Implications on Firefighter Operational Timeframes 2012.** Stephen Kerber

[5] **International Fire Service Journal of Leadership and Management Volume 7 2013**

Finding 2

Improper or ineffective use of ventilation and positive pressure ventilation (PPV) fan usage. The fan was placed early in the fire development without adequate ventilation, causing the gases to be disturbed and spread toward the only opening and exit.

Recommendation 2

Fans are most effective when you can channel products of combustion to exterior (e.g. if fire is in attic that has burned through the roof you are able to channel the fire out an opening by pressurizing). Firefighters must use fans with a direct purpose. Fans without an opening or in a large area that cannot be pressurized will push products of combustion into unaffected areas and are ineffective. Studies show fans cannot overcome wind speeds in excess of 10 mph.

Considerations affecting the decision to ventilate include:
- Risks to occupants and firefighters;
- Building construction;
- Fire behavior indicators;
- Location and extent of the fire;
- Type of ventilation;
- Location for ventilation;
- Weather conditions;
- Exposures; and
- Staffing and available resources.[6]

It has also been noted in many of the wind driven experiments that one or two 27-inch PPV fans could not exceed the pressures generated by a wind-driven fire condition.[7] An early roof report would assist with ventilation options to either cut a hole in the roof or use doors and windows for ventilation. In many circumstances if the roof burns through it will assist with ventilation, thus water on the roof should only happen on defensive fires.

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[6] **IFSTA Essentials of Fire Fighting. 6th ed. 2013**

[7] **NIST Technical Note 1629 Fire Fighting Tactics Under Wind Driven Fire Conditions: 7-Story Building Experiments April 2009.** Stephen Kerber, Daniel Madrzykowski

An Underwriters Laboratories report states tactical considerations should include:

- **Stages of fire development**. The stages of fire development change when a fire becomes ventilation limited. It is common with today's fire environment to have a decay period prior to flashover which emphasizes the importance of ventilation.

- **Forcing the front door is ventilation**. Forcing entry has to be thought of as ventilation as well. While forcing entry is necessary to fight the fire it must also trigger the thought that air is being fed to the fire and the clock is ticking until the fire either gets extinguished or it grows until an untenable condition exists jeopardizing the safety of everyone in the structure.

- **No smoke showing.** A common event during the experiments was that once the fire became ventilation limited, the smoke being forced out of the gaps of the houses greatly diminished or stopped all together. No smoke showing during size-up should increase awareness of the potential conditions inside.

- **Coordination.** If you add air to the fire and don't apply water in the appropriate time frame, the fire gets larger and safety decreases. Examining the times to untenability gives the best case scenario of how coordinated the attack needs to be. Taking the average time for every experiment from the time of ventilation to the time of the onset of firefighter untenability conditions yields 100 seconds for the one-story house and 200 seconds for the two-story house. In many of the experiments the onset of firefighter untenability until flashover was less than 10 seconds. These times should be treated as being very conservative. If a vent location already exists because the homeowner left a window or door open, then the fire is going to respond faster to an additional ventilation opening because the temperatures in the house are going to be higher. Coordination of the fire attack crew is essential for a positive outcome in today's fire environment.

- **Smoke tunneling and rapid air movement through the front door.** Once the front door is opened, attention should be given to the flow through the front door. A rapid in-rush of air or a tunneling effect could indicate a ventilation-limited fire.

- **Vent Enter Search (VES).** During a VES operation, primary importance should be given to closing the door to the room. This eliminates the impact of the open vent and increases tenability for potential occupants and firefighters while the smoke ventilates from the now isolated room.

- **Flow paths.** Every new ventilation opening provides a new flow path to the fire

and vice versa. This could create very dangerous conditions when there is a ventilation-limited fire.

- **Can you vent enough?** In the experiments where multiple ventilation locations were made it was not possible to create fuel limited fires. The fire responded to all the additional air provided. That means that even with a ventilation location open, the fire is still ventilation limited and will respond just as fast or faster to any additional air. It is more likely that the fire will respond faster because the already open ventilation location is allowing the fire to maintain a higher temperature than if everything was closed. In these cases, rapid fire progression is highly probable and coordination of fire attack with ventilation is paramount.

- **Impact of shut door on occupant tenability and firefighter tenability.** Conditions in every experiment for the closed bedroom remained tenable for temperature and oxygen concentration thresholds. This means that the act of closing a door between the occupant and the fire or a firefighter and the fire can increase the chance of survivability. During firefighter operations, if a firefighter is searching ahead of a hose line or becomes separated from his crew and conditions deteriorate, then a good choice of actions would be to get in a room with a closed door until the fire is knocked down or escape out of the room's window with more time provided by the closed door.

- **Potential impact of already open vent on flashover time.** All of these experiments were designed to examine the first ventilation actions by an arriving crew when there are no ventilation openings. It is possible that the fire will fail a window prior to fire department arrival or that a door or window was left open by the occupant while exiting. It is important to understand that an already open ventilation location is providing air to the fire, allowing it to sustain or grow.

- **Pushing fire.** There were no temperature spikes in any of the rooms, especially the rooms adjacent to the fire room when water was applied from the outside. It appears that in most cases the fire was slowed down by the water application and that external water application had no negative impacts to occupant survivability. While the fog stream "pushed" steam along the flow path there was no fire "pushed."[8]

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[8] **Underwriter's Laboratories Impact of Ventilation on Fire Behavior in Legacy and Contemporary Residential Construction 2010.** Steven Kerber

Finding 3

Command requested a search of the business when the doors were locked and the lights appeared to be off. The Incident Commander made this decision based on the possibility that an employee may be inside after hours working in an office. Some firefighters interviewed said heavy dark black smoke under pressure came out the doors once they were opened.

Recommendation 3

The decision to initiate a search is a complex one. The incident commander must ultimately decide if the conditions are in favor of a victim's survivability. This is an example of a "no go" situation. Searching with hand-line (preferably 2 ½" with water flowing) would have been a must at this point. Charging into "heavy dark black smoke" is walking into super-heated gases waiting to light off. The SAFD must incorporate systemic incident command training throughout the organization. SAFD Extremely Dangerous Structure SOG was not recognized in this incident.

The following comments are from Chief Brunacini based on his review of the incident. Chief Abbott affirmed these recommendations and comments:

Three levels of operational risk management form the standard foundation of the incident risk management system:

We will take a big risk to protect a savable life.
We will take a small risk to protect savable property.
We will take no risk to protect life or property that is not savable.
We will always operate in all risk levels in a highly calculated manner.

The highly calculated manner is based on the profile (severity) of the operational risks compared to the capability of the standard safety system we apply to hazard zone operations. The basic fire ground hazards that injure and kill hazard zone workers include structural collapse, thermal insult, and toxic insult. The basic standard safety system components include an adequate number of trained, fit firefighters, PPE, safety SOPs, hardware (tools, equipment, apparatus, water, technology, etc.), and the incident command system (ICS).

The Incident Commander (IC) must make an initial and ongoing offensive/defensive operational determination based on the size, speed, and location of the hazards vs. the safety system protective capabilities to establish and maintain the appropriate strategic inside (offensive)/outside (defensive) attack positioning. If the hazards are bigger, faster, and better placed than the safety system, the operation must be defensive. If the safety system is big enough, fast enough and better placed enough to out-perform the hazards and has the capability to protect the workers, the strategy can be offensive.

Making the strategic decision (offensive or defensive) determines the basic operational position and function of the firefighters. Making this strategy decision is a major responsibility of the IC and how quickly and conclusively Command makes this Go/No Go strategic decision is a major element in LODD outcomes. When the Go/No Go interior operating strategy is incorrect (major IC mistake) the firefighters operating in the hazard zone are typically located in an offensive position under defensive conditions – this strategy mistake consistently produces firefighter injuries and death, as was the outcome of this incident.

Comparing the hazard profile of this incident with the safety system of the SAFD reflects the following:

The structure involved in this incident is a typical older, very large (21 separate occupancies) strip (long, narrow) shopping center, un-sprinklered, with a normal level of fire load (contents). Outside access was open with typical large-area, adjacent parking lots. The involved occupancies were closed, entry doors were locked and required forcible entry. There was no evidence of any occupants upon arrival/entry and the no-occupant status was verified throughout and after operations.

Upon arrival of the first unit, the fire was reported to be somewhere inside the gym. It was quickly identified the fire was in the attic. Units reported the fire had burned through the roof four minutes after initial arrival. Firefighters operating on the interior unsuccessfully attempted to conduct an attack through the ceiling that was 8 feet high. Pulling an elevated ceiling (creating access holes) to operate fire streams into the attic under heavy fire conditions is virtually impossible. It is equally

impossible to produce and apply an adequate rate of flow through attack lines (either inside and/or outside) to effectively control within any successful time frame applied to an advanced fire in a large, commercial-sized attic (8400 square feet).

The firefighters initially entering through the front doors encountered heavy smoke and high heat conditions. Those conditions quickly overpowered and killed Firefighter Deem, who was fully protected in standard, well-maintained PPE. The interior environment was completely untenable and would have very quickly overcome any unprotected occupant based on the thermal and toxic insult created by interior conditions. These toxic - thermal conditions eliminated the possibility of any physical rescue of a trapped occupant. Those same insults sadly had exactly the same effect and outcome on Firefighter Deem. Within the standard risk management plan, this incident was a no-risk operation based on life and property already lost.

The advanced fire conditions also overpowered every other safety system component. The SAFD is a well-equipped and adequately staffed metro fire department and dispatched a standard commercial fire assignment. No amount of firefighters can unburn current advanced fire conditions in an already involved fire area (attic). There are no safety SOPs that can successfully protect firefighters from advanced fire conditions and these standard, long-standing safety procedures typically indicate the importance of developing a strategy (defensive) to match those advanced conditions. There is no hardware capability whose use (no matter the skill level of the workers) can convert deadly defensive conditions to survivable offensive conditions after those defensive conditions are advanced and deep seated. The other four safety system parts (adequate firefighters, safety SOPs, hardware, and PPE) must be used to match the overall operational strategy (that must be determined by the IC) and then used within that declared strategy. The strategy drives the use of those safety system components, not the opposite.

Command must develop both an overall operational strategy and related incident action plan (IAP) to match incident conditions. There is no offensive strategy miracle the IC can produce that will save unprotected interior occupants or control rapidly expanding current interior fire conditions within a commercial sized building. The level of interior involvement at this incident qualified strategically from the very

beginning as a no-risk commercial defensive situation. When there are defensive conditions present, the IC must go defensive simply because if those conditions "get on" a firefighter the IC cannot "get them off" (there is no decontamination of thermal/toxic insult and collapse). This is exactly what occurred to Firefighter Deem.

