

## Data Not Drama

Death, data, risk, and the muddy education of the fire service

# Removing Two-In/Two-Out: A modern, data-supported defense of our core mission



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Over the past quarter of a century, there has been a lot of discussion about Two-In/Two-Out and its impact on fire department operations. Since the inception of Two-In/Two-Out, there has been a considerable amount of data collected on fire dynamics, firefighter maydays, civilian fire victim rescues, and firefighter and fire

victim survival in the fire environment. Now more than ever before in the history of the American fire service, we have available data to support or disprove what has always been considered as best practices. The time has come to reconcile fiction, emotion-based opinions, scare tactics and political motives with science-based information. The information is there if we are willing to study it and apply it. Moving forward, we must commit to looking at what works, what those who pay for fire suppression and fire rescue services expect and the reality of fire department staffing and its impact on fire ground operations. This position paper will show that there is very little data to support the validity of Two-In/Two-Out and the value of having firefighters outside standing by, versus inside working to stabilize the incident.

## INTRODUCTION

To fully understand the impact that Two-In/Two-Out has on fire department operations, consideration must be given to why fire departments exist and the expectations of the taxpaying public for their local fire department resources.

Fire departments exist as a quick response public safety service with the primary mission of saving lives and protecting property.

Let's start by taking a look at what Two-In/Two-Out says (for an exact copy of Two-In/Two-Out, see Appendix 1).

*Fire departments shall ensure that at least two firefighters, wearing Self-Contained Breathing Apparatus (SCBA), enter the Immediate Dangerous to Life and Health (IDLH) atmosphere and remain in visual or voice contact with one another at all times, with at least two firefighters remaining outside the IDLH atmosphere.*

*One of the two individuals located outside the IDLH may be assigned to an additional role, such as the Incident Commander (IC) or safety officer, so long as this individual is able to perform assistance or rescue activities without jeopardizing the safety or health of any firefighter working at the incident. It also clarifies that nothing in this section is meant to preclude firefighters from performing emergency rescue activities before an entire team has assembled.*

In 1987, the inaugural edition of the National Fire Protection Association (NFPA) 1500 – *Standard on Fire Department Occupational Safety, Health and Wellness Program* was released. The standard specifies the minimum requirements for an

occupational safety and health program for fire departments or organizations that provide rescue, fire suppression, emergency medical services, hazardous materials mitigation, special operations and other emergency services (NFPA, n.d.). The standard also covers several topics including professional development, apparatus and equipment, emergency operations, medical and physical requirements, facility safety and occupational exposure, etc. [1].

The NFPA 1500 committee, focused on improving firefighter safety, first introduced the concept of a “standby crew” in 1987 [2]. This “standby crew” concept became known in the industry as “Two-In/Two-Out” and in theory was intended to improve firefighter safety by committing two firefighters (Two-Out) as a rescue team if firefighters (Two-In) working inside of a burning structure needed assistance. It is important to remember that this was occurring at a time when thermal imagers and the availability of portable radios for every firefighter were unrealistic in many fire departments.

In the late 1990s, the NFPA 1500 committee recognized staffing to be paramount to firefighter safety; however, opposition was strong. The committee was also deeply committed to improving firefighter assistance and rescue. With the publication of OSHA 1910.134, both issues were addressed: staffing was addressed, two plus two equals four and firefighter rescue was addressed, and Two-In/Two-Out became law” [3]. While staffing was and continues to be an issue for most fire departments, for much of the American fire service, staffing was not increased because of the publication of the respiratory standard.

In 1998, OSHA 29 CFR 1910.134 was codified, and section (g)(4) became law for states that hold OSHA-approved State Plans and became an industry standard for the rest of the country. In that time, several other agencies and organizations developed standards and policies to further define the use of Two-In/Two-Out. Some include NFPA, state occupational health agencies, and local fire departments.

OSHA first adopted the two-in/two-out policy in 1971, but it wasn’t until 1998 that it was expanded to include fire departments. 27 years without Two-In/Two-Out (after its inception in other disciplines) being required, and 26 years with Two-In/Two-Out. This experiment has been allowed to exist for 26 years, and what does the data show...are fire grounds safer for firefighters and civilians?

## **WHAT THE DATA IS TELLING US**

## **Fire dynamics and survivability data**

For well over a decade, Underwriter Laboratories (UL) Fire Safety Research Institute (FSRI) has collaborated with the fire service to quantify and clarify what is happening on the fireground. To date, FSRI has performed hundreds of fire experiments based solely on firefighting strategies and tactics. Due to their meticulous methodology and detailed analysis, FSRI has pragmatically brought fire science to the fire service. They have unraveled the fireground genome, thus making the fire service safer, more effective and more efficient. Due to the work done by FSRI, the fire service has upgraded our understanding of fire dynamics, fine-tuned our techniques and tactics, enhanced our equipment and cultivated our communication and coordination.

Multiple experiments have shown that due to a continuous change in our building construction materials and methods, as well as the furnishings within, fires are faster today than they have ever been in the past. In the picture below, we have two rooms of the same size; the one on the left is filled with natural fiber furnishings like houses of yesteryear, and the one on the right is filled with synthetic furnishings like most of our houses today. In both rooms, a fire was started on the couch at the same time and this picture was snapped less than five minutes later. As evidenced by the picture below, the power and speed generated by a fire today are more severe than in previous generations. This means that in three minutes or less, from the time a fire starts, rooms throughout a structure could have temperatures exceeding well over 1,000 degrees Fahrenheit and be filled with deadly levels of toxic smoke. This ever-evolving environment emphasizes the fact that fast fires need fast firefighters. Time is of the essence on the fireground, and the actions of the initial arriving crews will likely have the most impact on the fire, and on the possible civilians unable to rescue themselves.

