Resource centre

Improving firefighter safety is a key aim of a landmark US study exploring the effect of crew sizes and equipment arrival times on fire growth rates. **Lori Moore-Merrell** reports

MANY FIRE departments across the USA are being challenged by budget pressures, rising volumes of emergency calls, personnel and equipment shortages, security issues, and the overall expectation 'to do more with less'. All too often, these and other factors are resulting in responding fire crews facing increasing risk of injury and death.

Even with the technological advances of the last decades, the fire and rescue community in America has not yet been able to scientifically quantify its experiences to determine what staffing levels, asset configurations and response timeframes are most appropriate when responding to various levels of fire or emergency medical service (EMS) events, in order to minimise risk to firefighters, paramedics and the public. We believe the time has come to change that.

Supported by major grants from the US Department of Homeland Security's Assistance to Firefighters Grant Program, five top fire research organisations are engaged in an ongoing collaborative project to develop tools that will help local fire departments better assess the risks in their local communities and plan to respond to them more effectively and efficiently.

Whereas current decisions on fire service resources for incidents are determined by trial and error, or have a qualitative basis, the new study – which will explore the effect that firefighting crew sizes and equipment arrival times have on fire growth rates – will provide objective data to enable more informed decisions to be made that better match resources with risks.

This multi-year project – being conducted by the Commission on Fire Accreditation International, the International Association of Fire Chiefs, the International Association of Fire Fighters, the National Institute of Standards and Technology, and Worcester Polytechnic Institute – will establish a technical basis for risk evaluation and deployment of resources by local fire departments. It will also create tools that fire departments can use to better assess the risks and hazards in their communities; plan adequate resource deployment to respond to and mitigate emergency events; and measure their effectiveness in responding to and handling events.

'This is a study many fire industry leaders have dreamed of for several years,' said chief Dennis Compton of the International Fire Service Training Association, 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.'

Study details

Over the past 15 years, fire service research studies have become more advanced, in terms of the sophistication of their methods, but nonetheless have continued to support the general finding that crew size per piece of apparatus clearly affects the effectiveness and safety of fire department personnel during emergency response and fire suppression activities.

In an effort to supplement the scientific evidence available, the intent of this joint study is to determine how well fire service decision-makers match resources to risk, and what

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Experiments were conducted to show the effect that different crew sizes and arrival times have on time-to-task and operational effectiveness

factors are important in making better decisions about these matches in the future – recognising that decisions must be made in light of available funding in the community and the level of service the community expects.

The overall goal of the project is to reduce firefighter injury and death by making better decisions about resource deployment in a risk-filled environment. There are three key phases:

- **phase 1:** develop a scientifically-based community risk assessment and resource deployment model
- **phase 2:** conduct field experiments to assess resource deployment, including crew size and time-to-task analysis
- **phase 3:** develop performance evaluation tools to be used by fire departments to assess how well they match their community risk level to resources deployed

Based on analysis of data collected in phase 1, investigators will address three outcomes: firefighter injury and death; civilian injury and death; and economic impact. They will work to identify the most important factors in determining appropriate deployment to varied levels of adverse risk events occurring in a community.

It is hoped that the resulting data can be used to program a predictive computer model, which can then be converted into software, enabling operations chiefs to conduct 'what if' analyses to determine appropriate deployment to risk events in their community, in an effort to limit adverse outcomes (firefighter injury and death, civilian injury and death, and economic impact).

This data analysis will be coupled with the data from the field experiments in phase 2, conducted for both fire and EMS events:

- for EMS, arrival of basic and advanced life support resources were assessed in various timeframes for cardiac and systemic trauma events
- for fire events, two-, three-, four- and five-person crew sizes were assessed in relation to a 'first due' appliance and a 'full alarm' assignment, responding to a fire in a 2,000ft^2 single-family, two-storey, detached dwelling (*see below*). The low-hazard residential structure is the baseline event for the study. Once investigators have baseline data, they may assess greater risk environments in the future

Field experiments

Though phase 1 continues, as more than 400 US fire departments enter incident data into an internet-based survey, the field experiments are now complete.

These experiments were conducted to show the effect that different crew sizes and arrival times have on time-to-task and operational effectiveness. In addition to the partners on the project, firefighters from both Montgomery County in Maryland, and Fairfax County in Virginia were involved.

Real fire tests were carried out at a specially built 'burn house' at the Montgomery County Fire Department Training Academy in February. The mock-up two-storey house was fitted with state-of-the-art devices to monitor the interior temperatures and toxic gas build-up. Researchers also monitored 22 different tasks performed by participating fire crews at the scene. The experiments were conducted using relevant National Fire Protection Association standards.

The resultant data are now being analysed, and the results will be used to develop educational products/materials for dissemination to local government decision-makers. These products are anticipated for release in autumn 2009.

This research study will ultimately provide scientific evidence to guide decision-makers toward informed choices with regard to firefighter safety in the light of available resources. The results will give policy-makers the information they need to make decisions about the fire department mobile and personnel resources that are deployed and to assess the risks associated with their decisions ■

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More information on the project is available by contacting e-mail: lmoore@iaff.org or at website: www.firereporting.org