The local incident command system (this fire was a Type 5 incident - all SAFD resources) is the critical safety system component that determines the overall operational strategy and that strategy determines and must drive how the other parts of the safety system (number of firefighters/safety SOPs/hardware/PPE) must be conducted. If the IC declares a defensive fire as offensive and operates on the interior of the burning fire area, all the other parts of the standard safety system are basically futile simply because the fire will outperform them. In this incident that safety system defeat occurred very quickly with a fatal result. IC1(L-35 Captain) should have evaluated rescue/fire control conditions and connected that evaluation to a size-up of both the commercial size of the building and the extent, location and travel of the fire (venting from the roof) and declared and initiated operations as a defensive operation from the very beginning of his arrival/evaluation.

The transfer of command from IC 1 to IC 2 (BC-3) is a critical safety and effectiveness transition because that upgrade brings in a strategic level (rank) boss with a new set of "eyes." Taking command of an incident that is already underway requires IC 2 to critically evaluate current and forecasted conditions primarily to verify if the current strategy that is in place is correct. IC 2 inherited upon arrival an offensive interior attack operation in a large building with an uncontrolled fire in a concealed space (attic) that exposed the entire fire area. A critical reason for the critical review of the operational strategy when command is transferred is for the new IC to adjust the strategy if it does not match current conditions. It took several minutes for the new IC to order interior crews out of the building. Deteriorating interior conditions almost immediately created May Day conditions and responses. Given those conditions, IC 2 should have changed strategy, gone defensive, verified the exit with a PAR and then ordered ground level and elevated large caliber defensive fire streams into the fire area from outside the collapse zone(s). Based on a careful (fire/separation/structural) evaluation, cut-off operations might have been

conducted within the adjacent, exposed occupancies.

Recommendations by the representatives of the Houston Fire Department concluded Smoke Reading with Fire Dynamics would have prevented members from charging into the heavy dark black smoke in an occupancy that was closed and with few cars in the parking lot.

With the amount/kind of smoke described, it is common practice to make an evaluation hole in the ceiling upon entry with a pike pole to ensure that they were not passing fire. Pulling ceiling in the structure when they believed they had located the fire should only have been done with a hose-line in place.

In accordance with SAFD Extremely Dangerous Structure Guideline:

- .8 subset .2 states venturing into an extremely dangerous structure without a hose or LASAR (Life Safety Rope) is prohibited.
- .8 subset .4 states companies should not advance more than 100 ft. into a structure.
- .9 Primary searches in dangerous structures
    - A primary search should not be attempted in areas of a structure where victim survivability is not possible (i.e., fire areas, high heat areas, areas with heavy smoke for a substantial period of time, etc.).
    - For areas that are searchable, TIC (Thermal Imaging Camera) searches launched from exterior openings shall be employed. TIC searches will always include the use of a hose line or LASAR rope to provide means of escape if the TIC malfunctions or interior conditions rapidly deteriorate.
    - Primary search conducted without the use of LASAR ropes, TICs and/or with an attack line are prohibited.
    - TIC Search crews shall not venture farther than 100 ft. into an extremely dangerous structure.

Finding 4

Firefighters initiated the search without a tag line or hose-line and advanced past the suppression crew with the hose-line. The search crew saw what they believed to be fire in the attic and took actions outside of their assignment and changed from search to attack and began pulling ceiling without a hose-line readily available and unknown to Command. These actions are commonly referred to as "freelancing."

Recommendation 4

Freelancing is not to be confused with a firefighter's initiative or ability to do what needs to be done without direction. Freelancing by definition is when individuals work independently and commit to tasks and acts without the express knowledge or consent of an officer or incident commander. Essentially, it is firefighters doing what they want to do, when they want to do it. This often leads to avoidable close calls or tragedies.

The safety of responders operating at an emergency scene is a key concern and one of the primary skills that the firefighter must develop.[9] Firefighters must conduct operations, maintain team integrity, and make sure no team members' safety is compromised. There are ways to eliminate freelancing on the fire ground. It is critical to have pre-determined detailed assignments for special responses such as high-rise fires, hazardous material incident or an active shooter. The SAFD has incident management procedures in place, such as Staging, use of the Order Model, and Incident Command. These clearly lay out the actions to be taken by firefighters and fire officers on the fire scene. When followed, they also minimize the occurrence of freelancing. A review of these procedures, and a reaffirmation of SAFD management and supervisory personnel's understanding and support of these procedures, should be conducted.

It is critical that any SAFD members who are known to promote the independent and "Go Get It" attitude that might result in a disregard for command structure, firefighter safety or fire suppression best practices, be dealt with directly by supervisors and managers. This should be addressed through remedial training, disciplinary action, or if necessary, relayed to the SAFD senior staff for action.

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[9] NFPA 1001 2013 Edition Standard for Firefighter Professional Qualifications 5.3.3, 5.3.9

The Second Firefighter Life Safety Initiative states "The fire service can address this attitude head-on by implementing strategies for both the organization and the individual to accept responsibility and ensure that accountability is an integral component to creditable health and safety programs. Turning a blind eye to unsafe behaviors should never be an acceptable action. Above all else, the Firefighter Life Safety Initiative proposes that every member of a department must accept personal responsibility for his or her actions, as well as be "accounted for" and held accountable by the organization."[10]

The chances of freelancing in a fire department diminish greatly when all members on all teams understand the mission they are trying to accomplish and the structure they are required to do that within. This cannot be accomplished unless the SAFD places a high and ongoing emphasis on personal accountability.

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[10] Everyone Goes Home 16 Firefighter Life Safety Initiatives (see attached appendix)

Finding 5

The accountability system used was ineffective. After the interviews, it was unclear what system was in place other than Officers and Command manually keeping track of the crews. Crew integrity was not maintained, resulting in confusion when FF Vasquez was found because the crew had reported a PAR.

Recommendation 5

Command has access to a tactical sheet, CAD, and an electronic accountability system. The electronic system is utilized at the beginning of each shift to show what firefighters are on duty on what apparatus. The CAD system helps identify units on scene. A monitoring system for SCBAs is available on scene in some instances, but was not monitored in this incident until later in the "Mayday."

There is no effective fire ground accountability system in place for daily operations within the SAFD (Grace System, Scott SCBA Accountability System, or Passport System, etc.). Officers and Incident Commanders currently keep track of their own crews and provide PAR when requested.

A procedure is necessary for assigning members to another Captain or confirming a two-person crew procedure is in place.

Search teams must be diligent with accountability entering and exiting with all of their crew members.

All members who are likely to be involved in emergency operations shall be trained in the incident management and accountability system used by the fire department.[11] The fire department shall establish written standard operating procedures for a personnel accountability system that is in accordance with NFPA 1561.[12]

Fire departments should ensure that firefighters maintain crew integrity when operating on the fire ground, especially when performing interior fire suppression activities.

[11] **NFPA 1500 5.1.11.** 2018.
[12] **NFPA 1500 8.5.1.** 2018.

Discussion: Firefighters should always work and remain in teams whenever they are operating in a hazardous environment.[13] Team integrity depends on team members knowing who is on their team and who the team leader is; staying within visual contact at all times (if visibility is low, teams must stay within touch or voice distance of each other); communicating needs and observations to the team leader; and rotating together for team rehab, team staging, and watching out for each other (e.g., practicing a strong buddy system). Following these basic rules helps prevent serious injury or even death by providing personnel with the added safety net of fellow team members. Teams that enter a hazardous environment together should leave together to ensure that team continuity is maintained.[14] The 2010 IAFC Rules of Engagement of Structural Firefighting states, "Go in together, stay together, come out together."[15] The SAFD must utilize a fire ground accountability system at all emergency incidents. Sadly, this did not occur at this fire.

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[13] **IFSTA Essentials of Fire Fighting**. 6th ed. 2013.

[14] **Safety and survival on the fireground.** 1992, V. Dunn.

[15] **Rules of Engagement of Structural Firefighting**. 2010 IAFC Safety, Health, and Survival Section [http://www.iafcsafety.org]

Finding 6

When "Mayday" was called several units continued to operate on the channel being used for the "Mayday." PAR was conducted on the same channel as the "Mayday." FF Vasquez became separated from his crew and received a low air alarm on his SCBA. He performed a hot bottle change out from the RIT bag and never thought to call for a "Mayday," stating he never thought he was in trouble.

Recommendation 6

When a "Mayday" is called consider moving companies to another channel early if PAR cannot be completed, keeping RIT and any other companies that may affect the rescue on original channel.

San Antonio Fire Department RIT SOP .4 subset .2 states: Move all other traffic to a different TAC channel.

NFPA 1407 states "Secure a dedicated communications channel (talk group) for rescue operations."[16]

According to NFPA 1407, the following conditions are considered automatic criteria for calling "Mayday":
> (a) Member in low-air alarm *and* disoriented or unsure of location
> (b) SCBA failure
> (c) Member trapped, entangled, or unable to free self within approximately 1 minute
> (d) Finding a fire fighter in distress
> (e) At the discretion of Command[17]

The SAFD would benefit on multiple levels from the Fireground Survival Course put on by the International Association of Fire Fighters (IAFF). This course includes:

- Accountability Training

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[16] **NFPA 1407.** 2016 Edition 7.11(3).

[17] **NFPA 1407.** 2016 Edition.

- "Mayday" Training
- Search and Rescue Training
- Fire Dynamics Training
- Smoke Reading

Additionally, it is recommended that the SAFD review the research by Chief Don Abbott on "Maydays" located at http://projectMayday.net/

Finding 7

No pre-fire plans were available for the involved structure(s).

Recommendation 7

Pre-incident planning surveys allow the fire department to gather information about occupied structures before an emergency occurs which could assist with identifying any of the following:

- Locating and controlling the fire
- Locating occupants
- Determining potential hazards
- Improving emergency operations
- Construction type
- Floor Plans
- Contents
- Occupancy type
- Fire detection and suppression systems
- Fuel load[18]

Pre-incident plans may be done at the company level or with input from the code enforcement section within the jurisdiction. Input from the agency's inspection division is highly desired.

NFPA 1620 provides guidance in developing a Pre-Incident Plan.[19] The purpose of NFPA 1620 is to assist agencies in the development of pre-incident plans to assist personnel in effectively managing incidents and events for the protection of occupants, responding personnel, property, and the environment.

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[18] **IFSTA Essentials of Fire Fighting**. 6th ed. 2013.

