

For Fire Fighter Crews

# SIZE MATTERS



**“We know that running fours and fives is safer and more effective than running with twos and threes. This study gives us the scientific evidence we need to educate public officials so that they understand the connection between cutting fire service budgets and endangering public and fire fighter safety.”**

—General President Schaitberger

**W**estport, MA 1802 fire fighters violate fire safety standards and regulations on nearly every residential fire call.

That’s because units typically respond with just two fire fighters.

Local 1802 President Keith Nickelson says, “Upon arrival, many things need to be done, but there is only so much two fire fighters can do. Too often, we must weigh fire fighter safety against citizen safety.”

For years, the IAFF and its members have known the importance of having enough fire fighters on scene to safely perform rescue and fire suppression tasks.

Now, there is scientific proof.

A landmark study, released April 28 by the U.S. Department of Commerce’s National Institute of Standards and Technology (NIST), shows that the size of fire fighting crews and arrival times have a substantial effect on fire fighters’ ability to protect lives and property in residential fires.

“This study comes at a crucial time for the fire service,” says IAFF General President Harold Schaitberger. “Fire departments across the nation are doing more with less because the economic crisis is robbing them of the resources they need

to do their job safely. This new study shows that public officials, fire chiefs and others who make critical decisions that affect the lives of the men and women on the frontlines can do a much better job of keeping fire fighters and the public safe. These results cannot be ignored.”

Specifically, the results provide quantitative data on the most common and deadly fires in the country — those in single-family residences — to fire chiefs and public officials responsible for determining safe staffing levels, station locations and appropriate funding for community and fire fighter safety.

“We know that running fours and fives is safer and more effective than running with twos and threes,” says Schaitberger. “This study gives us the scientific evidence we need to educate public officials so that they understand the connection between cutting fire service budgets and endangering public and fire fighter safety.”

Jeff Johnson, president of the International Association of Fire Chiefs, adds, “This study raises the bar for discussions regarding the impact of changes in fire department resource levels on the community.”

“The information from this study will have an immediate and direct effect on how we respond to fires and other emergencies in our communities,” notes Montgomery County (Maryland) Executive Isiah Leggett.

The residential fire study, completed by NIST, the IAFF and other members of a broad coalition of scientific, fire fighting and public-safety organizations, is part of a larger multi-phase study on fire fighter safety and resource deployment.

The study is an outgrowth of the passage of National Fire Protection Association Standard 1710 (NFPA 1710) that provides guidance on the safest and most effective deployment of professional fire fighters to low-hazard events.

“NFPA 1710 defined what objectives and resources are necessary to respond to and mitigate a low-hazard structure fire efficiently, effectively and safely,” says IAFF Assistant to the General President for Technical Assistance and Information Resources Lori Moore-Merrell, a principal investigator on the study. “But, we still needed the scientific evidence — empirical data — to present the information to public officials.”

The study, which dealt with low-hazard residential fires, where the vast majority of fatalities occur, shows that four-person fire fighting crews completed 22 essential fire fighting and rescue tasks 30 percent faster than two-person crews and 25 percent faster than three-person crews.

“What is important here is that there is a more significant gap between four- and three-person crews,” explains Moore-Merrell. “This difference in time-to-task completion, coupled with fire growth data, clearly demonstrates that there are significant risks associated with the smaller crew sizes and the longer stagger between arriving companies.”

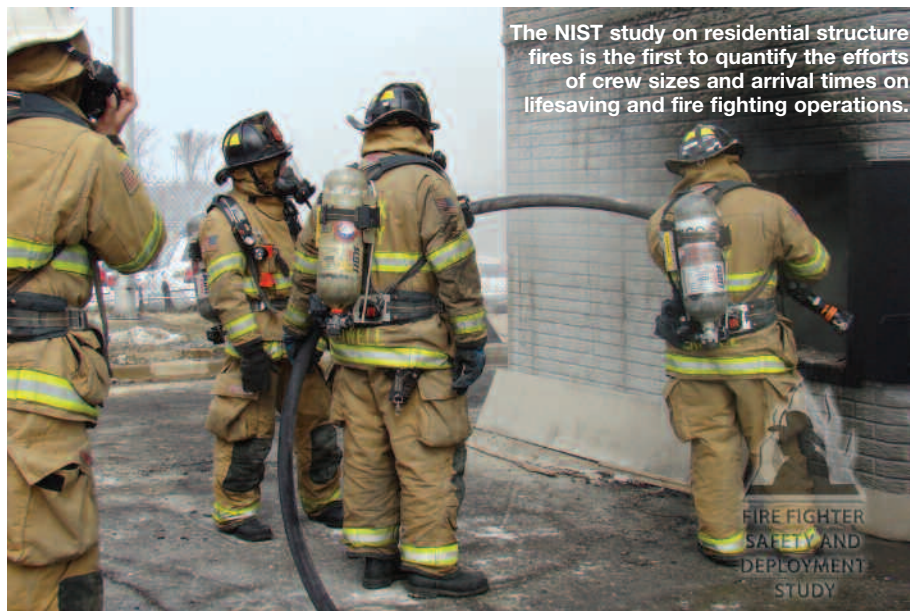
“We have to do more to show our public officials that anything less than four is not safe,” says Marin, CA Local 1775 President Robert Briare. “They just don’t understand. Finally, we have scientific proof to support our argument.”

