

Modern House Fires Warrant Tactical Agility

10/30/2015

BY JERRY KNAPP

The dispatch we were hearing while en route was one of those radio messages that sends chills up your spine: "PD reports kids trapped by fire." As we rounded the corner, fire was blowing out of several windows, and smoke was pushing hard and black. In the back of the rig, the firehouse banter stopped, faces got their game day looks, and we got ready. The engine stopped for what seemed to be a split second at the hydrant, dropped a line, and proceeded to the scene. As we got off the engine, the state trooper was obviously shocked as he reported that he "saw the girl at the second-floor window"-the one that now had fire belching from it. Fire had complete control of the house-every room, every floor, every door and window.

In 1975, we did not know it, but we made a great transitional attack, quickly knocking down the fire from the outside with a 2½-inch line, shutting it down, then pushing interior attack lines in with a search crew right behind. In a few minutes, the fire was knocked down. A member of the attack team looked out of the second-floor window and shouted to the captain outside, "Cap...I got three."



(1) Rapid interior and exterior fire spread will force us to change house fire tactics. This fire went from a mulch fire to fully involved in less than five minutes. (Photos by author.)

Three children died in that house fire. It was one of my first nonroutine house fires. After the overhaul and the lines and ladders were picked up, we took the bodies out. The last was the most difficult. The five-year-old was passed down by the firefighter on the ladder at the second floor to me. At the bottom of the ladder, I took him in my arms to carry him to the medical examiner's truck. He seemed to be trying to get out of that black body bag; his arms were outstretched, straining the fabric outward. I carried him as you would your own sick or tired child, only his arms could not wrap around my neck. What was left of them were stiff and outstretched pushing against the bag and its zipper. The warm sun was coming over the horizon. At the medical examiner's truck, I panicked. There was no place to put him. His older brother and sister were already there on the floor in the back, tightly zipped up. There was no place for him. I stacked him on his brother and sister like a piece of cord wood. Forty years later, I still see that scene and still feel guilty about it. House fires are the most important type of alarm for the American fire service.

The wise old expression, "If we don't learn from history, we are bound to repeat it," is painfully true in our profession. The purpose of this article is to help you increase your department's tactical agility at modern house fires by looking back at your house fire history and experiences and by looking forward to where our strategy and tactics may be or should be going. Tactical agility is the result of your ability to adjust experienced-based legacy fireground tactics to the new threats (to firefighters) presented by modern house fires. A review of current practices-your fireground history-may increase firefighter safety and efficiency on the fireground for years to come.

Typical Week in the Life of the U.S. Fire Service

We used to call them single-family dwellings or private-dwelling fires and not worry too much about them. They were the routine bread-and-butter fires. A typical fire was a couple of rooms, take the windows, a line to the seat of the fire and one above, quick knockdown, some fairly easy overhaul, and we were done. However, house fires have changed. Now, we have a very, very dangerous type of fire. How deadly? The U.S. Fire Administration reports weekly on civilian residential fire fatalities. For the week of December 14-20, 2014, there were 60 deaths from fire in the United States in residential occupancies; 75 percent of them were in private dwellings.¹ Was this a particularly bad week? No. In fact, it is the historical average loss of civilian life: a residential fire death about every three hours, 24 hours a day, seven days a week. We don't hear about most of them because Americans die in small groups, one or two at a time. This particular week, there were four multifatality deaths in the 52 fatal fires. The multifatality fires made national news; the others did not.

Who is most likely to die? According to the National Fire Protection Association (NFPA), on average, there is a home fire-related civilian injury every 40 minutes. These injuries are caused by the 43 home fires every hour in the United States, or one every 83 seconds. Thirteen of the victims were over the age of 65; nine children were under the age of 14. On average, there is a home fire-related civilian injury every 40 minutes. (1)

House fires in the United States also account for half the dollar loss of fires. According to the NFPA, house fires cost the United States \$200 a second, for a total direct property loss of \$8 billion each year.² The human cost in civilian and firefighter lives, injuries, and life-changing events is much more important than the statistical numbers indicate.

During that same week in December, according to fireengineering.com, Inwood, New York, Assistant Chief Joseph Sanford was killed in the line of duty while operating at a house fire as part of a mutual-aid company. He fell through the first floor into the basement when he entered the building at around 0400 hours.³ Clearly, house fires are a serious threat to firefighters. We must continually examine our department's procedures for house fires and consider updating our policies and procedures to increase tactical agility at house fires.