[19] **NFPA 1620** Standard for Pre-Incident Planning. 2015 Edition.

Finding 8

The Spartan Box Gym and Computer Repair Plus, two of the businesses involved in the fire, did not have approved inspections on file with the City of San Antonio. The last inspection was April 2017 for both businesses. Computer Repair Plus passed the fire inspection but failed the building inspection. The Spartan Box Gym failed the fire inspection. Neither business had been issued a Certificate of Occupancy (COO) by the city.

Recommendation 8

Inspections enhance safety of firefighters and citizens because the fire code represents best practices.

NFPA 1730 contains minimum requirements relating to the organization and deployment of fire prevention inspection and code enforcement, plan review, investigation, and public education operations. NFPA 1730 states that fire prevention inspection and code enforcement shall be conducted to ensure compliance with adopted codes and standards. It also states the Community Risk Assessment (CRA) shall be the basis for the development of the fire prevention inspection and code enforcement program per Chapter 5 of NFPA 1730.

The **Minimum Inspection Frequency.** Existing occupancy fire prevention inspection and code enforcement inspection frequencies shall be not less than those specified in Table 6.7. [20]

Table 6.7 Minimum Inspection Frequency

Occupancy Risk Classification	Frequency
High	Annually
Moderate	Biennially
Low	Triennially
Critical infrastructure	Per AHJ

At the time of the fire, none of the involved occupancies had a fire sprinkler system installed. This allowed the initial fire to grow in size and severity. Fire sprinkler systems have

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[20] **NFPA 1730** Standard on Organization and Deployment of Fire Prevention Inspection and Code Enforcement, Plan Review, Investigation, and Public Education Operations. 2016 Edition.

an excellent record of saving lives and property. Some portable fire extinguishers were present in various occupancies. Several penetrations in the walls between units were not sealed correctly to prevent fire spread. An inspection of the property would have likely identified unsealed penetrations in the fire wall separating the gym from the storage area (Wedge).

Finding 9

There is a significant time difference for the updates shown of the SOGs/SOPs reviewed for this incident. According to staff the SOGs/SOPs had been updated in the online database but the actual records provided did not show the correct date. SAFD members stated the database "SharePoint" is difficult to access or navigate, and retrieving the most recent record is difficult. SOPs/SOGs need to be updated regularly.

Recommendation 9

Organizations tend to get complacent without a built-in mechanism to ensure regular reviews of operational policies and practices. A periodic review of SOPs allows agencies to look at how they currently do things and determine whether it is the best (i.e., the most effective, efficient, and safe) way to conduct operations.

There are no hard and fast rules about the frequency and timing of periodic evaluations. For some agencies, a formal review every six months may be prudent. For others, an annual or biannual review might work. Agencies undergoing major organizational changes could decide to time evaluations after significant milestones in the process. Each agency must determine when and how often evaluations are necessary. The results should be institutionalized in management and operations plans.[21]

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[21] **USFA Developing Effective Standard Operating Procedures For Fire and EMS Departments** FA-197/December 1999

Finding 10

While San Antonio Fire Department has many good policies and procedures in place, pockets of members remain who are resistant to change. The SAFD would benefit from a culture of continuous improvement.

Recommendation 10

Fire Departments need to adopt "Cultural Change." Despite improvements in personal protective equipment (PPE), apparatus safety devices, more availability of training, greater emphasis on *firefighter health and wellness*, and decreases in the number of fires and dollar loss due to fires, the rate of on-duty firefighter death and injury has remained relatively un-changed in the past four decades.

The following five items from the **National Fallen Firefighters Foundation** (**NFFF's) 16 Firefighter Life Safety Initiatives (FLSIs)**[22] are directly related to this incident:

FLSI 1 states: Define and advocate the need for a cultural change within the fire service relating to safety; incorporating leadership, management, supervision, accountability, and personal responsibility. Merriam-Webster defines **culture** as a way of thinking, behaving, or working that exists in a place or organization.

FLSI 2 states: Enhance the personal and organizational accountability for health and safety throughout the fire service. The fire service can address this attitude head-on by implementing strategies for both the organization and the individual to accept responsibility and ensure that accountability is an integral component to creditable health and safety programs.

FLSI 3 states: Focus greater attention on the integration of risk management with incident management at all levels, including strategic, tactical and planning responsibilities. Too many lives are lost in situations where the risks were not justified. The fire service understands risks, yet the same accidents, injuries and fatalities keep happening. Incidents must be managed with a constant awareness and balance between risks and desired outcomes. High risk is only acceptable when there

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[22] http://www.everyonegoeshome.com/16-initiatives

is a real possibility of saving a life. Fire command must carefully measure and control risks to save valuable property that can be saved. It is not an acceptable risk to attempt to save lives or properties that are already lost. The fire service should remember that if something bad happens it miscalculated, and that we should never use "that's the way it's always been done" to ever accept a line-of-duty injury or death.

FLSI 7 states: Create a national research agenda and data collection system that relates to the 16 Firefighter Life Safety Initiatives. Communication with all fire departments in clear and concise ways is critical to improving the safety of firefighters. Acknowledging the need for research and data was an important step for the fire service to take in 2004. Now it is critical that the identified research be conducted, the results be transferred and implemented at the local levels. This is the only way that research will impact the life safety of firefighters and the communities they serve.

FLSI 9 states: Thoroughly investigate all firefighter fatalities, injuries, and near-misses. Each year nearly 100 firefighters are killed in the U.S. in on-duty incidents. In 2012, the National Fire Protection Association estimated that more than 69,000 firefighters were injured on the job. The National Fire Protection Association (NFPA) believes that their estimate is accurate to +/- 6.5%. This is a projection, not an actual number – we're really not sure how many firefighters were injured in 2012. We don't truly know how many actual injuries there were, and we certainly have no idea how many near-miss (or near-hit) incidents occurred.

Initiative 9 asks us to learn from our mistakes—the only way to do this is to thoroughly investigate every near-miss, significant injury or fatality.

Finding 11

A review was completed of training records for Firefighter Deem to be used as an indicator to evaluate training overall in the department. The document forwarded to the SFMO consisted of training completed at the SAFD Fire Academy to present. Other than initial training when FF Deem was hired, the majority of the recent training appears to be on-line courses required by SAFD. The SFMO inquired if any other training is documented in the department beyond this mandated on-line training and was informed that other in-service training is documented in a station log book. Identifying the specific training conducted while on duty would require the SAFD to review FF Deem's schedule and then go to each station he worked at and review the log book for specific information to validate fire station training took place. Unfortunately, the other findings in this LODD investigation suggest training enhancements are needed to minimize risk exposure for SAFD firefighters.

Recommendation 11

The SAFD needs to document all training of firefighters in a central location or system and be able to provide documents to verify the training for each firefighter in the organization. All training that cannot be verified through the department's record management system cannot be proven to have taken place. The Texas Commission on Fire Protection (TCFP) cites the Texas Administrative Code Title 37[23] regarding retention of records. The rule states "Continuing education records shall be maintained by the department in accordance with the Texas State Library and Archives Commission, State and Local Records Management Division, Records Schedule, Local Schedule (GR 1050-28), whichever is greater." Using only the station log book to document training is inadequate. Additionally, hands-on training needs to be in place to supplement on-line training to facilitate a robust program that continually improves the skill sets of firefighters. Hands-on training would include ongoing training programs at the SAFD Fire Academy, multi-company drills, incident command training, in-service company training, and other training opportunities.

NFPA 1401 Recommended Practice for Fire Service Training Reports[24] and Records provides guidance in developing and maintaining training.

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[23] Texas Administrative Code Title 37 Part 13 Chapter 441 Rule 441.5.

[24] **NFPA 1401.** 2017 Edition. Recommended Practice for Fire Service Training Reports and Records.

NFPA 1401 in part states:

5.1.1.1 All members of a fire department should receive standardized instruction and training.

5.1.1.3 Standardized training schedules should be prepared and published for both short-term scheduling (considerable detail), intermediate-term scheduling (less detail), and long-term scheduling (little detail) to facilitate long-term planning by the training staff, instructional staff, company officers, and personnel.

5.1.2.1 Periodic Training Schedule - Station Training. The station training schedule, which is prepared by the training officer, should designate specific subjects that are to be covered by company or station officers in conducting their station training.

5.1.2.2 Periodic Training Schedule - Training Facility Activities. The training facility activities schedule details when companies should report to the training facility for evolutions or classes.

5.4.1.1 Information and documentation that should serve as a foundation for submission to state certification programs should include, as a minimum, the following:

> (1) A single file that includes all training accomplished by the individual firefighter during his/her career.
> (2) Dates, hours, locations, and instructors of all special courses or seminars attended. (3) Monthly summaries of all departmental training.

National Safety Culture Change Initiative

FEMA

U.S. Fire Administration

Mission Statement

We provide national leadership to foster a solid foundation for our fire and emergency services stakeholders in prevention, preparedness, and response.

FEMA

National Safety Culture Change Initiative

Study of Behavioral Motivation on Reduction of Risk-Taking Behaviors in the Fire and Emergency Service

Developed by the
International Association of Fire Chiefs
through a partnership with the
U.S. Fire Administration

April 2015

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Executive Summary

Controlling and extinguishing hostile fire comes at a great cost to human life and secondarily at great financial expense. Despite improvements in personal protective equipment (PPE), apparatus safety devices, more availability of training, greater emphasis on firefighter health and wellness, and decreases in the number of fires and dollar loss due to fires, the rate of on-duty firefighter death and injury has remained relatively unchanged in the past four decades. The National Safety Culture Change Initiative (NSCCI) project is a joint partnership of the U.S. Fire Administration (USFA) and the International Association of Fire Chiefs (IAFC) aimed at identifying both positive and negative culture and climate found in the American fire and emergency service community. NSCCI, through this study and its website, www.ffsafetyculture.org, and other project efforts, will identify adverse behaviors and recommend changes to both culture and climate for occupational safety and health within the fire and emergency service.

Contributors

The organizations and individuals who contributed to this paper were selected as a representative cross section of the fire service. The intent was to capture both the breadth of the fire service, encompassing the different delivery models of emergency response, and the depth of the fire service by including groups that had agendas to look at the specific needs of the fire service. Additionally, the individual experiences of those connected to the creation of this paper, both within and outside of the fire service, provided a rich backdrop for discussion and comment of diverse viewpoints throughout the development of the paper.

