



Study of the Impact of Fire Attack Utilizing Interior and Exterior Streams on Firefighter Safety and Occupant Survival

Part I: Air Entrainment and Water Distribution

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Abstract

As research continues into how fire department interventions affect fire dynamics in the modern fire environment; questions continue to arise on the impact and implications of interior versus exterior fire attack on both firefighter safety and occupant survivability. Previous research into various types of fire ground ventilation, flow paths, and exterior fire streams has provided the fire service with a more in-depth understanding of fire dynamics in addition to raising questions about certain fire attack methods stemming from differing traditions and myths. This knowledge gap and lack of previous research into the impact of fire streams has driven the need for further research into fire department interventions at structure fires with a focus on hose streams and suppression tactics. Statistics show that both firefighters and building occupants continue to lose their lives due to fire. As such, research into the various methods of fire attack will allow a broader understanding of how firefighter interventions on the fire ground can impact the outcome of both life safety and property protection.

This study will build and expand upon the fire research conducted to date by analyzing how firefighting tactics, specifically suppression methods, affect the thermal exposure and survivability of both firefighters and building occupants in addition to impacting fire behavior in structures. The project will be comprised of 3 parts:

- Part I: Air Entrainment and Water Distribution.
- Part II: Full-scale Residential Fire Experiments.
- Part III: Acquired Structure Fire Testing.

This report details the experimental data from the air entrainment and water distribution experiments. Results from the first two experiment series were analyzed and reviewed with assistance from our technical panel. These results were summarized into tactical considerations and can be seen below:

Air Entrainment -

- Air entrainment in nozzles is dependent on nozzle type (smooth bore, straight stream, fog) and not nozzle manufacturer.
- Air entrainment in nozzles is dependent on structure geometry and configurations.
- Nozzle application patterns have little effect on overall air entrainment.
- Air entrainment, either into or out of the structure, is dependent on the distance of the nozzle to the ventilation opening.

Water Distribution -

- Water distribution is dependent on nozzle type (smooth bore, straight stream, fog).
- Water distribution is dependent on stream direction within a compartment (max angle, mid ceiling, min angle).
- Varying nozzle pressure and flow can affect the amount of water applied to a given area while the distribution remains somewhat constant.
- Applying water from the exterior or from a distance via the interior will adequately coat the surfaces of a compartment (walls and ceiling) while applying little water to the center of the room.