(2) This modern house had extensive and rapid fire envelopment outside because of the combustibile siding, insulation, and sheathing. Note the collapse of the truss roof, which occurred early in the fire.

Tactical Agility

Tactical agility in its simplest form means making sure our fireground actions-size-up, search, rescue, ventilation, fire suppression, and salvage/overhaul-can safely, efficiently, and effectively defeat the new threats at house fires. In a more personal sense, tactical and strategic fireground success really means fewer dead and injured firefighters. It also means fewer permanent empty seats at family dinner tables and more intact firefighter-families at their kid's sporting event. Embracing tactical agility is a matter of life and death, ours. Tactical agility keeps us current with emerging threats found in modern house fires. Albert Einstein said it best, "I must be willing to give up what I am in order to become what I will be."

Change Is Difficult

At the individual fire department, fire officer, or firefighter level, it takes courage to even consider looking back at what we did and how we may need to changes our tactics. But we must recall that we did the best we could at the time based on our training, experience, and level of personal protection. We all did great work, but that does not mean there is no room for improvement and change. Conversely, it is easy for the lazy firefighter who stubbornly sticks to the simple, one-size-fits-all, nonthinking strategy to blindly take chances at every fire, push in for search, or push the line in aggressively, ignoring the dangers and boasting about "this is how we do it." As a strategy, this is fundamentally wrong.

Change comes hard to most organizations, especially the fire service. Why change? What we do every day we know works. We know the strengths and weaknesses of the equipment and our procedures and plans. In fact, we make it happen during search and rescue, fire

attack, ventilation, extrications, and medical calls, and we experience it every day on every call. Current strategy must be working; we are putting out the fires! However, as we move through life we depend on our experience more and more; that experience is from yesterday, last month, last year, or even the last generation. Experience is invaluable: Our world is modified a bit each day today, and our house fire battlefield is changed permanently for tomorrow. Your next deadly house fire will be tomorrow.



(3) Despite severe radiant heat, the aluminum-sided home on the right sustained very little damage; fire never extended to this home.

In house fire terms, the modern house, our battlefield, has radically changed. It is built completely differently from houses even in recent fire experience (modular construction). It is built faster (truss framing), is more lightweight, and costs less. There is much less structural resistance to a fire load (I-joists, laminated lumber). In the past, houses rarely collapsed; the floors and frames were of dimensional lumber. The 20-minute rule was in full force-you had 20 minutes before structural integrity was compromised. This was drummed into our heads by bosses who demanded that we aggressively get inside and slug it out in close-quarter combat with the fire. We now know the modern house can collapse in about four minutes from the time the fire started, not the time we arrived on the scene.

To add further danger for us, the modern house contents are mostly petroleum-based materials (plastics/synthetics) that produce high volumes of dense smoke and intense heat and release them more quickly than ever before. The outside of the house is now a danger. It is clad in very combustible vinyl siding that is directly on top of very combustible polystyrene insulation that is attached to highly combustible chip board or oriented strand board (OSB). This fast moving outside fire attacks the vinyl window frames that fail quickly; like an octopus, the fire enters the home as a summer breeze through several windows.

This was the situation that killed Firefighter Kyle Wilson, a 21-year-old from Prince William County, Virginia.⁴ Called "exterior fire envelopment," this fast-moving exterior fire can kill us as quickly as the inside contents fire that goes to flashover if we do not change our tactics. This firefighter death was in 2007. What has your department learned from this tragic loss of life? What have you done to learn from it? None of this is new. This information is supported by both fireground experience and research. When will we consider a change?

In the case of the exterior fire, the fundamental strategic change is that we must extinguish the exterior fire before we allow search and rescue crews to enter the house. This dramatic change was first noted by Steve Kerber, director of the UL Safety Research Institute, at FDIC 2012. The interior hoselines, as hard as firefighters may try, will not get water on the fast-moving outside fire. Additional tactical agility is needed also because the exterior fire is gobbling up the exterior combustibles and penetrating the thin plastic soffit coverings. In photo 3, the fire entered the attic and directly attacked the roof rafters or trusses supporting the roof, causing a rapid collapse of the roof. The exterior fire was below the vertically attached, and soon to be burning, materials. Thus, it had the extreme advantage of preheating the materials before ignition, resulting in very rapid and dangerous fire spread.