Introduction

The National Fallen Firefighters Foundation (NFFF) has asserted that the culture of the fire and emergency service is a major contributor to the fatal trend in firefighter health and safety (Siarnicki, 2010). This culture has not been concisely defined, but literature suggests both that it exists as a stand-alone concept and that it has unique characteristics that are uncommon to nonuniformed professions. Soeters, a leading scholar in the organizational culture of military and emergency service units, states that the peculiarities of organizations, such as the fire and Emergency Service, "justify the special attention of researchers to the culture and identity of these ... organizations" (Soeters, 2000, p. 466). An understanding of the culture can be used to develop safer practices to reduce the number of firefighters killed and injured each year.

This effort is directly related to three of NFFF's 16 Firefighter Life Safety Initiatives (FLSIs). FLSI 1, which states: **Define and advocate the need for a cultural change within the fire service relating to safety; incorporating leadership, management, supervision, accountability, and personal responsibility** (NFFF, 2011), is an overarching initiative, acknowledging that the organizational culture of the fire service must undergo a change to accept the other 15 recommendations. Without understanding the culture within a fire and emergency service organization, it is likely that changes called for in the other 15 initiatives cannot be successfully implemented or sustained.

Initiatives 2 and 6 are also very relevant to this project. Since 50 percent of line-of-duty deaths (LODDs) are attributed to cardiovascular events and one-third of these deaths are in people with known cardiac histories, health and safety of agency members is a controllable risk factor (NFFF, 2011, p. 13). Initiative 6 encourages implementation of and adherence to existing medical and fitness standards, while Initiative 2 focuses on empowerment of all members of a department to be involved and engaged with departmental health and safety while around the station, while responding to and returning from calls for service, and while operating at emergency scenes.

The initial research phase of this study was directed toward clearly identifying and defining the problem. There is widespread acceptance of the presumption that behavioral issues contribute to both firefighter injuries and LODDs and that some type of cultural change is needed to alter the perceptions of acceptable and unacceptable risks. The objective of the research effort is to narrow the focus to identify the particular behaviors that need to be addressed.

The NSCCI project is aimed at identifying the aspects of fire and emergency service culture that contribute to preventable occupational illnesses, injuries and fatalities and subsequently changing those cultural norms that either promote or tolerate excessive risk behaviors. The Project Team developed this document based on the perspec-

tive that the expansion of a more appropriate safety culture should not be seen as a challenge to the overall fire service nor contrary to the mission of saving lives and protecting property. This document focuses on integrating safety into the fire service culture without diminishing any of its existing positive aspects.

It should be mentioned that understanding fire and emergency service culture as it relates to fire prevention activities is also important, although this project does not include that perspective.

Throughout this paper, the term fire and emergency service is used to broadly capture any type of emergency response organization that responds to fires or other crises that erupt in communities throughout the U.S. An effort was made to be inclusive of nonfirefighting areas, but there is little literature available that looks broadly at emergency services that are not directly engaged in firefighting. However, a study produced under a cooperative agreement between the National Highway Traffic Safety Administration (NHTSA), with support from the Health Resources and Services Administration's (HRSA's) Emergency Medical Services for Children (EMSC) program, and the American College of Emergency Physicians (ACEP) looks specifically at an "EMS Culture of Safety" and can be accessed at http://www.emscultureofsafety.org/wp-content/uploads/2013/10/Strategy-for-a-National-EMS-Culture-of-Safety-10-03-13.pdf.

Photo by Ron Moore, Courtesy of Cornbelt (Illinois) Fire Protection District

Understanding the Fire and Emergency Service Culture

From the origins of an organized fire and emergency service in the U.S. through the early 1970s, very little attention was directed toward firefighter safety (Granito, 2003); the inherent risk factors of firefighting and emergency operations were recognized and simply accepted as unavoidable occupational hazards. Generations of firefighters were subjected to extreme risks, in most cases because their mission was considered essential and there were few alternatives available to them. The image of the firefighter, which is the foundation of the fire and emergency service culture, was built around selfless heroism — the firefighter is always ready to face any risk and, if necessary, to make the supreme sacrifice in order to save lives and property.

Serious efforts to address firefighter safety began during the 1970s and expanded significantly through the 1980s and 1990s, coinciding in part with major advances in protective clothing and equipment, as well as the development of more effective tools and procedures that allowed for fire suppression operations to be conducted with better calculated risks to the firefighter. During that time period, operational procedures began to incorporate firefighter health and safety as primary objectives, on a par with saving civilian lives and as a higher priority than saving property (Linke, 2008). National Fire Protection Association (NFPA) 1500, *Standard on Fire Department Occupational Safety and Health Program* was published in 1987 as the first consensus standard to address occupational safety and health for organizations delivering emergency services.

The NSCCI project is directed toward this particular aspect of the effort to further reduce LODDs, as well as decreasing occupational injuries and illnesses within the fire and emergency service. It is intended to identify and examine the factors that cause or influence firefighters to make decisions and engage in actions that involve unnecessary and avoidable risks, which often places their own lives, and potentially the lives of their fellow firefighters, in danger when there are less dangerous options available. Expressing the concept in terms of risk management, this would refer to situations where the potential gain is out of balance with the potential loss.

This paper and its proposed strategies for reducing risk-taking behaviors in the fire and emergency service are based on a literature review, focused discussions, and the experiences and collective knowledge of members of the Project Team and reviewers.

What Drives Firefighter Behaviors?

U.S. society as a whole may contribute to the risk behaviors that are demonstrated within the fire service. Communities expect an urgent and timely response to emergencies and disasters with fully trained individuals arriving on adequately staffed apparatus. However, public knowledge of the complexities and challenges of building, maintaining and delivering such service capabilities is often transparent or invisible to those funding the services until the system fails to meet public expectations. Some fire and emergency service organizations do not have the resources to implement advanced training programs or provide training beyond that which is minimally required for each position.

Firefighters who are questioned in relation to their high-risk behaviors often refer to either public or organizational expectations of selfless heroism. Such perceptions are consistent with the popular image of the firefighter as a daring individual who is willing to risk life and limb to save the life of a total stranger and who is lauded for doing so.

Those with a traditional outlook often express disagreement with the emphasis that has been directed toward "acceptable risks" and "rules of engagement," claiming that they promote nonaggressive and ineffective operations. The opposing viewpoint asserts that there are times when it is appropriate to be boldly aggressive and times to be intelligently cautious. The focus of this paper is to seek out areas where the level of safety in the provision of a fire and emergency service organization can be improved without diluting or lessening the critical mission of service delivery.

Examples of Inappropriate Risk Behaviors

Firefighters are routinely called upon to deal with situations that involve risks that could result in their death or injury or contribute to an occupational illness or disability. Several of these risk factors are inherent to the nature of the work that firefighters perform; however, the level of exposure to those risks varies depending on decisions that are made and actions that are taken — or not taken — when faced with a particular situation and set of circumstances. A general risk management philosophy in the fire service is risk

a lot to save a lot, risk a little to save a little, and risk nothing to save nothing (Linke, 2008).

Most of the discussion of risk exposure is written in the context of structural firefighting, where the concepts of offensive versus defensive strategy are easily defined. Offensive strategy places firefighters in close contact with the fire, inside the burning building, and involves a certain level of inherent risk. Defensive strategy keeps firefighters outside, in what should be safe exterior locations, to minimize risk. This concept requires some extrapolation to be applied to other emergency responses and scenes.

While the Incident Commander's (IC's) decisions establish a theoretical level of acceptable risk that applies to every individual involved in an incident, at times, individual firefighters knowingly or unknowingly expose themselves to higher levels of risk than the IC has deemed acceptable. This is a particular problem when individual perceptions of acceptable risk are different from the IC's perceptions.

Fire and emergency service organizations should concentrate on implementing and demonstrating an effective and measurable model of firefighter training. This model supports and emphasizes the behaviors learned during initial firefighter training (recruit training) and continuously builds upon those experiences to build advanced skill sets throughout their service as a firefighter/EMS provider. This training should subscribe to the philosophy that health and safety are the capstone of any model. The focus areas of risk behavior modification are education, training, health and wellness.

With regard to vehicle operations for both personally owned and agency-owned vehicles, fire and emergency service organizations should concentrate on implementing and demonstrating an effective and measurable model of driver/operator training that advances skill sets throughout tenure as a firefighter, ensures quality, and provides for driver/operator accountability. The focus areas of risk behavior modification are driver capability, quality assurance and accountability.

Fire and emergency service organizations must also focus on moving toward compliance with national standards for health and wellness, fitness for duty, and emergency scene rehabilitation.

In each of these cases, scenarios can present themselves where emergency responders act without a full understanding of the potential scope and fallout from their actions, leading to illness, injury or death that is out of alignment with the potential value of the chosen action.

What Is Culture?

To change the undesirable components of fire and emergency service culture, one must first understand the broad construct of culture and then apply this framework within the fire and emergency service. Schein describes the culture of a group as the "basic, shared, assumptions" learned by a group as it solves problems (2004, p. 17). He indicates that when this problem-solving is successful, the methods are taught to new members as correct solutions to the problems (Schein, 2004). Hofstede refers to these methods and assumptions as the "collective programming of the mind" (2001, p. 1). Kluckhorn similarly defines culture as "patterned ways of thinking," based upon traditional and historical ideas (1951, p. 86). All three of these definitions identify culture as a process that occurs in the individual, based upon learned behaviors that are influenced by a group and the group's history.

Culture is reflected in a group's internal characteristics, its character, and its daily existence (Goodman, Zammuto, & Gifford, 2001). It is influenced by organizational history, policies, uniforming, facilities, vocabulary, leadership and management within an organization (Compton, 2003). Uniformed professions, such as police departments, fire and emergency service organizations, and military units, have such unique cultures unto themselves that they have characteristics, such as a sense of duty and allegiance, that are not found in such a strong degree in other professions.

"Culture can be difficult to substantively define, but culture truly describes how things are done in the [fire and emergency service] organization" (Compton, 2003, p. 24). This comment may allude to how entwined the culture of the fire and emergency service organization is with all aspects of the operations and delivery of services. The culture impacts how the firefighters interact with each other, from where a firefighter or officer sits at the dinner table, which seat they can occupy in the TV room and when they may sit down, where they sit on emergency apparatus and what their roles at emergency scenes will be, to how they may interact with other members of the company. While these rituals and values have some commonality across the different fire and emergency service organization types and sizes throughout the U.S., it would be both inaccurate and irresponsible to assume that these traits and values are reflected identically in all fire and emergency service organizations. However, since the fire and emergency service functions as individual organizations within the framework of a larger organi-

zational culture, there should be some common themes and values that are present throughout most fire and emergency service organizations.