Local 1775 held a Fire Ops 101 for local decision-makers, first using a four-person crew response, then a response with two and three fire fighters.

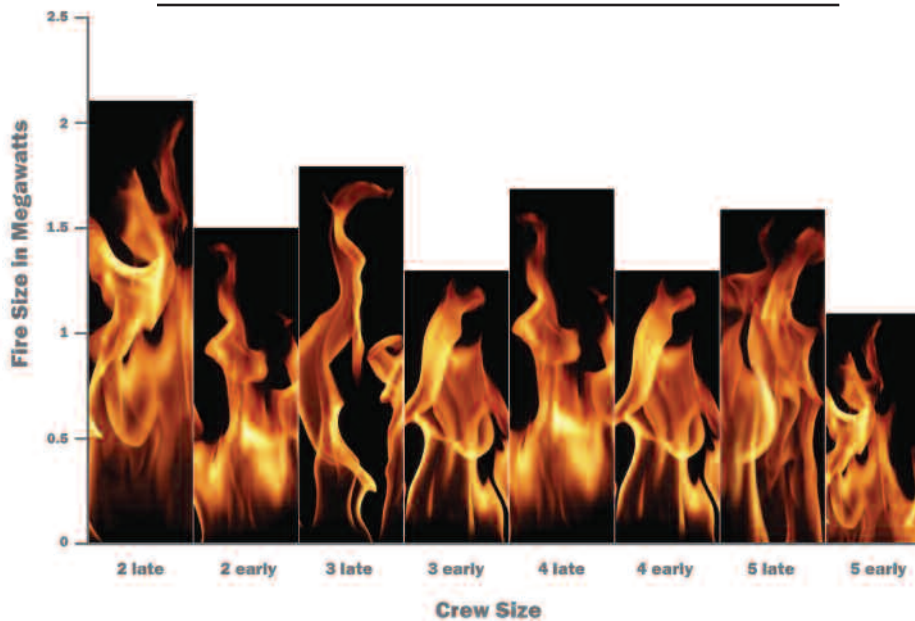
“Participants all said afterwards they could not believe we do this every day with less than four,” says Briare.

Local 1775, which represents 12 fire departments in Marin County, California, responds to emergencies with two or three fire fighters per company, depending on the department.

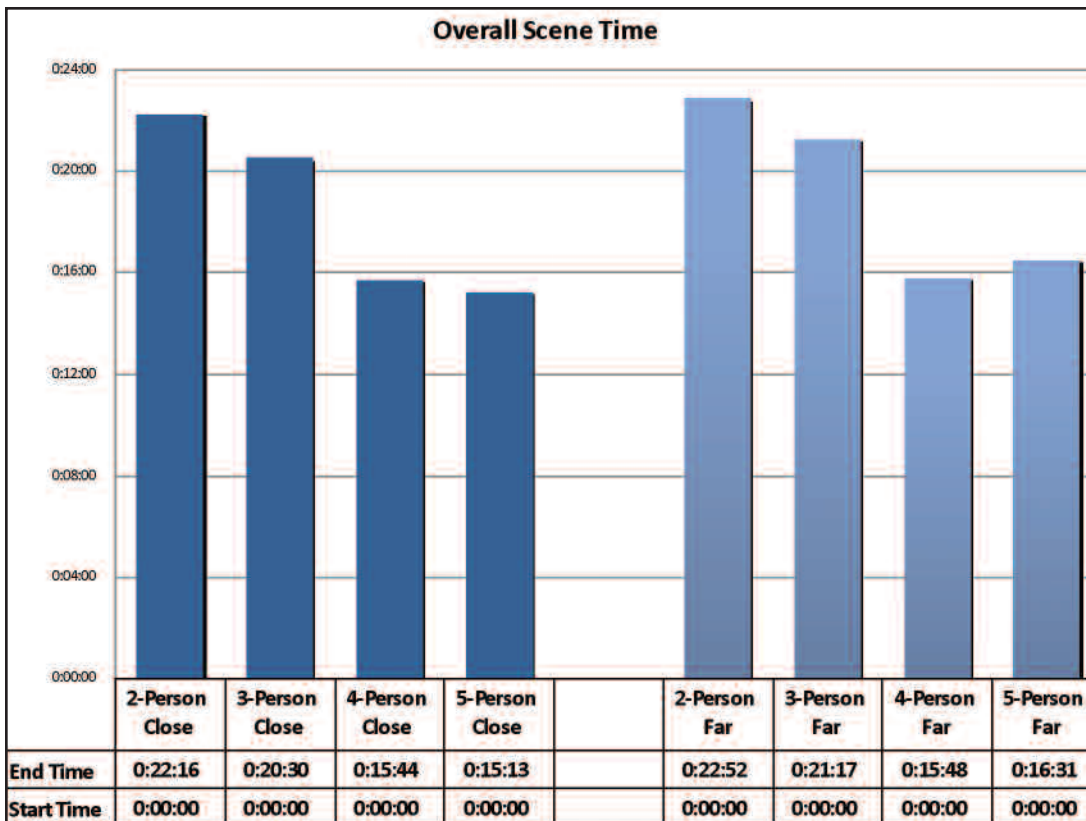
For the study, researchers built a low-hazard structure as described in NFPA 1710. The two-story, 2,000-square-foot test facility was constructed at the