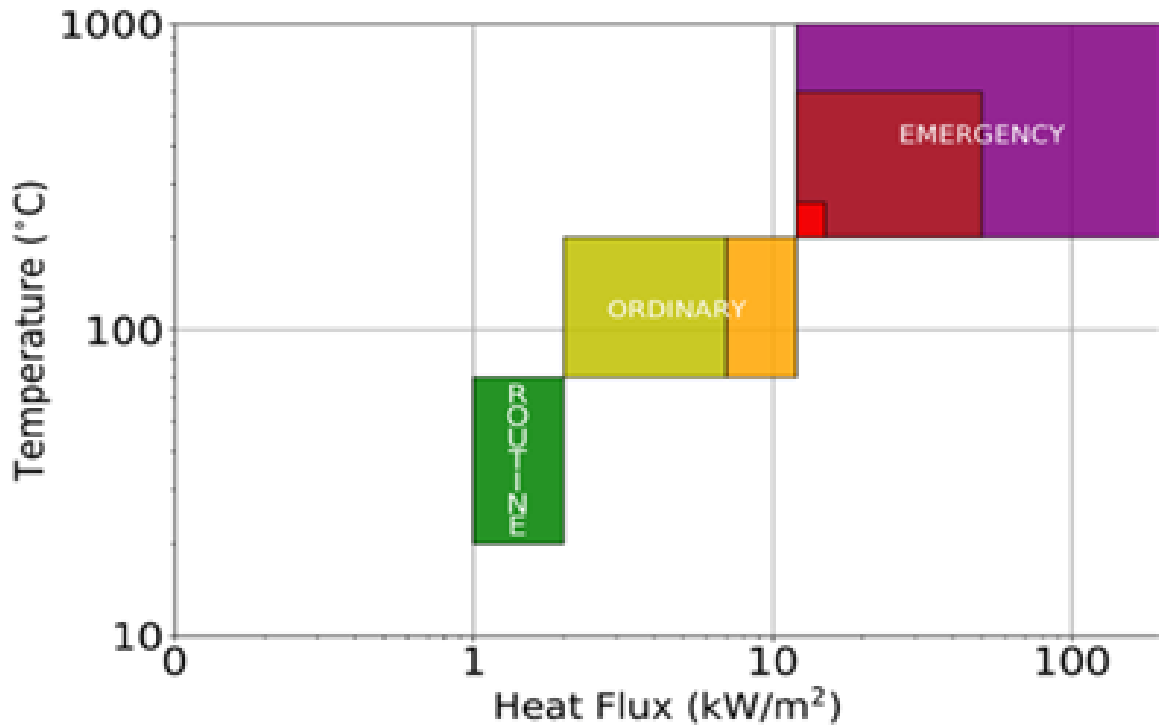




**(Figure 1)** Screenshot of UL FSRI Home Furnishings Comparison (Natural vs. Synthetic) video showing the difference in fire growth rate and flashover times due to the change in contents.

On the fireground, our decisions and actions can have a significant impact on occupants. When examining the empirical data from the FSRI fire attack study [4], and the search study [5], the results don't support the benefits of Two-In/Two-Out when compared to search and fire attack.

From the fire attack study, one of the tactical considerations derived from the data states, "Although survivable spaces exist at the time of fire department arrival, the survivability potential decreases as the time of exposure increases. When resources permit, interior search and rescue operations can and should proceed simultaneously regardless of the fire attack tactic selected [4]." This consideration is echoed in the FSRI search study, "provided effective interior and/or exterior suppression and sufficient resources, consideration should be given to the simultaneous execution of suppression, search, and rescue operations [5]. The unfortunate simple truth for thousands of fire departments across the U.S. is that following "Two-In/Two-Out" results in reduced tempo and slower operations.



Operating Class	Temperature Range [°C]	Heat Flux Range [kW/m <sup>2</sup> ]
Routine <span style="color: green;">■</span>	20 – 72	1 – 2
Ordinary I <span style="color: yellow;">■</span>	72 – 200	2 – 7
Ordinary II <span style="color: orange;">■</span>	72 – 200	7 – 12
Emergency I <span style="color: red;">■</span>	200 – 260	12 – 15
Emergency II <span style="color: darkred;">■</span>	260 – 600	15 – 50
Emergency III <span style="color: purple;">■</span>	> 600	> 50

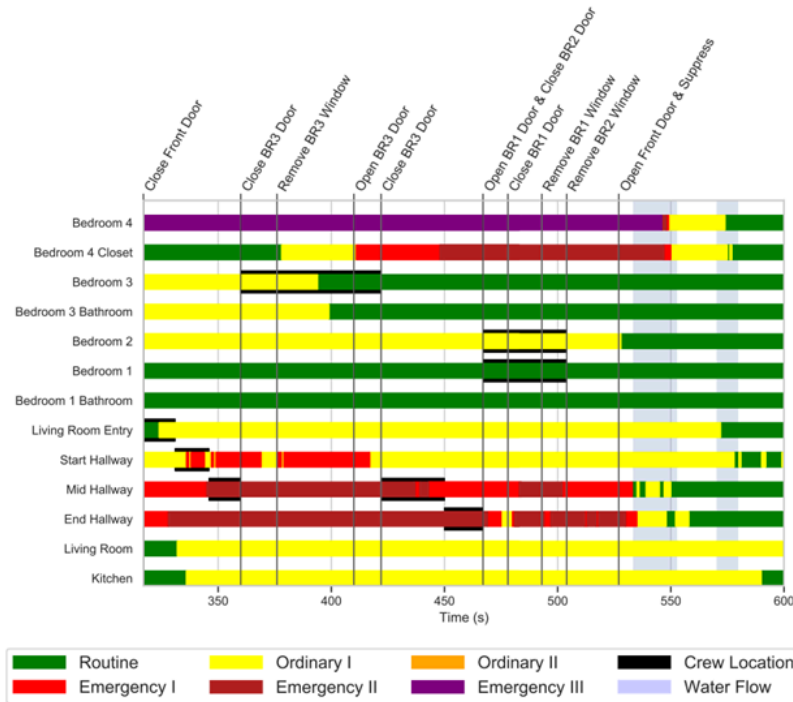
**(Figure 2)** Modified Thermal Operating Classes. This figure is from FSRI’s *Analysis of Search and Rescue Tactics in Single-Story Single-Family Homes Part III: Tactical Considerations* technical report (p. 12).

Research from FSRI has shown that once there is a fire, there are four variables that impact the survivability of a given space:

- Location
- Elevation
- Isolation
- Duration

Location refers to one’s proximity to the fire; elevation means a person’s height relative to the fire; isolation indicates whether there is compartmentation between

an individual and the fire; and duration refers to how long someone is in the affected space. Unfortunately for us, and anyone trapped, we have limited means of affecting these variables until we occupy the interior. Namely, we can flow water from the exterior, ventilate, isolate (exterior doors and/or windows), or some combination of these. These constraints in our operational options ultimately, and unsurprisingly, lead to less effective, less efficient and less safe outcomes.



**(Figure 3)** Thermal operating conditions based upon 3 ft elevation temperatures and heat fluxes during post-intervention period for pre-suppression door initiated search tactics in Experiment 6. This figure is from FSRI’s Analysis of Search and Rescue Tactics in Single-Story Single-Family Homes Part III: Tactical Considerations technical report (p. 42).

As can be seen in the graph above, flowing water for 15-20 seconds can decrease the temperatures in a space from less than 600° C (Emergency III) to below 72° C (Routine). Any delay in effective water on the fire leads to worsening thermal and toxic conditions, for both civilians and firefighters. With everything else being equal, so will a delay in locating, isolating and removing victims.

Assuming the worst, that the victim inside the fire building is in cardiac arrest, data from the American Heart Association (AHA) states that for “every minute Cardio Pulmonary Resuscitation (CPR) is delayed, a victim’s chance of survival decreases by 10% [6].” FSRI and the AHA have empirically proven that time is life,

and subsequently, that speed saves lives. Firefighters can have the most direct effect on life once they get inside the fire building, and anything that slows them down foundationally leads to fewer lives being saved.

