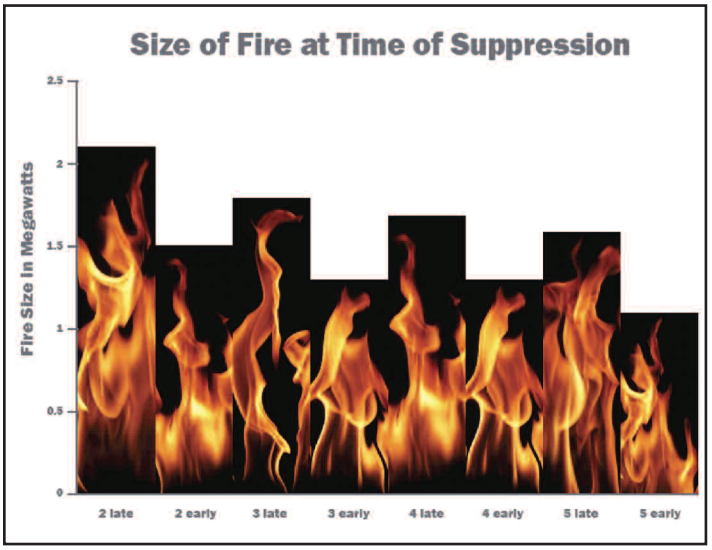
FIRE SIZE FACED BY DIFFERENT CREW SIZES AT TIME OF SUPPRESSION

Fire fighting is dangerous business. Even with the best pre-incident planning and safety protocols, firefighters are called upon to enter burning structures with less than ideal knowledge of the dangers they may face. While it is intuitively obvious that larger crews can begin fire suppression activities more quickly than smaller crews, and with less risk to and stress on firefighters, a major research project[1] has provided compelling data that illustrate the risks to both firefighters and trapped occupants as fire size increases before fire control can be achieved.

Fire risks grow exponentially. Each minute of delay is critical to the safety of occupants and firefighters and is directly related to property damage. Results show that five-person crews were able to apply water to the fire 22 percent faster than two person crews. Four-person crews were able to apply water to the fire 16 percent faster than two-person crews and 6 percent faster than three-person crews. What this means for firefighter safety is that two-person crews arriving later to the scene faced a fire about 2.1 megawatts in size. On the other end of the spectrum, five-person crews arriving earlier to the scene faced a fire about half as big at 1.1 megawatts. For context, a 1 megawatt fire would be a fully-involved upholstered chair burning at its peak. A 2 megawatt fire, however, would be sufficient to produce near-flashover conditions in the 12 by 16 foot room of fire origin used in our experiments. Facing a fire of twice the intensity greatly increases the danger to the firefighters and increases the likelihood that the fire will spread beyond the room of origin.

The following graph shows dramatically how a fire grows as it takes smaller crews longer to complete the tasks necessary for fire suppression and extinguishment (e.g., advancing a hoseline).



The graph also shows how later arriving crews of the same size face larger fires. Note how a late arriving two-person crew faces a fire almost twice as large as that faced by an early arriving five-person crew.

The information presented here is important for making informed staffing decisions. **The danger that rapidly growing fires present to emergency responders indeed to the public at large is a compelling reason to deploy adequate resources in a timely manner to any fireground.**

NIST Report on Residential Structure Fire

The study is the first to quantify fire service lifesaving and firefighting operations for a low-hazard residential structure including the effects of changes in crew size, arrival time, and stagger on rescue and suppression effectiveness.[i]

The study included more than 60 controlled fire experiments, both in our large fire laboratory and at the custom low-hazard residential burn building constructed at the Montgomery County Training Academy.

Overall, the results of the study show that that the number of fire service crew members in each company responding to a fire in a 2,000 square-foot, two-story structure had a substantial effect on the crew's ability to protect lives and property. The results also provide quantitative data to fire chiefs and public officials responsible for determining safe staffing levels, appropriate station locations, and necessary funding for community and firefighter safety.

Methods

A team of fire service experts designed a research methodology that led to over 60 experiments measuring time-to-task completion with crew sizes of two, three, four, and five firefighters, with different arrival times and different intervals between arrival of each apparatus. A burn building with sophisticated instrumentation was specially constructed for the project. Twenty-two key tasks were measured, beginning with the first engine stopped at the fire hydrant and ending with a fan operating at the front door for mechanical ventilation. Using firefighters acquainted with the tasks as timers and corroborating their data with video records, the researchers accurately timed each task as it was performed by the different crew sizes. Personnel from the Montgomery County (Maryland) and Fairfax County (Virginia) Fire and Rescue Departments performed the various tasks specified by the research methodology. The data from the time to task experiments were combined with results of fire modeling conducted at the National Institute of Standards and Technology to correlate task timing to fire growth rates.

NIST National Institute of Standards and Technology U.S. Department of Commerce

[1] Funded by a grant from the Department of Homeland Security/Federal Emergency Management Agency Grant Program Directorate for Assistance to Firefighters Grant Program, the project was conducted by a research partnership of the Commission on Fire Accreditation International, the International Association of Fire Chiefs, the International Association of Firefighters, the National Institute of Standards of Technology, and Worcester Polytechnic Institute. The complete report is available for download at http://www.nist.gov/cgi-bin/view_pub.cgi?pub_id=904607&division=866