Uniformed organizations, such as fire and emergency service organizations, represent "specific occupational cultures that are relatively isolated from society" (Soeters, 2000, p. 465). Archer (1999) supports this with his assertion that the fire and emergency service is "characterized by its strong culture," which includes the use of a uniform, hierarchical command structure, promotion solely from within the existing ranks, and long-standing traditions (p. 94). Fire and emergency service organizations further differ from other organizations/businesses in that they are exposed to uncommon levels of danger, work unusual or shift schedules, require a great deal of physical and mental stamina from their members, and can recall staff and cancel their prescheduled leave due to emergencies or staffing shortages (Soeters, 2000).

This culture of the fire and emergency service has evolved through a complex process of group learning (Thompson & Bono, 1993). This group learning occurs during training, emergency responses, downtime around the fire station, and informal activities, such as cookouts, meals at the department, storytelling, and watching TV. In some cases, in the fire and emergency service, methods espoused as solutions may be incorrect, but they are perpetuated because they are viewed as traditions (Gasaway, 2005). Pessemier supports this in his 2008 discussion of improving fire and emergency service organization safety by stating:

> "Normalization of unsafe practices can also occur as a result of the fact that other individuals take the same [incorrect or unsafe] actions. If, in general, nothing bad happens as a result of unsafe practices, and if everyone else in the organization participates in the same practices, then these practices become part of the normal and accepted way of accomplishing tasks. As a result, Fire and Emergency services organization history and traditions can create a culture that is difficult to change" (2008b, p. 3).

In June of 2007, nine firefighters from Charleston, South Carolina, were killed in a fire in a large furniture store. The analysis of operations of the Charleston Fire and Emergency Services organization revealed that, among many factors, "The culture of the Charleston Fire Department promoted aggressive offensive tactics that exposed firefight-

ers to excessive and avoidable risks and failed to apply basic firefighter safety practices." As a result, in the initial report on changes that need to be accomplished in the department to prevent a reoccurrence of a similar tragedy, one of the highest priority items is a change to the department's "Culture and Leadership" (Routley, 2007).

In addition to the number of fatalities, it is important to consider the number of on-the-job injuries that firefighting contributes to annually. NFPA reports that in 2012, there were 69,400 job-related injuries. Peterson identifies over 95,000 injuries per year (2010), and Houdous, Pizatella, Braddee and Castillo support this with a calculation of 90,000 injuries per year, with an increasing rate of injury in the fire and emergency service (2004). Brennan (2011) extracted from NFPA the number of on-scene emergency injuries to be 32,205 in 2009 and compared these to the number of members of the U.S. military who were wounded in combat. In the period from October 2001 through August 2008, there were 30,568 U.S. service members wounded in action — less than the number of firefighters injured in the single year 2009 (Brennan, 2011). It should be mentioned here that the likelihood of all on-the-job injuries and related illnesses being reported consistently is suspect and that the numbers are probably higher.

Aspects of the Culture

Being service-focused, having a strong identity and role in the community, and being willing to accept risk are all positive traits when they exist in an environment that is safety-focused (Compton, 2003).

Before discussing some of the negative traits that have been documented about the culture of the American fire and emergency service community, one must remember that no culture is all good or all bad. Traits offered in this paper are to further the point that a change is necessary, so more of the negative traits are elucidated. Additionally, there are more examples in the peer-reviewed literature of the failures of the culture, as these events tend to receive more attention than the daily successes and examples of positive action. According to Brunacini, the original firefighters in colonial America in 1740 were selected to protect their community based on their ability to do three things: (1) They had to be **fast**, to get to emergencies in a minimum amount of time; (2) they had to be willing to take great personal risks to get **close** to the fire; and (3) they had to be able to put water on the fire, to get the fire **wet** to extinguish it (1998). Brunacini identifies these

three traits as the core tenet of even the modern firefighter's culture, even though actions should be more measured and risks should be better assessed in this modern age. Firefighters should operate in full protective clothing and within an accountability system in the performance of their duties (1998). Having a fire and emergency service that embraces the notion of "fast/close/wet" may misalign with the goal of operating safely. Clark furthered Brunacini's message by adding that if firefighters continue to ascribe to fast/close/wet as the way to respond to fire emergencies, the inevitable result is risk, injury and death (2011).

Firefighter fatalities are closely linked to unsafe practices and a fire and emergency service culture that is not fully committed to safety (Cross, 2010). This lack of commitment to safety is not a new problem in the fire and emergency service. In 1973, the National Commission on Fire Prevention and Control published the landmark study "America Burning." This initial look at the fire problem in the U.S. revealed that 6,200 people, including firefighters, died annually as a result of hostile fire (Bland, 1973). Additionally, over 100,000 injuries were reported annually, with a dollar loss of over $10 billion (in 1973 dollars) (Bland). The report estimated a nationwide rate of 300 fires per hour, which translates to over 2.7 million fires annually. In 2007, there were less than 1.6 million fires in the U.S., leading to 3,430 fire deaths and a property loss of $14.6 billion (Federal Emergency Management Agency (FEMA), 2008). This represents a 44 percent reduction in the number of civilian deaths from fire, and a 40 percent reduction in the number of fires overall. During that same time period, there was no reduction in the number of firefighters who died in the performance of their duties.

In 2011, Kunadharaju, Smith and DeJoy conducted an analysis of 189 National Institute for Occupational Safety and Health firefighter fatality reports for the time period 2004-2009. They found that there were four higher-order causes of firefighter death and injury: insufficient resources, inadequate preparation, insufficient incident command structure, and suboptimal personnel readiness (Kunadharaju, Smith & DeJoy). They concluded that these four higher-order causes "may actually be tapping the basic culture of firefighting ... the job must get done, get done as quickly as possible, and with whatever resources are available" (p. 179). They also advocated for additional research in the area of defining the culture of the fire and emergency service.

As has been shown for other occupational safety problems, the true root causes of many firefighter fatalities may be traceable back to basic cultural attributes (Pidgeon & O'Leary, 2000). The focus on culture as a factor in firefighter fatalities is not new, with IAFC, NFFF and the International Association of Fire Fighters being three high-profile organizations identifying culture as a critical area for change within the fire and emergency service. Various task forces and panels have called for culture change within firefighting organizations. What is new here is an initial attempt to probe for cultural symptoms using a very important and valuable data source: firefighter fatality investigations. Although the conclusions presented in the present research are not in any way definitive or final, they do highlight the importance of cultural factors in firefighter line-of-duty fatalities and suggest some specific factors that should be examined in future research.

David Archer concurs with this description of the fire and emergency service culture, and elaborates on what he calls the discipline code, which "is highly prescriptive, promotes ... from within the organization only ... has long standing traditions, and is predominantly white-male dominated" (1999, p. 1). He further discusses that this system is perpetuated through the cultural processes that individuals are introduced to when they go through the paramilitary-style initial training.

Baigent identified five key areas of culture that are common in interactions between firefighters (2001, p. 7):

1. Ostracizing anyone different.
2. Ostracizing anyone who doesn't conform.
3. Bullying and threatening anyone who resists the dominant group.
4. Excluding outsiders from fire station life.
5. Frequent joking as an instrument to continue bullying.

Brunacini's description of the treatment of new firefighters who don't follow the direction of the older firefighters is consistent with Baigent's criteria.

Lewis, a scholar studying issues of gender and racial inequity in firefighter selection and training, juxtaposes the image of firefighters as heroes against the culture of firefighting: "Firefighters around the world are heroes in the hearts and minds of the public. ... However, research into the culture of firefighting worldwide has also shown disturbing and quite 'uniform' characteristics have been normalized by many under the guise of tradition" (2004).

Phillip Schaenman conducted a study of over 1,000 firefighters' attitudes and perceptions regarding safety in the wildland firefighting environment. Respondents described the culture as being one "of hardship, adventure, close friendships, and commitment; experience over rank ... enjoys stories of conquest and danger," and pride at how different a wildland firefighter's life is from the rest of society (1996, p. 193). One respondent described the culture as one with "long traditions" (p. 196). These varied descriptions of aspects of the culture make up the tightly woven fabric of the American fire and emergency service community that bears closer investigation and analysis. Organizational cultures such as this are more complicated and have a greater impact on decision-making than insiders to the culture typically realize (Vaughan, 1997). Organizational values within the fire and emergency service are the "shared standards and core beliefs that guide decisions and actions within" the fire and emergency service (Cochran, 2006, p. 454).

Cultural Change

It is evident that many interrelated factors must be addressed in order to produce a significant change in outcomes in terms of reducing line-of-duty injuries and deaths and improving overall firefighter safety and health. The existing fire and emergency service culture, as it relates to occupational safety and health, was identified as both a cause and an effect of the current situation. A cultural change would set the stage for many incremental changes that would produce the desired positive impact.

Cultural researcher Edgar Schein identified the fundamental components of an organizational culture as a system of shared behaviors, values, assumptions and beliefs (2004). He describes these components as a three-layer system:

- Assumptions and beliefs.
- Values.
- Behaviors.

This model begins with a system of shared assumptions and beliefs that provides the foundation for organizational values. Those values, in turn, create expectations for acceptable and unacceptable behaviors. To apply this model to one particular aspect of the fire and emergency service, it could be stated that firefighters tend to attack fires in a manner that is bold and aggressive because their value system provides positive recognition for this type of behavior. These values are based on the belief that the mission of the fire and emergency service is to extinguish every fire as quickly as possible and the assumption that the best way to control a fire is to hit it hard and fast.

All three layers of this model were described by the symposium participants in the discussions that produced the 16 FLSIs. It was noted that unsafe attitudes and behaviors often prevail in spite of the common knowledge that there are less risky alternatives that could result in fewer deaths, injuries and illnesses. In fact, it was noted that efforts to promote health and safety were often met with resistance and scorn, reinforcing the notion that they created conflict with established attitudes, assumptions and values.

The existing system of assumptions and beliefs reinforces particular values:

- Every LODD is automatically labeled as heroic, no matter the circumstances (versus an occupational fatality that is preventable).

- Recommendations to follow standard operating procedures and exercise appropriate caution are described as cowardly.

- The urgency of quickly arriving at the scene of an emergency justifies driving in a manner that endangers the lives of other motorists and pedestrians who may be encountered en route, as well as the responders themselves.

The same sense of urgency:

- Justifies attempting to don protective clothing and equipment en route as opposed to being properly seated and belted in an approved riding position.

- Allows inadequately trained drivers to operate emergency vehicles.

- Allows poorly designed and poorly maintained vehicles to be operated.