### **Transitional Fire Attack**



- **Every minute CPR is delayed, a victim’s chance of survival decreases by 10%**

**(Figure 4)** American Heart Association data showing the impact early CPR has on victim outcome.

Arriving at the scene with a fire showing can make many things more difficult on the fireground, but it makes our size up easier since the fire location, and sometimes extent, is obvious. When fire is visible from the exterior, flowing water into the fire compartment from outside the structure before moving inside to extinguish the fire, can be an effective tactical consideration. In the fire attack study, UL FSRI stated, “When a transitional attack is chosen and a single hose line is going to be utilized to complete the tactic, the crew should understand the importance of rapidly relocating the hoseline from its exterior position after the initial knock-back to the interior for complete suppression. The faster this can be accomplished, the less the temperatures will rebound.” [4] When we arrive with nothing showing, or smoke showing, determining the location and extent of the fire takes precedence. Also from the fire attack study, “When the fire is not venting out an opening, determining the location can be difficult. In this instance, an interior attack may be the most effective way to locate, confine, and suppress the



fire [4].” This means that if nothing is showing, smoke is showing, or fire is showing upon arrival, regardless of where we initially begin flowing water, the best course of action is to get inside as soon as conditions allow. If we don’t initially have enough personnel on the scene, the Two In/Two Out policy will cause departments to wait until more members arrive, before anyone can get inside. This wait could be anywhere from seconds to minutes. The civilians inside don’t have this time to spare.

The data from FSRI has shown that removing any potential victim from the hazardous atmosphere as soon as possible after arrival on the scene is essential for increasing the chance of survival. As FSRI states, “finding them is the first step to removing them, and therefore searches need to start as soon as possible [4].” As can be seen in the graph below, “Once water is applied down the hallway as the crew advances towards the fire compartment, the conditions in the hallway go from the ordinary (yellow) and emergency (red) operating ranges to the routine (green) range. A search crew could follow the advancing attack crew, accessing and searching the bedrooms,” off the hallway as the crews advance.



**(Figure 5)** Thermal conditions before (left) and after (right) water application down the hallway during an interior suppression tactic in Experiment 7. Color conditions represent operating zones where green is routine, yellow is ordinary, and red is emergency. This figure is from FSRI’s *Impact of Fire Attack Utilizing Interior and Exterior Streams on Firefighter Safety and Occupant Survival: Full-Scale Experiments technical report* (p. 181).

Some argue that Two-In/Two-Out makes the fire service, and therefore those served safer. Experimental evidence from FSRI illustrates that any intentional slowing down of getting trained and equipped personnel inside the fire building

leads to worse conditions for any firefighters and civilians on the inside. An enhanced understanding of fire dynamics, paired with improved tactical operations leads to safer firegrounds. The research from FSRI has been critical in creating superior mindsets and skill sets throughout the fire service. These improved capabilities produce safer fire grounds... competence breeds safety, not directives and policies.

## **Firefighter Fatality Data**

As stated, the basis of the Two-In/Two-Out standard is that two firefighters enter the Immediately Dangerous to Life or Health (IDLH) atmosphere together while two firefighters remain outside of the IDLH in the event the two inside need to be rescued. One of the two outside firefighters is supposed to monitor the status of the two inside firefighters. The other outside firefighter can perform other fire ground tasks/duties. This identification of the two outside firefighters is implied to be the initial rapid intervention team (IRIT), rapid intervention crew (RIC), or firefighter assistance safety team (FAST), depending on how the department identifies them in the initial moments firefighters arrive on the fireground. Once a larger number of firefighters have arrived, the two-out pair are replaced by a larger number of firefighters whose focus is the rescue of a trapped firefighter or firefighters. This number is not strictly specified although some fire departments, such as the Phoenix Fire Department, have determined through their processes that the proper number may involve at least two companies or between 12 and 15 firefighters and a detailed command and communication structure [7]. The ideation of having firefighters standing ready to rush inside and rescue trapped, downed, or missing firefighters has culturally shifted from being a rational idea in its time, to a panacea easily tossed around as an immediate solution to the incorrect belief that the majority of line-of-duty deaths happen inside burning structures.

The Phoenix Fire Department report on the line-of-duty death of Firefighter Brett Tarver in 2001 states concerning increased staffing, “Approximately 100 firefighters are killed in the line of duty each year and another 100,000 firefighters are injured. A common contributing factor is the lack of staffing on initial arriving companies to overcome the hazards [8].” While increased staffing is vital, the statement about it being a “common contributing factor” in connection to the number of firefighters killed and injured each year is incorrect. Stress and overexertion leading to heart attack, cardiac arrest, or stroke are the correct common contributing factors related to the “100 firefighters

killed in the line of duty each year,” and every year except for the years 2020 and 2021 when COVID-19 was the leading nature of death.

In the last decade, the understanding and sharing of Don Abbott’s Project Mayday data has promoted the realization that RIC, RIT, or FAST teams have not been a large part of firefighter rescues. In contrast, downed or missing firefighters have largely been rescued by firefighters close to them or in the immediate area. This does not void the importance of rapid intervention teams but instead provides a greater truth about their immediate effectiveness [9]. This firefighter rescue idea, the Two-In/Two-Out standard, does not have the data supporting its effectiveness as is commonly believed and written about.

Considering the data from Project Mayday, and the actual wording of the Two-In/Two-Out standard, the language of the standard itself negatively affects the reasoning of how an interior rescue of firefighters would be successfully performed, and – for those with an interest in situational awareness and command/task saturation – allows one of the two firefighters out to not be 100% focused on the status of the two firefighters inside, this is evident by allowing that firefighter to perform other fireground tasks.

What does the data show us? Traumatic interior firefighter deaths, those caused by burns, collapse and asphyxiation, are a very small percentage of each year’s total number of firefighter fatalities. In a deeper review of the traumatic interior fatalities, and the non-traumatic fatalities inside a burning structure, the victims were rarely alone and rarely initially operating alone in the first minutes while on the scene.

The supposition that having two firefighters outside, ready to rescue the initial two firefighters inside, will reduce line-of-duty deaths is unrealistic; repeatedly proven to have little impact based on practical data, and is often emotional when referred to in fatality investigation reports.

	Firefighters			Civilians
	Advancing hose – Interior	Search	Collapse during ventilation	
2021	5	3	0	3800
2020	5	0	0	3500
2019	5	0	1	3700
2018	6	1	0	3655
2017	0	1	0	3400
2016	2	2	0	3390
2015	4	2	1	3280
2014	9	2	0	3275
2013	9	4	1	3240
2012	4	0	0	2855
<b>Average/ Year</b>	<b>4.9</b>	<b>1.5</b>	<b>0.3</b>	<b>3410</b>

Source: Data Not Drama. Bill Carey      Source: NFPA

**(Figure 6)** Civilian and firefighter fireground death comparison, Data taken from NFPA and Data Not Drama, graph from Ben Schultz’s “Every Second Counts” presentation.

