



Improving Safety and Resource Deployment

In 2005, under the Department of Homeland Security (DHS)/Federal Emergency Management Agency (FEMA), the Assistance to Firefighters Grants (AFG) office began funding research and development studies designed to help reduce fire fighter deaths and injuries. This is the third in a series of articles that will review fire fighter health and safety issues, as well as the findings of some of these AFG-supported research and development activities.

Fire departments across the nation are challenged by the economic crisis, rising call volume, personnel and equipment shortages, security issues and the overall expectation to do more with less. These and other factors put IAFF members at increased risk for line-of-duty injury and death.

As part of the effort to improve fire fighter safety and resources, the IAFF is participating in a multi-phase study to design an acceptable resource deployment model based on contemporary community risks and type of service delivery. The study seeks to determine the technical basis for deployment vs. risk decisions and what factors help improve such decisions in light of available funding and the level of service the community expects. The study will

ultimately provide scientific evidence to guide local government decision-makers in making informed choices regarding fire fighter safety.

The multi-year project, a collaboration of five top fire research organizations, including 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 technical basis for risk evaluation and deployment of resources by local fire departments, create tools to better assess the risks and hazards in their communities, plan adequate resource deployment to respond to and mitigate emergency events and measure the effectiveness in

responding to and handling events.

“This is a study many fire industry leaders have dreamed of for several years,” says Chief Dennis Compton of the International Fire Service Training Association (IFSTA) who is also a technical advisor to the project. “Until now, it has simply not been possible, due to the complexity of the tasks proposed and the costs involved.”

Over the past 15 years, other studies have consistently supported the importance of adequate staffing per piece of apparatus in the efficacy and safety of fire fighters during emergency response and fire suppression.

Two studies in particular look closely at which distinct tasks could be performed safely and effectively by three- and four-person fire companies. Following a series of common fire ground simulations, investigators from the Austin Fire Department assessed the physiological effects and injury rates among the variably staffed fire crews.

In these simulations, an increase from a three- to four-person crew resulted in marked improvements in time-to-task completion in a two-story residential fire drill, aerial ladder evolution and high-rise fire drill. Researchers concluded that — independent of fire fighter experience, preparation or training — loss of life and property increases when an insufficient number of personnel are conducting the required tasks. Injury reports from the Austin Fire Department further revealed that the injury rate for three-person companies in the four years preceding the study was nearly 1.5 times more than for

crews staffed with four or more fire fighters.

In a sequence of similar tests, the Office of the Fire Marshal of Ontario also found that three-person fire companies were unable to safely perform deployment of back-up protection lines, interior suppression or rescue operations, ventilation operations that required access to the roof of the involved structure, use of large hand-held hose lines or a water supply from a static source without additional assistance and within the time limits of the study.

In addition, the Ontario study noted that three-person crews were also at increased risk for exhaustion due to insufficient relief at fire scenes, and made recommendations for minimum staffing levels per apparatus for suppression and rescue-related tasks.

These studies demonstrate that crew size clearly affects the comprehensive dynamics of a fire crew's response capacity, ability to perform fire operations and fire fighter injury rates.

However, there is an ongoing need to update and further quantify the required tasks, event sequences and necessary response times for effective fire suppression in order to determine with accuracy the full effects of either a reduction or increase in fire company staffing.

Over the past three decades, fire department response has expanded to include emergency medical services, terrorism attacks, hazardous materials incidents and mitigation, natural disasters, specialized rescue and other community incidents. This expansion of responsibility has not always been matched with an optimal deployment of resources.

A report for the NIST stressed the continuing need to address the relationship between crew size and personnel injury rates, stating that "a scientific study on the relationship between the number of fire fighters per engine and the incidence of injuries would resolve a long-standing question concerning staffing and safety."

In much the same way that earlier environmental assessments of a community's fire risk emphasized that demographics and building characteristics can radically alter the types of emergency situations fire fighters face, an increasing body of literature has shown that deployment will impact the overall quality and effectiveness of emergency service delivery.

Factors such as fire fighter training, health, wellness and fitness, pre-incident planning and mutual aid agreements also play key roles with respect to a fire crew's ability to perform fire suppression activities and in terms of fire fighter safety and larger occupational health risks. ■



Study In Progress

The intent of the fire fighter safety and resource deployment study is to determine how well fire service decision-makers match resources to risk, and identify what factors are important in establishing these matches in the future — recognizing that decisions are made based on available funding in the community and the level of service the community expects.

The overall goal is to reduce fire fighter and civilian injury and death and increase property conservation by improving resource deployment in a risk-filled environment. The study includes three phases:

- Phase I - Develop a scientifically-based community risk assessment and resource deployment model.
- Phase II - Conduct field experiments to assess resource deployment, including crew size and time-to-task analysis.
- Phase III - Develop performance evaluation tools for fire departments to assess how well they match their community risk level to resources deployed.

Based on analysis of data collected in Phase I (currently underway), investigators will look at fire fighter injury and death, civilian injury and death and economic impact and identify the most important factors in determining

appropriate deployment to varied levels of adverse risk events occurring in a community.

These data will be used to develop software that can determine appropriate deployment-to-risk events in a community in order to limit fire fighter injury and death, civilian injury and death and economic impact.

More than 400 U.S. fire departments are participating in the study by entering incident data into a web-based survey. Data analysis from the online survey will be coupled with data from the field experiments in Phase II (now complete), which were conducted for both fire and EMS events (see www.firereporting.org).

The Montgomery County, Maryland, and Fairfax County, Virginia fire departments participated in the field experiments conducted at the Montgomery County Fire Rescue Services Training Academy. Relevant NFPA standards, including NFPA 1403 and NFPA 1500, were followed during the experiments. The resulting data are now being analyzed and will be used to develop educational products and materials for dissemination to local government decision-makers. The overall study results, report and the education products are anticipated for release in the fall of 2009.

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