The three-layer model suggests that cultural change has to occur progressively, beginning with changes in assumptions and beliefs that gradually bring about changes in the values that are accepted and shared by the individuals within an organization. Changes in the organizational values legitimize and promote changes in behavior. These behaviors need to be reinforced by an ongoing commitment to safety culture at the organizational level and among individual firefighters and their crews. This three-stage process is described as the most natural and effective manner of accomplishing a cultural change.

The application of this approach to the firefighter safety issue suggests that the first priority should be to convince individuals, companies, departments, and society as a whole that the current rates of death and injury are unacceptable and that operating with a higher regard for safety would not compromise the mission of controlling fires and saving lives. The large-scale acceptance of these new assumptions and beliefs would lead to a change in the value system so that being safe would be given equal weight to being effective in controlling fires and saving civilian lives. The new values would encourage firefighters to be more careful and to stop engaging in reckless behaviors that lead to preventable deaths and injuries.

It is also possible to work in the opposite direction, from the top down, although this approach is much more likely to encounter resistance. Every fire chief has the ability to establish rules and regulations that require changes in behavior within his or her own fire and emergency service organi-

zation. For example, the consistent enforcement of a strict policy requiring the use of seat belts in fire apparatus would probably, over a period of time, result in a change of values — at least with regard to seat belt use. Ultimately, the members of the fire and emergency service organization would come to accept and integrate seat belt use as part of their organizational culture.

Members of the fire and emergency service, especially fire chiefs, must align their personal values with the organizational values, and they must model these values (Cochran, 2006). The leader must then ensure alignment of values within the organization in order to ensure a strong work ethic; appropriate treatment of stakeholders; a cooperative atmosphere; teamwork; and high levels of dedication, discipline and commitment (Cochran). Therefore, not having a description of the values or culture makes it difficult, if not impossible, for a leader to initiate organizational change, since there is a limited baseline upon which to center the change interventions.

The difference between the two approaches is that the bottom-up strategy should enable much more comprehensive changes in behavior once the new values become accepted, especially since firefighters would be involved with identifying solutions (and doing so could bolster their buy-in). The top-down approach is likely to encounter resistance for every individual change in behavior that is introduced. The large-scale cultural adjustment may eventually be accomplished; however, it is likely to be a slow and lengthy process.

The statement within FLSI 1 that the cultural change must incorporate leadership, management, supervision, accountability and personal responsibility is an expression of the need to address the process with a unified effort at every level in order to accomplish the objective, working from the bottom up and from the top down. The successful insertion of occupational safety and health into the fire and emergency service value system should support numerous behavioral changes that could lead to a significant reduction in occupational deaths, injuries and illnesses.

Resistance to Change

Resistance to change, even change initiated internally, is often cited as a significant characteristic of fire and emergency service culture. This factor is often expressed with a mixture of pride and amusement by slogans such as "200 years of tradition unimpeded by progress" (Fire Department of New York (FDNY)).

Resistance to external influences is sometimes described as a particular characteristic of the American fire and emergency service culture. Although it is evident that more and more external influences are demanding compliance and adjustment, particularly in relation to occupational safety and health, there is no question that the fire and emergency service culture strongly resists being told what to do.

These factors underline the point that the type of cultural change that is the target of FLSI 1 will require significant adjustments to some of the values and beliefs that are commonly associated with fire and emergency service culture. This can only be accomplished by convincing firefighters at every level that the change is both desirable and necessary, and that the adjustments may be accommodated without compromising any of the highly valued aspects of fire and emergency service culture.

Toward a Safety Culture

The culture of the American fire and emergency service community is a contributing factor to the high incidence of injury and death. Daniels (2005) asserts that until the fire and emergency service is willing to make substantial changes in training, procedures, equipment and recruiting, this fatal trend shall continue. In some cases, the injurious behaviors may have originated as a bad habit that evolved slowly over time into a tradition, slowly injecting a poor practice or dangerous procedure into the fire and emergency service organization over generations (Gasaway, 2005). Firefighters may engage in an unsafe act, thinking it is the correct way to operate or behave because the unsafe act or technique was how they were originally instructed (Gasaway). Storytelling and instruction from an older generation of firefighters to a younger generation of firefighters is a trait of the tightknit culture. This can be advantageous when the information is appropriate and relates to current department operating guidelines and situations, but it can be detrimental when there is no "filter" to ensure that the hand-me-down messages are safe and effective (Schaenman, 1996).

An additional issue cited by Pessemier is that "the U.S. Fire and Emergency Service does not have an institutionalized methodology for managing safety" (2008b, p. 1). He identifies this as a conflict between the organizational mission of the fire and emergency service and the view of safety as completing demands, instead of synergistic values.

Schneider (1973) suggests that cultures should be "for" something, for example "for service" or "for safety." One possible solution to the American fire and emergency service community's dilemma of how to change this culture is to develop an understanding of what it is and then refocus it to be "for" a different value or concept. Slight shifts in the practices within the fire and emergency service are likely to be more successful than large, sudden change (Daniels, 2005b). Schaenman identified that firefighters recognize the importance of safety, but they aren't always sure about how to accomplish an activity safely (1996). Incrementally moving the current values, and therefore the culture of the fire and emergency service, toward a safety culture can provide the framework and strategies for how to address both of these potential issues.

A safety culture reflects the values, norms, assumptions and expectations regarding safety (Mearns, 1999). A company's safety culture is expressed by management's safety practices, which are reflected in the workplace safety climate (i.e., employees' perceptions, attitudes and beliefs about risk and safety) (Mearns, 1999). A positive safety culture, as part of comprehensive safety improvement interventions, has been shown to influence safety behaviors by maximizing employee motivation and improving safety knowledge, which, in turn, helps to improve employee compliance, thereby resulting in safer behaviors and fewer injuries.

Pessemier (2008a) furthers this notion of moving toward a safety culture in the fire and emergency service. For illustration, the Phoenix Fire Department has shifted from a transactional service model to one of building longer-term and deeper relationships by shifting the focus of its culture from "for service" to "for building long-term relationships" (Schneider, Bowen, Ehrhart, & Holcombe, 2000). This ability to change a culture in the fire and emergency service is supported by Hofstede, who states that an organizational culture is easier to change than a national culture (2001).

The culture of the U.S. could be modified toward a safety culture. The nuclear industry coined the term following accidents at Chernobyl in 1986 and at Three Mile Island in 1979 and used it to describe what was lacking in these two events. It is a concept that encompasses "a combination of managerial, organizational, and social factors" that contribute to accidents and near misses (Freimuth, 2006). Once cultural goals and expectations were identified, they were reinforced by managers to instill and then reinforce these changes. Regarding culture in the American fire and emergency service community, it has been said that "without the emergence of a new safety culture, all attempts [at increasing firefighter safety] will be in vain" (Siarnicki, 2010, p. 9).

Climate exists within a culture, so moving toward a safety culture would require movement toward a safety climate. While the main focus of this paper is cultural (versus climate) change, it is worth acknowledging the concept of climate and its close relationship to culture while differentiating the two concepts. Safety climate is not only a set of values, beliefs and perceptions about safety as a concept, but also the policies, procedures and practices that support safety in an organization (Colley, Lincolne, & Neal, 2013; Goulart, 2013). Climate is more temporal and local to a particular unit, whereas culture is broader and spans the entire organization, and in some cases, the profession (Mortenson, 2014).

One of the gradual shifts that can be made from the current culture toward a safety culture is to focus on fire-safe behavior, shifting away from heroic acts. Alan Brunacini, former chief of the Phoenix Fire Department and a firefighter there since 1958, describes the problem with the current nonsafety culture that focuses on heroic acts in this way:

> "For 225 years, it was OK for a burning building to kill us. When the fire kills us, our department typically conducts a huge ritualistic funeral ceremony, engraves our name on the honor wall, and makes us an eternal hero. Every Line of Duty Death gets the same terminal ritual regardless if the firefighter was taking an appropriate risk to protect a savable life or was recreationally freelancing in a clearly defensive place … Genuine bravery and terminal stupidity both get the same eulogy. Our young firefighters are motivated and inspired to attack even harder by the ceremonialization of our battleground death" (2008, pp. 6-7).

By emphasizing actions that violate safety guidelines and awarding firefighters for heroic acts that come at a greater-than-usual level of risk or unnecessary danger (Walton et al., 2000), the message being communicated within the culture is that these types of behaviors are acceptable and will be rewarded. "Most of the awards for valor usually involve … doing things you aren't supposed to do. It's in our nature to want to save someone. If nothing goes wrong despite ignoring the rule, you'll be praised for saving someone" (Peterson et al., 2010, p. 27). Brunacini explains this disregard for safety by suggesting that today's firefighters "… have never stopped hearing Ben [Franklin]'s voice tell them to be Fast/Close/Wet when they are responding to a fire. I think this is what culture really means in the current safety discussion" (2008, p. 9). Firefighters need a safety culture message that speaks louder than Ben Franklin's whispers to effect a change within a system that promotes and rewards appropriate risk management behaviors.

A concise summary for the role of culture in the fire and emergency service is provided in this quote from the Charleston, South Carolina, report on nine firefighters killed in 2007: "The cultural lessons may be the most important and also the hardest to embrace" (Laws, 2008, p. 64). Making sense of cultural lessons such as this requires a solid understanding of the organization's history (Hofstede, 2001). While much of the work on injury and fatality reduction in firefighting has focused on technology and increasingly more stringent regulations, little has focused on the culture.

A closing thought from Hofstede (2000) serves as a fitting end to the discussion of the organizational culture and values in the fire and emergency service and the need for a shift in this culture to reduce on-duty fatalities. "Uniformed organizations have to balance their attempts to introduce new ways of working … with the necessity of preserving traditional basics. Changing uniformed cultures requires patience and wisdom" (p. 481). It is the intent of this research to develop some of the wisdom necessary to effect a positive change in the fire and emergency service by reducing the number of on-duty deaths through first understanding the existing values of the fire and emergency service.

Areas of Focus for Cultural Change in Fire and Emergency Services

Thus far, this report has defined culture, described the origins and characteristics of the culture of the American fire and emergency service community, and made a case to move toward a safety culture. The staggering death and injury toll within the fire and emergency service has also been detailed, and from that description, it is clear that the losses experienced are disproportionate to the decreasing number of fires in the U.S.

The culture of unsafe practices may be so deeply ingrained that efforts to change are viewed as challenges to fundamental beliefs, while other unsafe practices are created by the culture of the fire and emergency service as a whole. Still other behaviors, which are not cultural or motivational, are the result of an individual's health or family history. The Project Team focused on the changes that could be standardized and easily implemented within an organization to effect change.