Years of firefighter fatality data from the United States Fire Administration (USFA) show a total, lump sum number of line-of-duty deaths. Looking into the specific details of each year’s fatalities, the average percentage of firefighters who suffered traumatic fire ground deaths is approximately 10% of the total number each year. This percentage is often lower than the number of line-of-duty deaths counted under the Hometown Heroes Act [10], and approximately 10% or more of each year’s total number.

A deeper investigation of traumatic interior fatalities reveals that the majority of the incidents occurred when the number of personnel both inside and outside the structure was far more than the ‘two out.’ While there are incidents where it can be presumed that Two-In/Two-Out might have had a positive effect, they are very few, and the most recent incident, in Oklahoma, includes reports of trapped occupants [11].

The intention of Two-In/Two-Out, at its conception, was based on the best intention to improve the operational safety of firefighters at structure fires across the country. However, in the current time when the fire service is being urged to be data-driven and data-literate, the data simply shows that Two-In/Two-Out does not affect immediate firefighter safety and rescue. Instead, it reduces the

number of working firefighters in an era where firefighters are also being urged to be time-to-task conscious, and make every effort to reduce the time it takes to interrupt a fire's progression and to affect the rescue of trapped occupants.

## **Experiential Mayday Data**

During a comprehensive 5-year study of over 12,000 fire ground incidents, information was obtained into the cause and response to firefighter mayday events [12]. An accumulation of 1,107 radio traffic reports and 121 dash and video recordings confirmed almost all information and data received during this period. Information such as this allows the question to be asked, what would it look like to manage risk?

The fact is, that transitioning to a risk management mindset begins with a change of culture. If the fire service exists to save lives and protect property, then fire departments need to take a hard look at the data that proves time wasted equates to more civilian fatalities. In a fire, minutes make the difference between rescue and recovery, especially for those who are unprotected and trapped inside a burning building. Simply put, whatever is allowed to happen without intervention, ultimately becomes the accepted standard of care.

In the case of the Two In/Two Out policy, concern has been that to enter the structure, at least 4 people should be on the scene. This is because the idea is that two people outside the structure can assist those inside if need be. Unfortunately, this is a false sense of security as one of the personnel outside is allowed to perform pump operations and is likely not fully dressed and unable to readily enter a hazardous environment. Going further, the second person is allowed to assume the role of the incident commander and is also not likely in a position to make an immediate rescue of a down firefighter if needed. NFPA 1500 defines "mayday readiness" as the ability to don, doff, and manipulate the SCBA in zero visibility while wearing firefighting gloves. Knowing this, we must ask ourselves if the Two In/Two Out policy is the most effective way to operate and if it is best for our citizens and firefighters. The research obtained on Two In/Two Out shows that it does not work and has not produced any significant results. Reasons for this include but are not limited to; too few people, not properly dressed, there was no RIT/RIC bag or any other proper rescue equipment available, mentally individuals were not prepared, and there was no plan or backup plan and or team.



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**IRIC, RIC, RIT Operations**

**2 in / 2 out**

***Our research, based on  
Victims, ICs, IRIC/RIC  
DOES NOT WORK ...  
It has not produced any  
significant results ...***

- to few people
- not properly dressed
- **NO RIC bag/or proper rescue equipment**
- mentally unprepared
- **NO plan**
- **NO back-up plan or team**

*(Figure 7) Project Mayday analysis of two in, two out effectiveness, from 2021 Annual “Project Mayday” General Report, Career 2021, Part 1 of 2 (slide 446).*

If we break down the data further, we find that the highest percentage of maydays occur when there are 16-22 personnel on the scene (33% of maydays) and the crew size was three for 41% of maydays in comparison to crew size of two which was for 29%. Digging deeper we find the largest percentage of maydays happening after we arrive on scene is 19% and that is at 20-25 minutes into the incident, proving that time does matter when it comes to tasks on the fireground and the overall safety of our firefighters. It is also worth noting that less than half of our maydays (42%) occur in the residential setting.

Information such as this is important to know because for a firefighter to survive the dangers of firefighting, they must know how other firefighters have died or been seriously injured. Let’s break down the actual numbers about the firefighter mayday to better understand what they mean for us.

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**“MAYDAY” Elapsed Time When Maydays Occur**

**After marking on the scene .... 4min 45sec...**

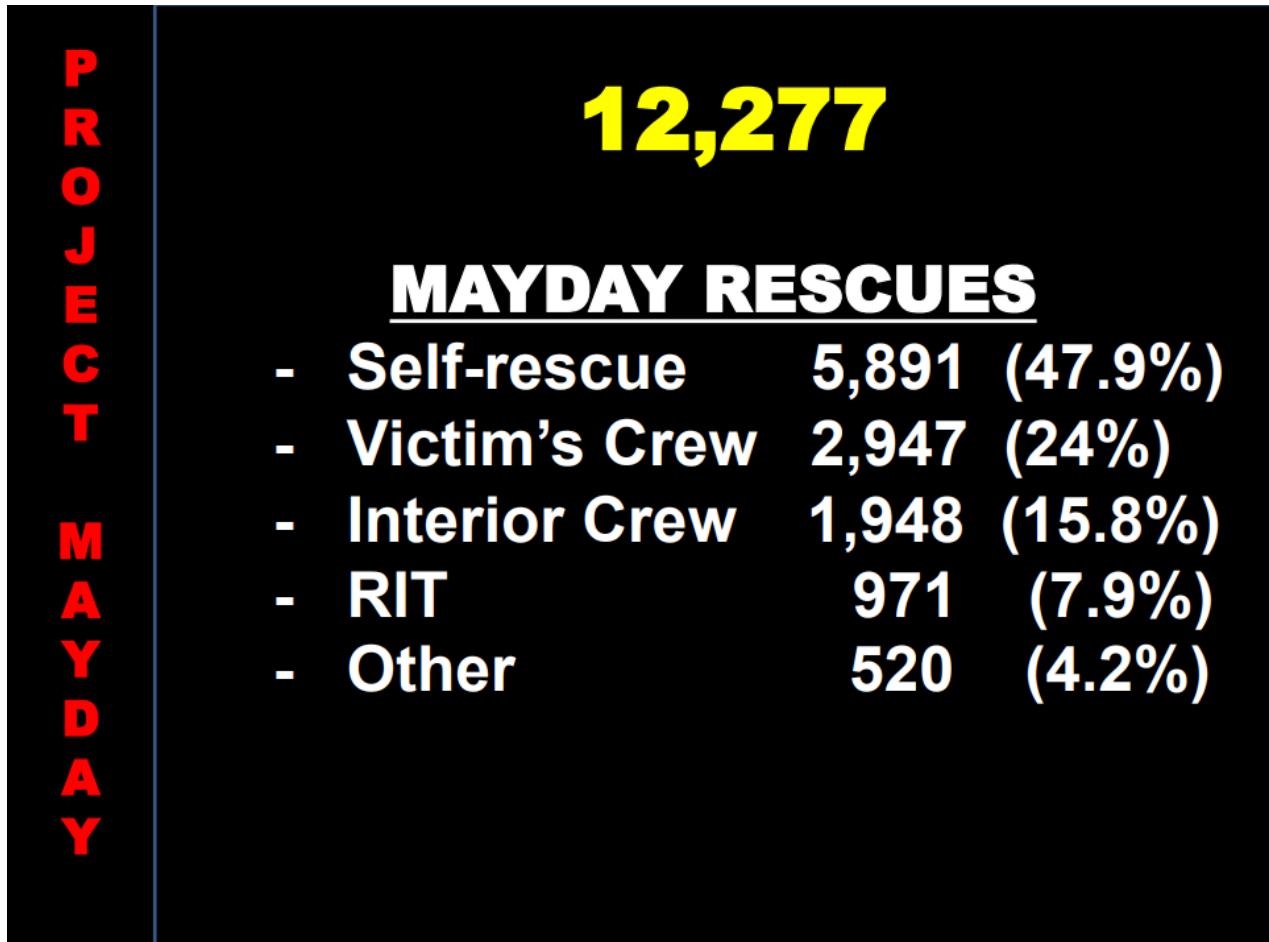
< 10 mins	71	.5%
10 – 15 mins	743	6%
15 - 20 mins	1,606	13.1%
<b>20 – 25 mins</b>	<b>2,337</b>	<b>19.1%</b>
<b>25 - 30 mins</b>	<b>2,125</b>	<b>17.3%</b>
<b>30 - 35 mins</b>	<b>1,890</b>	<b>15.4%</b>
35 – 40 mins	1,349	11%
40 - 45 mins	1,192	9.7%
45 - 55 mins	623	5%
> 55 mins	261	2.1%