Regardless of these facts, the fire service religiously and with the best intentions passes on yesterday's experience from one generation to another. The result is that we sometimes use the previous generation's experience on modern fires. At your next "live burn" at your concrete burn building, consider making trainees extinguish the simulated exterior fire before you let them enter for interior operations. Our strategy and tactics training must be agile enough to adjust to reflect changing fireground conditions. We must be tactically agile to increase our safety.

Look Back at Fire Attack

During my recruit training, a very seasoned firefighter showed me, with great enthusiasm, how to quickly make an interior attack at a house fire. "Look, kid, put it on 30° fog, get inside, whip the nozzle around, and the fire will go out. You can breathe off the nozzle if you put your face close enough; the oxygen comes off the water." Well that sounded good and worked for a few years, especially on one-room fires.



(4) This fog stream is being directed into a room that is vented with a three-foot × seven-foot oversize door. It is moving approximately 5,000 cubic feet of air per minute into the room, overpressurizing the room. The steam is being driven onto the attack crew.

Fireground experience was showing us that the fog technique did not work well for multiple-room fires, where we had to fight our way in through a fully involved room, move through it, and extinguish the other rooms or protect the means of egress for occupants or other firefighters. We learned that the fog nozzles made Fireman Soup of the environment, and we were the main painful ingredient. Use of the two self-contained breathing apparatus (SCBA) on the engine was strictly optional. For those of us who wore them, Fireman Soup was a very painful reality. As early as 1980, the National Institute of Standards and Technology had measured 2,000°F temperatures at typical living room fires in its live burn testing.⁵ The creation of Fireman Soup was the result of massive amounts of entrained air in the fog effectively acting as a positive pressure fan, stirring up and driving hot steam down onto the members inside. Since we get a second-degree burn at a mere 124°F, the fire has a real advantage on us. Maybe it was time to look into that other pearl of wisdom, breathing off the fog nozzle. I'm no chemist, but if the oxygen comes off the water molecule, that leaves hydrogen, which is pretty explosive. Something just did not seem right.

Looking back at an apartment fire that I often joke about now, it all really makes sense. We were particularly short staffed that night, and as we pulled into the apartment complex, fire was pushing out of a window of one apartment. I stretched the line to the public hall. The assistant chief led me to the fire apartment door and told me the fire was "just in to the left." The door was already open, and I moved in and angled to the left, not knowing that I was passing the fire room that was immediately on the left. As I was trained, I turned the nozzle to 30° fog and moved it in clockwise circles, but it did not seem to knock down the fire or the heat. I shut down and tried to figure out what was going on. I opened up again, moving the

nozzle. Now it was getting hotter; really hot air swept past me from behind, burning my ears. Hoods were not in style yet; the ear flaps on my helmet helped some. I persisted and tried again. Finally, after a few tries, I backed out and told the chief at the door I could not get it. He said that was okay because the guy from the other engine got it with a booster line from the outside-yes, a booster line and, yes, from the outside.

As the current research attempts to prove, that booster line did not push fire onto me and it did put the fire out. The straight stream on the booster line got to the seat of the fire, killing the fire, while my fog stream inside simply moved massive amounts of air in through the open window of the fire room and sucked the superheated fire gases toward me. Lucky for me, there was not a vent in front of the hoseline (short staffing) because my fog stream likely would have caused what we now know to be a flow path from the fire room onto the unsuspecting and inexperienced young firefighter with the nozzle and would have caused more than ruby red ears.

We should have recognized it then, but the tactical agility necessary here was to move away from the fog nozzle toward the solid or, at least, straight stream position. We summarize that now with the statement, "Right to fight." This, of course, is referring to turning the barrel of the combination tip to the right for a straight stream. What if we were not agile enough to make these changes?

Look Ahead

As we all know, the solid stream-fog stream battle raged for decades in the American fire service. Leaders like the late Andy Fredericks, Jay Comella, Rick Fritz, Jeff Shupe, and others preached at FDIC on the value of a solid stream for efficient and safe fire attack. But why was this simple tactical change so difficult? There was no hard evidence. Each side argued from emotional perspectives based on their own, now sanitized, versions of fireground experience. Using some firehouse ingenuity, I assembled a team [Captain Christopher Flatley, Fire Department of New York, and Chief Tom Pillsworth, Winona Lake (NY) Engine Company]⁶ and measured the air flow caused by fog, straight, and solid fire streams to predict their effect on the residential fire suppression effort. *Fire Engineering* published the results in 2003-2004 (6), and we taught and demonstrated these critical tactical options at FDIC engine company stations for several years. After working through our hands-on training engine company station, firefighters from across the country were in position and had the knowledge and ability to demonstrate this in their home departments. With this information, they could consider changes to their current fire suppression tactics.