### Size of Fire at Time of Suppression



NIST researchers conducted more than 60 controlled fire experiments to determine the relative effects of crew size, arrival times and the spacing between the arrival of fire apparatus.



**Time-to-Task Graphs**  
Overall Scene Time (Time to Complete All 22 Tasks)

The four-person crews operating on a low-hazard structure fire completed the same number of tasks on the fire ground (on average) 7 minutes faster than the two-person crews.

Montgomery County Public Safety Training Academy in Rockville, Maryland. Fire crews from Montgomery County, Maryland, and Fairfax County, Virginia, responded to live fires in this facility.

NIST researchers and collaborators conducted more than 60 controlled fire experiments to determine the relative effects of crew size, arrival time of the first fire crews and the stagger — or spacing — between arrivals of successive waves of fire fighting vehicles and equipment. Stagger times simulate the later arrival of crews from more distant stations versus crews from more nearby stations.

Crews of two, three, four and five fire fighters were timed as they performed 22 standard fire fighting and rescue tasks to extinguish a live fire in the test facility, including search and rescue, putting water on fire and laddering and ventilation. Apparatus arrival time, the stagger between apparatus and crew sizes were varied.

The United States Fire Administration (USFA) reported that in 2008, 403,000 residential structure fires killed close to 3,000 people — accounting for approximately 84 percent of all fire deaths — and injured approximately 13,500. Direct costs from these fires amounted to nearly \$8.5 billion. Annually, fire fighter deaths have remained steady at about 100, while tens of thousands more are injured.

Researchers also performed simulations using NIST’s Fire Dynamic Simulator to

**“We have to do more to show our public officials that anything less than four is not safe. They just don’t understand. Finally, we have scientific proof to support our argument.”**

— President Robert Briare,  
Marin, CA Local 1775

examine how interior conditions change for trapped occupants and fire fighters if a fire develops more slowly or more rapidly than in the actual experiments. The fire modeling simulations demonstrated that two-person, late-arriving crews can face a fire that is twice the intensity of a fire faced by five-person, early arriving crews.

Additionally, the modeling demonstrated that trapped occupants receive less exposure to toxic combustion products — such as carbon monoxide and carbon dioxide — if fire fighters arrive earlier as three or more persons per crew.

Nickelson notes that any complicating factor is a real risk for fire fighters. During a recent brushfire, dispatchers sent the usual first response of two fire fighters. The two arrived and quickly realized they could not control the fire themselves. An

additional two were sent to assist. All four fire fighters sustained minor injuries during the four hours it took them to get the blaze under control. Meanwhile, both of Westport’s fire stations were left unstaffed.

The study is funded under a federal Assistance to Firefighters (FIRE Act) grant from the U.S. Department of Homeland Security’s (DHS) Federal Emergency Management Agency (FEMA), as well as other grants.

The multi-year project, conducted jointly by the IAFF, the Commission on Fire Accreditation International (CFAI), the International Association of Fire Chiefs (IAFC), the National Institute of Standards and Technology (NIST) and Worcester Polytechnic Institute (WPI), will establish a comprehensive look at risk and how to keep risks to a minimum.

The next step for this research team is to develop a training package for fire fighters and public officials to provide both a quantitative and qualitative understanding of the research, a project also funded by the DHS FIRE Act grant program.

The IAFF is currently developing an online resource of information, materials and other tools for affiliates to use in their efforts to educate elected officials and other decision-makers about the critical need for adequate staffing.

For more information, visit <http://firereporting.org> or contact Lori Moore-Merrrell at (202) 824-1594. ■