**12,227**

*(Figure 8) Project Mayday data on FD arrival on scene until mayday, from 2021 Annual “Project Mayday” General Report, Career 2021, Part 1 of 2 (slide 90).*

When a mayday occurred, almost 48% of the time the firefighter was able to self-rescue. The firefighter’s crew mitigated the mayday 24% of the time, while 16% of the time another interior crew was able to rescue the mayday firefighter. However, there seems to be a hyper-focus on the less than 8% of the time the firefighter(s) is unable to self-rescue or be rescued by another crew. Over 92% of maydays are removed without a RIT because other firefighters are already operating in the same area; nearly 88% of successful rescues come from within the structure. It is also worth noting that 36% of the events required no hand tools, and 23% needed no personal tools to self-rescue. What this proves is that putting our civilians first is safer for everyone involved. A firefighter in distress will usually revert to what was taught and is routine, so the conversation that we really should be having is that more time needs to be spent on how to read fire and smoke conditions as well as self-rescue and search and fire attack techniques, instead of just assuming that if things go wrong, a RIT will come and save the day. This leads to a complacent

way of operating and puts too much faith in something that is rarely used and those assuming the role likely have little to no training in.



*(Figure 9) Project Mayday data showing who rescued firefighter maydays, from 2021 Annual “Project Mayday” General Report, Career 2021, Part 1 of 2 (slide 281).*

Only 16% of mayday victims reported that they had confidence in their RIT, whereas 83% reported they had confidence in their company officer, and 82% reported confidence in their incident commander.

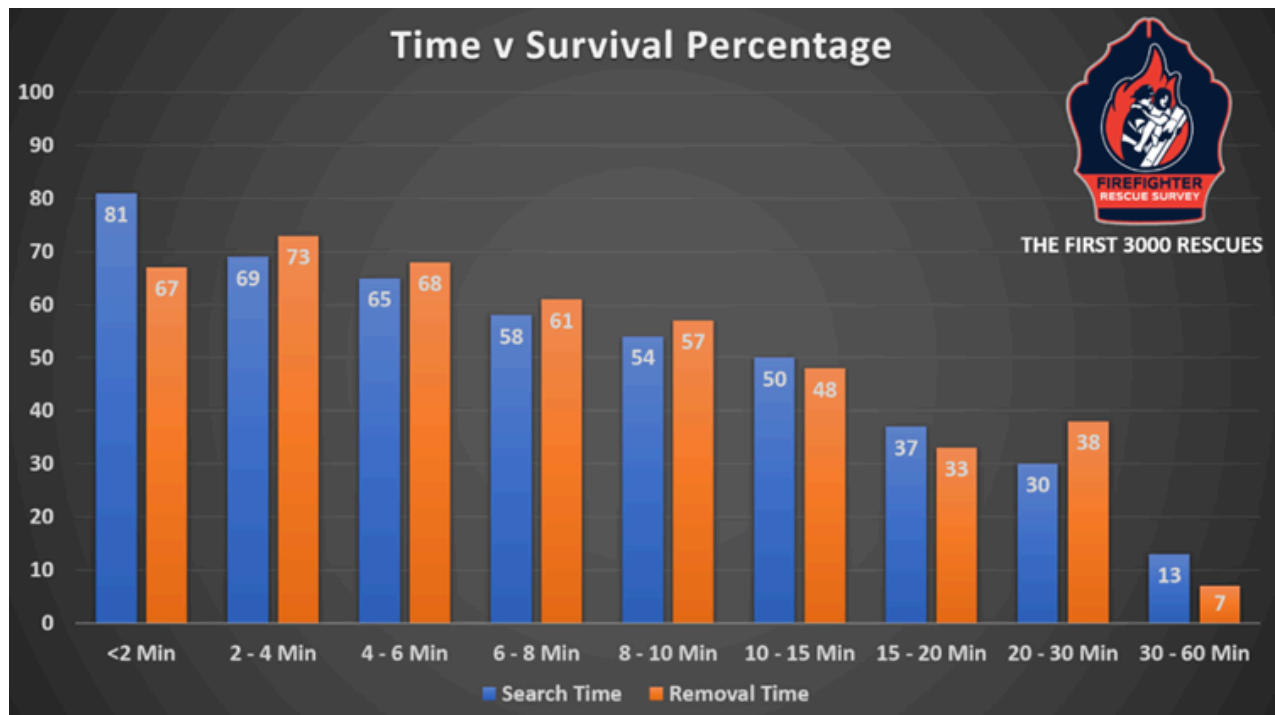
Better training for Firefighters should be taking the place of risk-averse policies. Lack of situational awareness contributed to 76% of maydays and decision-making accounted for 79% whereas structural issues only accounted for 9%. The fire service needs to be operating on facts and not fear, and the fact is that if we made better decisions and remained situationally sound, many maydays could be avoided.