Using the focus areas and their objectives, the Project Team concentrated on developing sets of behaviors for chief officers, Company Officers (COs) and firefighters that minimize risk. These behaviors were derived using a frequency analysis and consensus of the working group. Risk-taking behaviors have been shown to be an organizational problem and not one that lies solely with firefighters' behaviors; therefore, strategies to change firefighter behavior need to address multiple levels of influence. The working group identified the following areas of focus: situational awareness, individual responsibility, leadership, health and wellness, training, vehicle operations, seat belt usage, recruiting, and environmental factors.

Situational Awareness

Fire and emergency service organizations should concentrate on implementing and demonstrating an effective and measurable model to improve situational awareness of all responders, along with the command and control of all incidents. One way to encourage this change is for fire and emergency service organizations to draw on a risk management approach that obtains input from firefighters and involves a cyclical process of identifying operations or activities that pose high risk for injuries, redesigning operating procedures to reduce risks, implementing these changes, and evaluating their impact. The focus areas of risk behavior modification are situational awareness and inadequate command, control and supervision.

There is considerable room for discussion in defining the boundary limits for acceptable and unacceptable risk in relation to potentially survivable or nonsurvivable conditions, and increased situational awareness aids in establishing these limits. Situational awareness is defined as "the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future" (Endsley M., 1988).

The study of decision-making with its many subsets, including situational awareness, is at its core: the study of human factors and human error. It is the study of complex interactions of human behavior and the consequence of those actions. One area of scholarly agreement is that understanding of the complex interaction between human causal factors is always likely to see changes, though it is imperfect and incomplete (Wall, 2012). S. Dekker points out that some labels, such as complacency or loss of situational awareness, are a better and more accurate description of events than labeling an accident as human error; they appear to give a reason behind the behavior. In high-risk occupations that have already failed to predict complex situations, it is nearly impossible to completely engineer all safety mechanisms; thus, human decision-making must be studied and well-understood (Dekker, 2002).

Situational awareness becomes a key factor in cases where it is not known whether a building is occupied or unoccupied and whether the occupants are still alive or already deceased. Should firefighters risk their lives to search for potential occupants under extreme fire conditions when there are no clear indications that the building is occupied, or where fire conditions suggest that it is extremely unlikely that anyone could be saved?

Photo by Ron Moore, Courtesy of Cornbelt (Illinois) Fire Protection District

Individual Responsibility

The two key aspects that apply to every member of the fire and emergency service at every level are accountability and personal responsibility. Every individual, from entry-level firefighter to fire chief, must be accountable for meeting the expectations assigned to his or her role and position within the fire and emergency service. All individuals must also accept personal responsibility for their own health and safety, as well as for that of their co-workers and particularly for that of anyone they supervise.

Accountability is an inherent aspect of management and supervision, expanding at each successive level of hierarchy. The fire chief cannot avoid accountability for the overall performance of the fire and emergency service organization and for every positive or negative occurrence. The fire chief must hold subordinates accountable for

performance within their areas of responsibility. The same principle applies to every level, down to the individual firefighter who is accountable to the organization as a whole but directly accountable to a supervisor and usually also to a group of co-workers.

Accountability is often ignored until something bad happens — in this case, an incident that results in on-duty injury or death. Positive accountability is associated with ensuring that all of the proper policies and programs are in place to prevent this type of occurrence, whereas negative accountability begins with attempting to explain why they were not in place after a preventable event has occurred. **The most undesirable type of accountability comes from outside an organization, when individuals have to defend the organization, or even themselves, in legal proceedings.**

Leadership

Leadership is often mentioned as a key component in relation to implementing safety policies and programs. Change is unlikely to occur unless the leaders of an organization embrace the effort and demonstrate a commitment to the endeavor. This applies directly to the formal leadership, which includes labor as well as management, and it often includes informal but influential leaders within the organization.

Effective leadership must go beyond simply issuing directives and policy statements. The members of a fire and emergency service organization can generally differentiate between policies that are intended to satisfy a duty or responsibility and legitimate efforts to lead the organization in a specific direction. There are many examples of fire and emergency service organizations that have issued policies that are based on recommended safety and health standards and then failed to demonstrate a true commitment to those policies.

Health and Wellness

Almost half of all firefighter fatalities in the U.S. are cardiac-related (USFA), and the majority of those deaths are found to be related to pre-existing and preidentified medical conditions. These factors reinforce the message that all firefighters should be periodically evaluated to ensure that they are medically and physically fit to perform their expected duties. This message is incorporated within NFPA 1500. It is also expressed in FLSI 6, which states: **Develop and implement national medical and physical fitness standards that are equally applicable to all firefighters, based on the duties they are expected to perform.**

Although the message is clearly stated and its importance is widely accepted, the American fire and emergency service community has been very slow to adopt mandatory policies to implement such requirements. The necessary standards have been developed and adopted, yet there are still fire and emergency service organizations without programs of this nature and tens of thousands of active firefighters who have not been medically certified for emergency duty.

The two primary factors that inhibit the adoption of mandatory medical and fitness standards are cost and the belief that a substantial percentage of fire and emergency service members would be unable to meet the requirements. This behavioral aspect reflects the determination of many individuals who join the fire and emergency service or who continue to serve in spite of their medical status and physical fitness limitations. Indeed, many fire and emergency service organizations would face a serious crisis if the recommended policies were immediately mandated, as they may lack the resources to medically screen all personnel and to recruit new members to replace those who are found to be ineligible for service.

Cost is a significant problem for the various types of fire and emergency service organizations; however, the potential loss of active members may be a more critical concern for many volunteer fire and emergency service organizations that are already dealing with recruiting and retention issues and don't have the added incentive of pay to bring new recruits in. In addition, volunteer fire departments face additional barriers, such as the fact that they typically do not provide health insurance for their members, they typically don't have access to a department doctor, and departments in

rural areas may not have easy access to medical resources. Within the career fire and emergency service, the concern tends to be associated with the fate of career employees who are determined to be unfit for duty.

The individual determination of many fire and emergency service members to remain active in physically demanding positions in fire and emergency service organizations, in spite of risks to their own health, is evident from the half of LODDs that result from medical causes. This behavior may be driven by dedication to the fire and emergency service mission, as well as the sense of membership within the fire and emergency service community.

Training

While training is often viewed as an essential component to accomplish any type of positive change in firefighter behavior, it is also frequently noted that inappropriate training is encouraging or reinforcing high-risk behaviors. This suggests that the problem may not be limited to inadequate training; it may also involve applicable training that establishes inappropriate attitudes, actions, beliefs and behaviors.

Fire and emergency service training organizations must be conscious of the behavioral influences that are incorporated within the content of their training programs, as well as the manner in which training is being delivered. The attitudes, beliefs and behaviors of the instructor may be more influential than the program content itself.

In addition to ensuring that the intended content is delivered and the desired attitudes and behaviors are developed, it is essential to ensure that training activities are conducted with a high degree of safety. The annual reports of firefighter fatalities almost invariably include deaths associated with training activities, whether from traumatic injuries or medical causes. The latter category often includes overexertion, heat stress, and a variety of known and unknown medical conditions.

Initial Firefighter Training

Firefighter competency is foundational to firefighter safety. Training for firefighters (NFPA 1001, *Standard for Fire Fighter Professional Qualifications*) should include educational components that discuss the new science and research now available, including fire behavior based on factors such as fuels present, the limitations of PPE, and the limitations of the human body when fighting fire in the new protective ensembles. Back to basics isn't more hose evolutions — it is the **why** behind what we do. Fire and emergency service organizations should continue to monitor research and the ensuing evidence to adapt/update protocols and practices that improve safety and fire protection. Firefighters should be taught to evaluate the risk of every action so they never have to answer "I don't know" when asked why they took a particular action. Firefighters should not take action without knowing the possible consequences.

The fire and emergency service has seen and heard of presentations based on the Underwriters Laboratory (UL) and National Institute of Standards and Technology (NIST) research conducted with the Chicago Fire Department; FDNY; Spartanburg, South Carolina Fire and Rescue; and others that suggest a change to traditional first-arriving actions. These research reports, based on science, suggest changes to the initial on-scene report and operational mode, which are designed to limit exposure to risk, that include "aggressive defensive operation being performed in preparation for an interior attack."

The UL and NIST live burn tests are aimed at quantifying emerging theories about how fires are different today. This difference is largely due to new building construction and the composition of home furnishings and products that in the past were mainly composed of natural materials, such as wood and cotton, but now contain large quantities of petroleum-based products and synthetics that burn faster and hotter. Whereas a fire in a room once took approximately 20 minutes to experience "flashover" — igniting all the contents — this can happen with today's products in as little as four to five minutes.

The primary motivation for the live burn experiments is the changing dynamics of fires. The contents of American homes have changed significantly in the past few decades. Plastics and other synthetic materials have replaced the natural materials that once made up the bulk of furniture items. In addition, modern living spaces tend to be more open, less compartmentalized and better insulated than homes built years ago, leading to increased fire spread in "modern dwellings."

The UL/NIST studies suggest that a change in traditional tactics begins with a direct exterior attack, making the interior safer for entry when the interior attack begins. This is being viewed as particularly appropriate in reduced staffing or delayed backup situations. These changes may pose a cultural challenge with the use of the verbiage, such as "aggressive exterior attack" instead of the traditional "defensive operation," which implies that we are giving up. Regardless of how the incident begins, in the most critical situations, the IC has to make the decision to switch from an offensive strategy to a defensive strategy and withdraw firefighters from interior operating positions based on an ongoing assessment of incident scene hazards.

Officer Training

Training for COs (NFPA 1021, *Standard for Fire Officer Professional Qualifications*) should include educational components, such as health and safety, leadership, and tactics for new building construction features, in addition to those changing components for firefighters. Back to basics for COs is not simply more leadership classes — it also includes the principles of reading smoke, adequate size-up with a declaration of strategy, understanding fire behavior, building construction, victim survivability profiling, and using the Incident Command System to help manage the incident with safety as the overarching, guiding principle. COs should be asking themselves:

- "Am I training on the types of incidents to which we actually respond?"

- "Do we have experience or training on this type of incident?"

- "Is another company better trained or equipped to handle this incident?"

Training for chief officers (NFPA 1021) should also include educational components related to budgeting (execution and understanding) and maximizing partnerships to improve service delivery. Back to basics for chief officers who operate on the fireground should include skills needed for proper apparatus placement, managing multiple divisions/groups, and managing personnel accountability, in addition to those new skills being learned at the CO level.

