

# CREW SIZE

Overall, the results of the NIST High-Rise study show that the number of fire service crew members in each company responding to a fire in a 30,000 square foot, thirteen-story structure had a dramatic effect on the crew's ability to protect lives and property. This conclusion can be summarized in three principal parts.

First, when responding to a medium growth rate fire on the 10th floor, 3-person crews ascending to the fire floor confronted an environment where the fire had released 60% more heat energy than the fire encountered by the 6-person crews. Unfortunately, larger fires expose firefighters to greater risks and are more challenging to suppress.

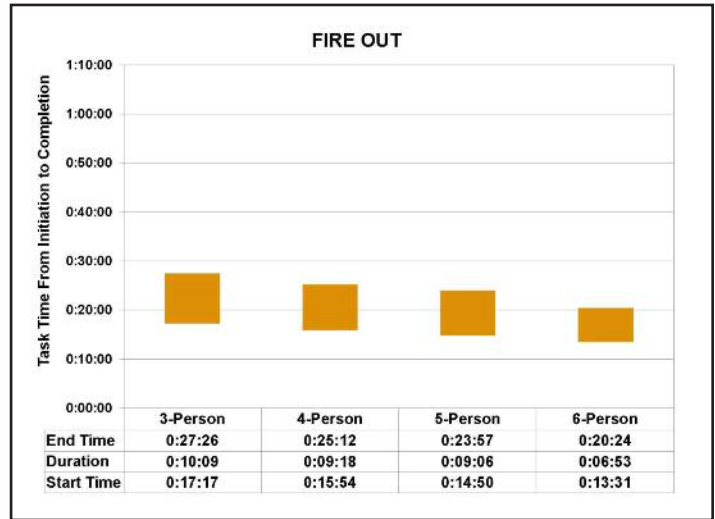
Second, larger fires produce more risk exposure for building occupants. In general, occupants being rescued by smaller crew sizes and by crews that used the stairs rather than the elevators were exposed to significantly greater dose of toxins from the fire. While the exact risk exposure for an occupant will depend on the fire growth rate, their proximity to the fire, and the floor on which the fire is located, it is clear that on-scene deployment decisions can have a dramatic impact in determining the fate of building occupants.

Third, the study confirmed that a properly engineered and operational fire sprinkler system drastically reduces the risk exposure for both the building occupants and the firefighters.

While information has been well understood for many years and most new high-rise buildings are constructed with fire sprinkler protection, NFPA estimates that 41 percent of U.S. high-rise office buildings, 45 percent of high-rise hotels and 54 percent of high-rise apartment buildings are not equipped with sprinklers. Moreover, sprinkler systems fail in about one in 14 fires. Thus, fire departments should be prepared to manage the risks associated with unsprinklered high-rise building fires.

## TIME

Going from 3-person to 4-person crews had a large impact on advancing the attack line, advancing the second line, and begin times for search and rescue. Reductions in times to begin these tasks were in the range of 1 min to 2 min. Going from 4-person to 5-person crews reduced the times to begin all critical tasks by 1 min to 2 min. Increasing crew size from 5-person to 6-person crews showed significant reductions in begin time, just over 1 min, to advance the attack and second lines and for search and rescue on the fire floor (10th floor).



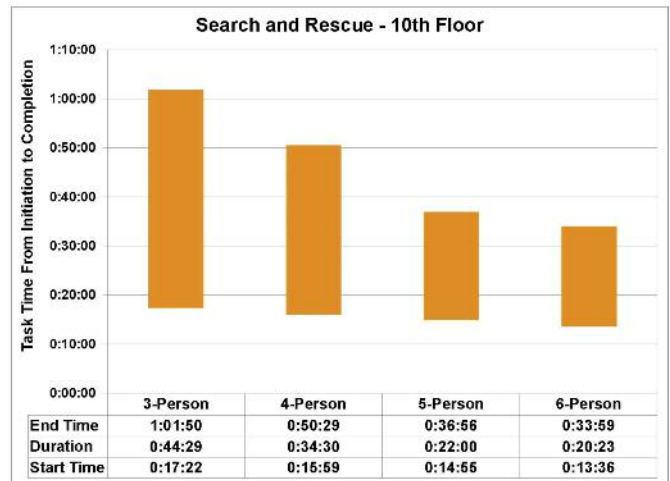
When assessing task end times and incrementally increasing crew size by a single firefighter (i.e., 3 to 4, 4 to 5, and 5 to 6), the time improvements are seen when going from crew size 3 to 4. As firefighter crews navigate the later tasks, the gains reach the 10 min to 15 min range. Very large time improvements are seen for the 10th Floor Search and Victim #1 Rescue tasks (over 11 min) when incrementing crew size from 4 to 5. The improvements in the times to complete all tasks are substantial (9 min to 12 min) when incrementing crew size from 3 to 4 or from 4 to 5.

## FIRE OUT

Getting the fire out is critical to reducing risk to both firefighters entering the structure and to trapped occupants. Fire Out, in the study, was defined as having both the attack line and the second hose line in place. There was a 2 min 14 s difference (8.1 %) in the Fire Out time between the 3- and 4-person crews. There was an additional 1 min 15 s difference (5.0 %) in the Fire Out time between the 4- and 5-person crews. (i.e., 5-person crews extinguished the fire 3 min 29 s faster than 3-person crews). Finally, There was a 7 min 2s difference (25.6 %) in the Fire Out time between the 3- and 6-person crews.

## SEARCH AND RESCUE 10TH FLOOR

The fire floor was an open floor plan and contained 96 cubicles. In the high hazard high-rise commercial building, the 4-person crew started the search 1 min 23 s (7.8 %) faster and completed the search and rescue 11 min 21 s (18.4 %) faster than the 3-person crews. In the same structure, the 5-person crews started the search 1 min 4 s (6.7 %) faster than the 4-person crews and 2 min 27 s (14.1%) faster than the 3-person crew. Additionally, 5-person crews completed the search faster than the 4- and 3-person crews by 13 min 34 s (29 %) and 24 min 55 s (42 %) respectively. Six-person crews had the best performance, starting the search 1 min 19 s faster and completing the search 2 min 57 s (8.0%) faster than 5-person crews. The greatest difference in search times was between 6- and 3-person crews. Six-person crews started the search on the fire floor 3 min 46 s (22 %)faster and completed the search 27 min 51 s (47 %) faster than the 3-person crews.



## VICTIM #1 RESCUED

There was a single victim located on the fire floor that was found and rescued by all crews. A 5-person crew located the victim on the fire floor 25 min 19 s (50.6 %) faster than a 3-person crew and 12 min 7 s (32.9 %) faster than a 4-person crew. Likewise, a 6-person crew located the victim on the fire floor 28 min 33 s (57.1 %) faster than the 3-person crew, 15 min 21 s (41.7 %) faster than the 4-person crew, and 3 min 14 s (13.2 %) faster than a 5-person crew.