## Firefighter Rescue Survey Data

Through the Firefighter Rescue Survey (FRS), and over 3,000 detailed submissions, we can bring another perspective to our discussion. FRS is aimed at decreasing some of our unknowns during the fog of fire, the data can be found at [www.FirefighterRescueSurvey.com](http://www.FirefighterRescueSurvey.com) [13]. FRS has collected, calculated, and collated thousands of rescues, resulting in over 142,000 data points. This is the first time in the history of the American fire service that we have tactical, actionable data on civilian rescues. A small sample of the dissected and distilled data are presented below.

We all intuitively know that time matters on the fireground, for both the civilians trapped by fire, and for the firefighters putting themselves in harm's way. This is so obvious that even those not in the fire service are aware of it. This is the reason why others pull over for us when we are responding with lights and sirens. Now, for the first time in the American fire service, we have experiential data that relates time to fireground survival. The data below might be the most telling data sets from FRS, even if they are just reinforcing tacit knowledge that we've all inherently known since day one.

The graph shows that there is an obvious, direct correlation (and potentially causation) between speed and survival. Meaning that with everything else being equal, the faster we locate and remove victims, the better it is for them. In the graph below, the blue lines (Search Time) represent the times from the fire department's arrival on the scene until the victim is located. The orange lines (Removal Time) represent the times from the fire department's arrival at the victim until the victim is removed from the fire building. The survival percentage when the victim is located in less than two minutes is 81% and consistently decreases until it is less than 60% when it takes us more than six minutes to locate someone. Let this sink in...how does your department prioritize search? Does it make sense to wait to search until we have established 'two out'? Could we remove a victim(s) faster if we had more help initially?



**(Figure 10)** Graph showing Search Time (blue) v Survival Percentage, and Removal Time v Survival Percentage (orange) of recorded rescues from Firefighter Rescue Survey’s “The First 3,000 Rescues” breakdown.

While we all intuitively, and now experientially know that time is our ally on the fire ground, we can also see where search is prioritized on the fireground. These data show that in 96% (721/748) of all successful rescues, a search was initiated before RIT/RIC was established; and that in 92% (1745/1901) of all successful rescues, a search was initiated before, or simultaneous with fire knockdown. FRS defines a successful rescue as one where the victim survived, as of the participant’s last known information.

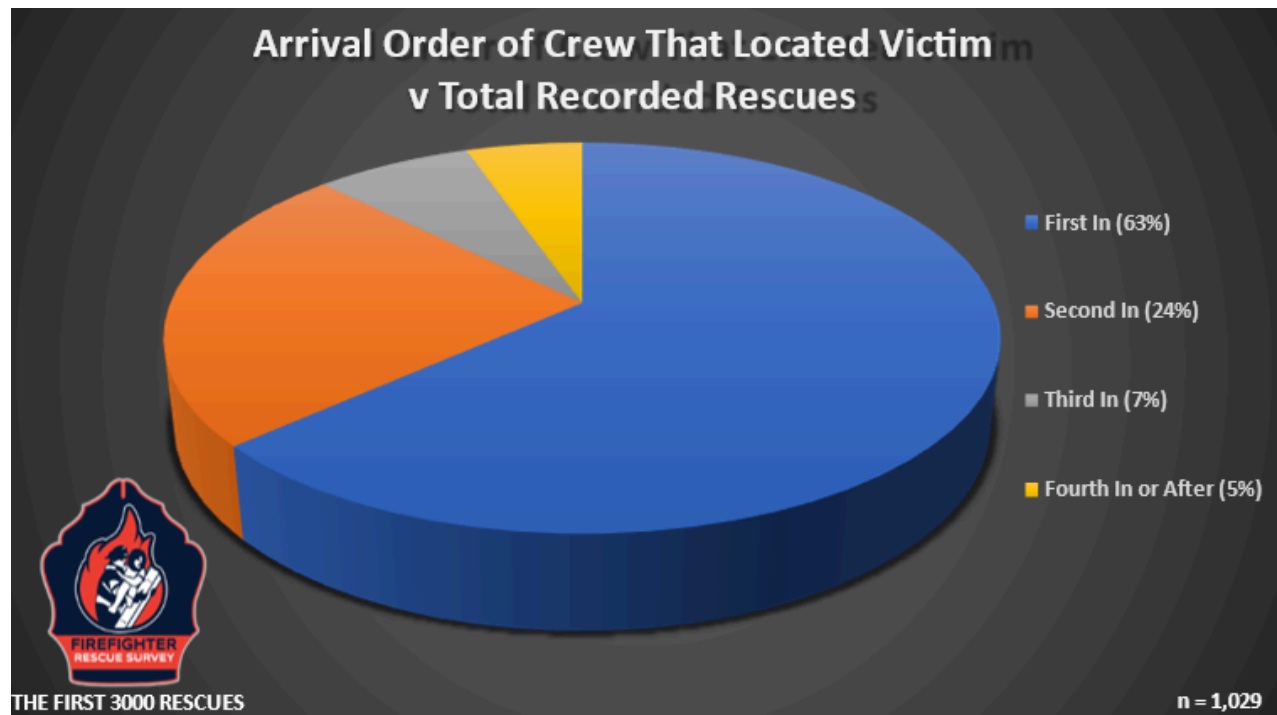
This information likely challenges our perspectives and our procedures. If firefighters have the resources to search simultaneously with suppression, instead of sequentially, they will save more lives. The same can be said if a search is prioritized before RIT or ‘two out.’ Many firefighters have experienced being on scenes with limited personnel early in an incident, leading to the need to triage operations.

Following Two-In/Two-Out handcuffs firefighters and exacerbates these difficult decisions. What the data is telling is, that the faster we can get crews inside for suppression and search, the better the outcome. Taking this a step further, as