Officers who have responsibilities for overseeing a fire and emergency service organization's health and safety program should be meeting the requirements of NFPA 1521, *Standard for Fire Department Safety Officer.* Training for such officers should include educational components, such as health and safety program management, workplace safety compliance, fireground tactics, hazard recognition, and Incident Safety Officer's responsibilities. While not every department has a designated Health and Safety Officer, it should be every officer's responsibility to function as a "safety officer" both on and off the fireground.

Emergency and Personal Vehicle Operation

The operation of fire and emergency service organization vehicles and apparatus warrants specific attention. As indicated by the NFPA, during the time period 1998-2013, 13 percent of LODDs occurred while responding to or returning from calls for service. Organizations should concentrate on implementing and demonstrating an effective and measurable model of driver/operator training that advances in skill sets throughout a career and that ensures quality and driver/operator accountability. The focus areas of risk behavior modification are driver capability, quality assurance and accountability.

Factors Influencing Safe Emergency Response

The basic nature of the emergency response mission encourages drivers to reach the scene of an incident as quickly as possible, and in the case of more rural departments, firefighters are encouraged to first reach the fire station more rapidly. Traffic laws provide specific allowances and exemptions for emergency vehicles in order to reduce response times. Sirens, air horns, warning lights, as well as larger and more powerful engines tend to increase the sense of urgency and the driver's perception of invincibility.

The two factors that are most often identified in relation to reducing emergency vehicle crashes are increased driver training and enforcement/strict adherence to safe driving procedures. The logic of these influences is self-evident; however, attention must also be directed toward the factors that encourage drivers to stretch the limits of reasonable and prudent driving habits.

In addition, response time is often used as a primary performance indicator for fire and emergency service organizations, and shaving a few seconds from the annual average response time is considered to be a significant accomplishment. All of these factors appear to justify higher levels of risk when responding in an emergency mode. Driving faster is closely associated with driving more aggressively — taking chances and forcing or challenging other drivers to yield the right of way. Excessive speed is a known risk factor for crashes and crash-related death and injury.

Additional factors have been identified as encouraging inappropriate emergency vehicle driving habits. Competition and peer pressure may encourage faster response simply to get to the scene of an incident first or ahead of a rival company. In some fire and emergency service organizations, faster response speeds have been noted when multiple companies are responding to the same incident than when only a single company is responding. At the same time, each of these factors is offset by the expectation to drive safely and with due regard for the safety of all others who may be encountered en route to the location of the emergency incident. Safety is presented as a legal and moral obligation as well as an organizational value.

Driver/Operator policies will assist every jurisdiction in establishing the guidance needed for their members to safely operate all vehicles when responding to or returning from an incident, beginning with proper licensure for the jurisdiction, as well as proper training on how to drive and operate the specific emergency vehicles that the driver will be responsible for. It is prudent that not only departmental policies but also national guidelines be established that define tiered emergency responses for all departments. These policies must address both personal and department vehicles and cover both emergency and nonemergency driving expectations.
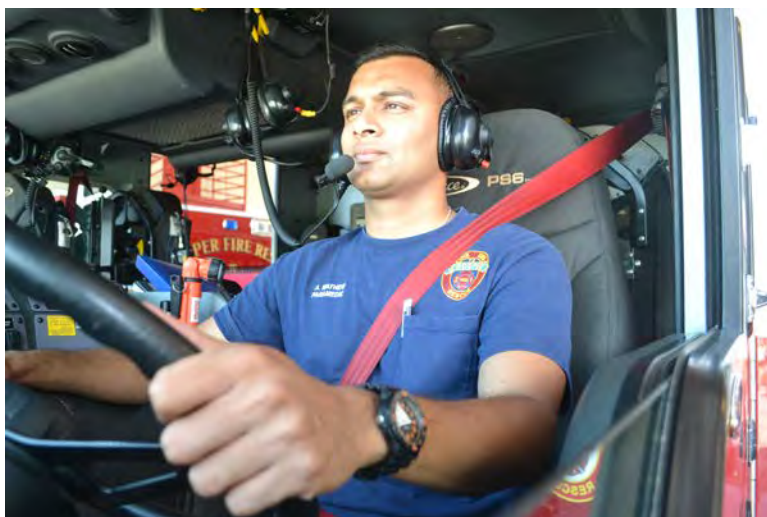

Photo by Ron Moore, Courtesy of Prosper (Texas) Fire Rescue

Photo by Ron Moore, Courtesy of Prosper (Texas) Fire Rescue

Based on the assumption that every organization may need to create or revise driver/operator policies, a list of potential incentives that organizations can use to promote driver/operator behavioral changes and a list of possible consequences that organizations may face if they choose not to adopt a driver/operator policy are provided at www.ffsafetyculture.org.

Seat Belt Use

The broad scope of the cultural issue becomes evident when it is applied to the question of why many firefighters do not use seat belts when riding in fire apparatus. While the adoption and enforcement of a policy requiring the use of seat belts appears to be relatively uncomplicated, the issue is considerably more complex than it appears.

The vast majority of fire and emergency service organizations have adopted official written policies that require firefighters to use seat belts whenever vehicles are in motion. There are no known written policies in fire and emergency service organizations that allow for the nonuse of seat belts. Requirements to use seat belts are incorporated in many state vehicle codes, and the same policy is clearly stated in NFPA 1500. In addition, tremendous efforts have been put forth to educate firefighters on the need to use seat belts and promote their use as a personal safety decision.

Considering all of these efforts, it is appropriate to ask why so many firefighters continue to not use seat belts. Below is a list of factors that have been identified as contributors to the problem:

- The belief that the urgency of emergency response requires donning protective clothing and equipment en route.
- The belief that a fastened seat belt will delay the firefighter's ability to exit the vehicle upon arrival at the scene of the emergency.
- The difficulty of manipulating inadequately designed seat belts in the limited seating space that is available and in the presence of breathing apparatus straps.
- The sense of personal invincibility that comes from riding in a vehicle that is larger and heavier than most other vehicles on the road.
- The fear of being viewed as nonconforming when others are not using their seat belts.
- The failure to enforce officially adopted policies creates the impression that compliance is not a high priority for managers and supervisors.

While all of the noted rationalizations apply to emergency response, they often carry over to nonemergency situations. Firefighters may easily develop the attitude that if it is acceptable to ride to an emergency without a seat belt, then there is no need to wear a seat belt when returning from the emergency or when riding in a fire and emergency service organization vehicle for any other reason.

One key factor appears to be the priority that is directed toward seat belt use by the fire chief and senior level officers of the fire and emergency service organization. A strong policy statement accompanied by a serious enforcement policy is usually effective in achieving a high level of compliance. In larger organizations, the policy must be enforced at each successive level of supervision down to the individual firefighter.

Where there are valid technical issues, such as problems with the design and installation of seat belts, management must be prepared to address those problems as part of the overall strategy. Members cannot be expected to work with equipment that does not perform the required function.

Recruiting

An important point made by Hofstede (2000) is that one way to change the culture of a uniformed organization, such as the fire and emergency service, is to recruit more members with values that are different or independent from the organization. Soeters and Boer (2000) found this to be the case to help reduce military aircraft accidents. By incorporating more civilians and fewer people who had been indoctrinated into the military value system, a cultural shift toward a safer work environment ensued, and the number of aircraft accidents was reduced.

The same factors tend to influence individuals to become firefighters, both career and volunteer. The fire and emergency service is often viewed as an attractive outlet for individuals who are seeking opportunities to face extreme challenges and imminent danger. The recognition that is often associated with heroic actions is further motivation for many individuals to become involved in the fire and emergency service. The strongest, bravest and most daring individuals are often motivated to become firefighters.

The whole notion of daring and death defiance is continually applied to the fire and emergency service from external sources. The public tends to view firefighters as individuals who are willing to face extreme risks in order to save lives and property. These public perceptions are naturally incorporated into the firefighters' self-image and tend to further promote risky behaviors.

The media portrayal of fire and emergency service workers is generally not realistic, and it does not represent a true slice of what the work of the fire and emergency service is. Protective clothing may be altered or not used to show an actor's face or demonstrate a level of aggression or risk that is unreasonable in a real-world setting. This image is further reinforced by slogans such as "No Fear" and "Are You Tough Enough to Be a Hero?" as well as graphics portraying firefighters as dragon slayers and warriors facing overwhelming threats with nothing more than courage and daring. Peer pressure and competition often entice a "more daring" spirit than other individuals, companies, or fire and emergency service organizations. In some cases, actions that demonstrate appropriate caution are viewed as cowardly or impossible.

The warrior image is increasingly used to promote a sense of preparedness to engage in actions that require high levels of training and involve extreme physical challenges. These concepts are not inconsistent with the values of a strong safety culture. In many cases, the warrior image is presented in a context that appears to label the safety movement as a cowardly approach, expressing the notion that warriors are not concerned with safety because they are able to overcome any adversity.

Environmental Factors

It has been observed that the current fire and emergency service generation has been raised in an environment that glorifies risk and expresses little or no concern for the potential negative consequences of bad decisions. The Internet along with tremendous expansion in the use of social media outlets, such as Facebook, Twitter and Instagram, and the influence of national fire service websites provide a continual supply of video clips and photos showing individuals risking life and limb in the pursuit of thrills and recognition. While many of these efforts result in obvious injuries, the consequences of such misadventures are never included in the video that is posted. There is an aura that even anonymous recognition for extreme daring is sufficient justification to accept the consequences of failure. Additionally, newer members who are accustomed to playing video games that allow individuals to experience simulated confrontation with every conceivable danger, with absolutely no risk of death or injury to the thrill seeker, may contribute to a lack of understanding of real-life consequences of high-risk behaviors.

Summary

The culture of the American fire and emergency service community is rich and time-honored. The culture has aspects that provide superior protection for life and property, while it also has portions that contribute unnecessarily to firefighter and emergency worker injury and death. The culture can be changed at national, state and local levels without diminishing the quality of services provided by enhancing firefighter competencies needed at emergency scenes. Both the culture and climate can be moved toward a common sense, safety-oriented approach to balance the risks and rewards of questionable behaviors better.

This report generates important ideas that can be implemented to address culture and climate in an effort to change behavior in the American fire and emergency service community, which will lead to fewer injuries and deaths.

This document provides a foundation for future work in this area that will involve developing enhanced online educational materials and outreach. fire and emergency service organizations and individual responders can begin to engage in this move toward positive cultural change by visiting www.ffsafetyculture.org.

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