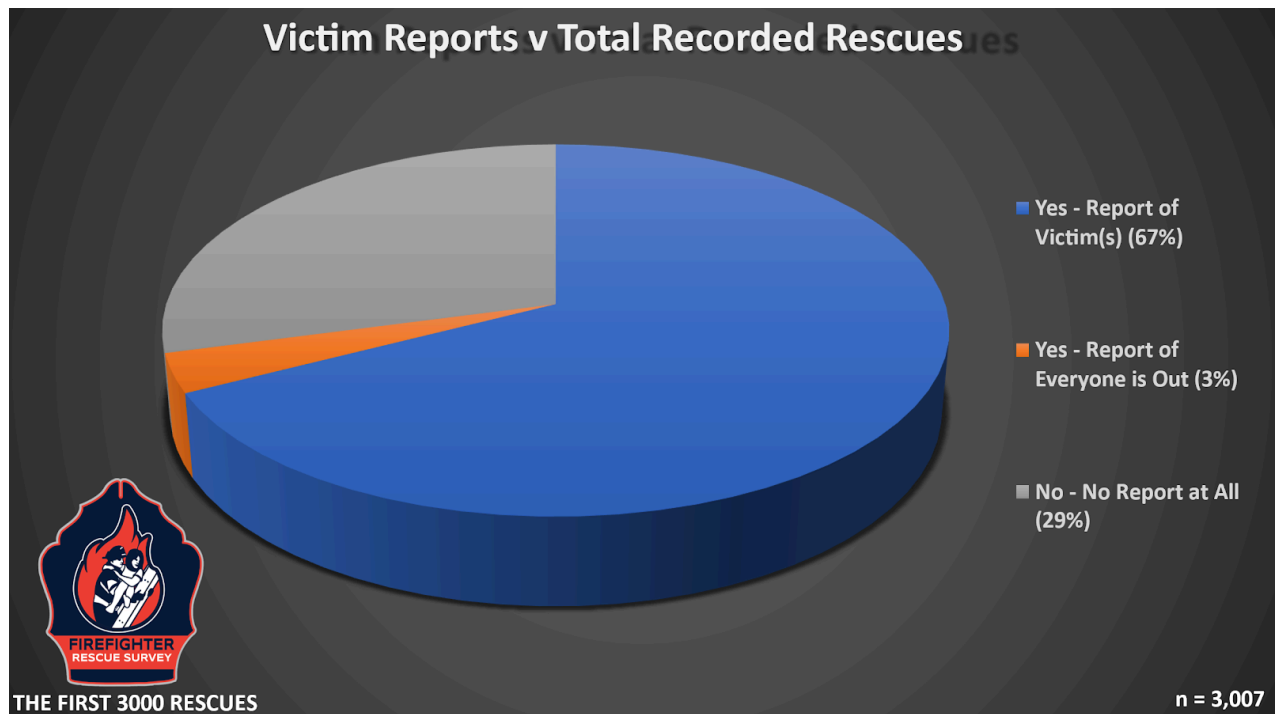
Aaron Fields so succinctly states, “If we make it better for them, by definition, we make it better for us.”

Figure 11 compares the data related to speed and the importance of making sure that the first arriving crews are entering the fire building as soon as conditions allow, see the graph below. The graph illustrates that 87% (900/1029) of all victims have been found by the first two arriving crews on the scene. Also, in 91% (645/710) of all successful rescues, the victim was located by one of the first two crews. This information reinforces the importance of having the first two crews operating at the task level, and ideally inside the structure to save lives and property. Remember, saving lives is our fundamental mission. Not only will we put ourselves in a better position to save lives, but there are other benefits to getting firefighters inside the fire building sooner rather than later. One of those benefits that are underappreciated by many is that getting our eyes inside the building can tell us a lot that we might be missing from the outside (i.e. tunneling, fire location and size, closed doors, burning regime, layout, location of victims, etc.). An interior size-up is at least as imperative, and for some reason, much less championed than the exterior size-up, or 360-degree survey of the building.



**(Figure 11)** Graph showing Arrival Order of Crew That Located Victim v Total Recorded Rescues from Firefighter Rescue Survey’s “The First 3,000 Rescues” breakdown.

There is indeed an explicit exemption in the respiratory protection standard that if life is in jeopardy, we can waive the Two In/Two Out requirement. This is an incredibly important clarification, although the rub lies in knowing if, as the respiratory protection standard codifies it, “emergency rescue activities [14]” are needed on the scene. Oftentimes, especially in the first couple of minutes on scene, we don’t know if a building is occupied. FRS data below indicates that in 33% (979/3007) of recorded rescues, firefighters on scene had no reports or negative reports of victims trapped inside the fire building. Furthermore, in 3% (102/3007) of recorded rescues, we had reports that “everyone is out.” FRS data also indicates even when we had reports of victims, 20% of these victim location reports were inaccurate. The more we learn about decision-making under stress, the more we realize that there are serious gaps in our abilities when we are under duress. This can help explain why when someone’s world is burning in front of them, they make relatively simple mistakes. Conditions and resources should dictate our strategies and tactics, not the civilians on-scene, and with all due respect, not OSHA.



**(Figure 12)** Graph showing Victim Reports v Total Recorded Rescues from Firefighter Rescue Survey’s “The First 3,000 Rescues” breakdown.

Simply put...speed saves. Besides being intuitive, we now have experimental (FSRI) and experiential (FRS) data to back up this adage. The faster that we can get crews through the door (or window), to start suppression and search, the more

lives we will save. This seems undeniable. FRS data also shows that 10% (299/3003) of victims have been found within 6' of an exterior door, and 6% (175/3003) have been found directly beneath a window. The importance of occupying the space, as soon as conditions allow, cannot be overstated. Having to wait potentially minutes for another crew, or two, to arrive before we can get inside is not in the best interest of the civilians we serve. Thus, it is also not in the best interest of firefighters.

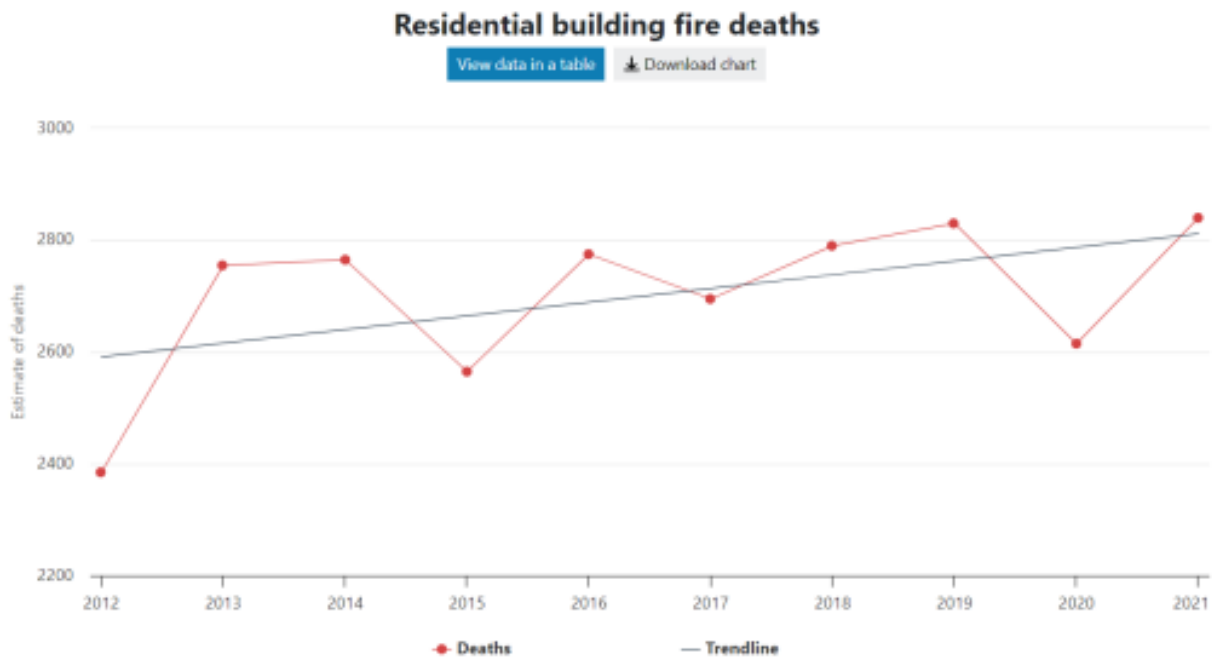
A quick thought experiment can solidify this for us. Imagine that you are at work and you hear tones drop for a working fire at your house across town. Your wife and kids are likely at home, but you are not sure. You call your wife's cell, but there is no answer.

You look at the Computer Aided Dispatch (CAD) notes and see that Engine 9 is going to be first on the scene, but the second and third due rigs are on other calls. You realize that the second arriving rig is going to be at least five minutes behind Engine 9. Engine 9 is fully staffed with three firefighters. Like the majority of fires we respond to, Engine 9 does not know if anyone is inside. What should Engine 9 do?

What if that was not your house, and you did not know the people that live there? Does it matter if we know the people that live there? Should it? We posit that all our decisions should be made by simply asking ourselves 'what we would do if it were our house, our family, our kids'...by making it personal, you not only help Mrs. Smith, but you also help your personnel.

## **CONCLUSION**

Data, when used properly, can change ideologies, operations, and outcomes. Our goal should be to utilize all the data available to us to have the most accurate picture of the fireground. If data-driven decision-making is our goal, FSRI, Project Mayday, NFPA, and Firefighter Rescue Survey data are some of our best resources to enhance our understanding of such a complex environment. The combination of data from these sources all converge on a simple fact, that two-in/two-out, while well-intentioned, makes the fire ground less safe for civilians and firefighters. The former is evidenced by the ongoing fire dynamics research undertaken by FSRI and information from the Firefighter Rescue Survey. The latter is shown by data from both Project Mayday and NFPA LODD information.



**(Figure 13)** Graph showing the most recent ten-year period of residential building fire deaths per USFA.

It is obvious to many that Two-In/Two-Out will lead to worse outcomes for civilians. Softening our response and slowing our tempo, while fires continue to get faster and more powerful is a recipe for disaster. Recent nationwide trends show a decrease in the number of residential fires, but an increase in deaths. Intuitions and insights should lead us to question the continued need for Two-In/Two-Out. We know that fires are getting faster, but are we?

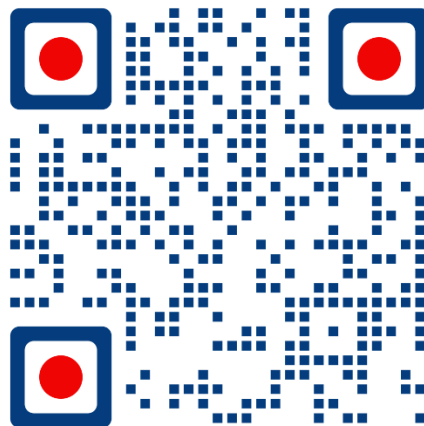
It may seem counterintuitive to many that Two-In/Two-Out leads to less safe operations for firefighters, but the data is explicit. If a firefighter finds themselves in trouble inside the building, having firefighters standing by outside the building is not very helpful to those inside. The data also reveals that more firefighters working inside the building solve more problems faster. The fact is, that solving problems quickly creates a safer fireground for firefighters.

This seems like an appropriate spot to thank our former team member, Project Mayday creator, and fire service luminary: Don Abbott. Don began working on this project shortly before he passed, and had actively been trying to remove the Two-In/Two-Out requirement for fire departments after he began dissecting the data from Project Mayday.

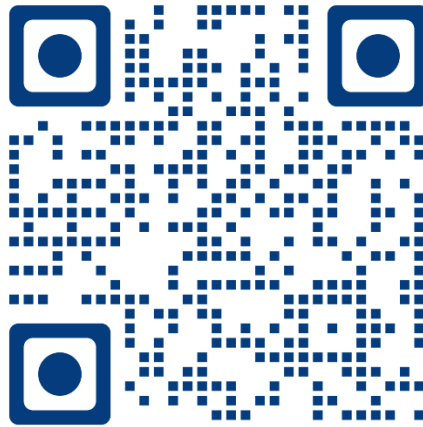
In this document, we have done our best to present the reader with objective information so they can make an informed decision. We have been running the Two-In/Two-Out experiment for 26 years and there is now sufficient information to conclude the effectiveness of two-in/two-out on building fires. We believe the data is clear.

## A Call to Action

While this project started two years ago, the timing for this document's release is perfect. Currently, OSHA is proposing folding two in/two out, with some changes, into a new safety and health standard, titled *Emergency Response Standard*. The new *Emergency Response Standard* will effectively replace the existing *Fire Brigades Standard* and can be seen by clicking [here](#). One of the changes tightens up the language so that the only exceptions to two in/two out would be “for the rescue of a person in imminent peril only, where team members or responders observe or are informed by a witness of the imminent life hazard” [15]. This would make it more difficult for fire departments to forgo two in/two out with the intent of possibly saving a life or lives. This is the best chance we've ever had to effect a change to two in/two out and end this existential experiment. To make your voice heard, scan the QR code below, or click on the link [here](#), and submit a public comment to OSHA on the proposed changes to two in/two out and the *Emergency Response Standard* (The majority of the Two-In/Two-Out language is on page 64 of the proposed standard). **Public comments are only open until July 21, 2024.** If we don't make our voices heard, we could be stuck with a policy that we know doesn't work, and data demonstrates that will cause more deaths. We need your help, and so do the civilians we're sworn to protect.







*(Fig. 14 and 15) QR codes to public comments for OSHA’s proposed Emergency Response Standard (left), and to the current proposed version of the Emergency Response Standard (right) (The majority of the Two-In/Two-Out language is on page 64 of the proposed standard).*

## **Appendix 1**

OSHA 29 CFR 1910.134(g)(4)

***Procedures for interior structural firefighting.*** In addition to the requirements set forth under paragraph (g)(3), in interior structural fires, the employer shall ensure that:

1910.134(g)(4)(i)

At least two employees enter the IDLH atmosphere and remain in visual or voice contact with one another at all times;

1910.134(g)(4)(ii)

At least two employees are located outside the IDLH atmosphere; and

1910.134(g)(4)(iii)

All employees engaged in interior structural firefighting use SCBAs.

Note 1 to paragraph (g): One of the two individuals located outside the IDLH atmosphere may be assigned to an additional role, such as incident commander in charge of the emergency or safety officer, so long as this individual is able to

perform assistance or rescue activities without jeopardizing the safety or health of any firefighter working at the incident.

Note 2 to paragraph (g): Nothing in this section is meant to preclude firefighters from performing emergency rescue activities before an entire team has assembled.

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