It is important to understand the history of the fog methods of fire attack. It came from Lloyd Layman, who developed it for shipboard firefighting during World War II and published two books on his experiments.⁷ It apparently was very effective (I have never been to a ship fire) in holds of ships where firefighters could "inject" water fog, close the hatch, and the water

turned to steam and smothered the fire in the compartment or hold of the ship. In his books, he seemed to have success with it at building fires where specific conditions were present. But on several pages in his books, he warned that using fog inside could be very dangerous. He notes: "An indirect attack should always be made from positions that will enable personnel to avoid injuries from superheated smoke and live steam." Regardless, the American fire service used this method for some time in many areas of our country. In its defense, during this time, SCBA did not exist, and the thermal protective performance (TPP) value of turnout gear did not exist either. A rubber coat and a flannel backing were the extent of it.

Whether you were using fog or straight stream, we were (and maybe still are) paying too little attention to reading the actual condition or stage of the fire and less attention to the danger of flashover from the ignition of combustible gases. With the hydrocarbon-based fuel load in modern homes, this seems to be more important than ever. Now, we aggressively push in with our 1½ smooth bore flowing 180 gallons per minute and attempt to take over and blindly bully the fire. This usually works, but experience is showing that some house fires are so fast moving that firefighters are being killed even with a hoseline, as in the now infamous 1999 Cherry Road house fire⁸ that killed District of Columbia Firefighter Anthony Phillips and Firefighter Louis Matthews.

Our European counterparts use much less water during interior fire attack, but they pay particular attention to the fire condition. Station Officer John Chubb, Dublin (Ireland) Fire Brigade, is an international member of the technical panel for the latest UL study, "Impact of Fire Attack Utilizing Interior and Exterior Streams on Firefighter Survival and Occupant Survival." He provides some interesting thoughts on reading the fire conditions and the judicious application of water during an interior attack at house fires. It is critical to recall that the fire loading in European homes may be different from that in the United States. I am not suggesting that we immediately throw out our 1¾-inch handlines and replace them with high-pressure hoses.

Chubb continues, "But here is the thing: in my world, we would never utilize a fog nozzle in a manner remotely like that. We will pulse a fog spray pattern into smoke on our approach route to the fire. The pulsing action, used correctly, maintains thermal balance, cools the environment extremely efficiently, and improves visibility. When we locate a burning gas layer, we will sweep the burning gases with a disciplined control over the amount of water until the gas phase ignition is suppressed. On finding the fuel phase (the seat of the fire), we revert to straight stream and extinguish. I feel that to achieve true tactical agility, we all have to consider the best tool and technique to deal with the presenting conditions. In that vein, we, too, have smooth bore nozzles, and we use them where appropriate." You may disagree with the European method, but the point is that in the United States we may want to consider

training our members to better understand the fire dynamics of a modern house fire and monitor interior conditions a little more closely than we do now.

No Room for Error

My department experienced a number of major commercial and industrial fires. One very interesting fire was at a factory that made aerosol spray paint. It was fully involved on arrival; plastic caps and exploded aerosol paint cans rained down on us for the first 30 minutes of the fire. Thousands of caps floated down the street in runoff water like little boats. Still, these fires, although spectacular, were nothing compared to the injuries, deaths, dollar loss, drama, and emotional stress caused by house fires. For 10 years after the fatal house fires previously mentioned, all our members would start asking, "Is everyone out?" immediately after dispatch. You could see members sniffing for the hideous smell of burning human bodies as they got off rigs at house fires.

Following another multifatality fire in my first-due area, this time taking the lives of five civilians and almost killing a firefighter (who fell through the floor while pushing the first line in and was rescued by other members; Firefighter Assist and Search Teams were not part of the game yet), I developed the "Rescue and Firefighting Operations at House Fires" training program while working at the Rockland County Fire Training Center in Pomona, New York. At this point, I was in the fire service about 12 years, and based on that limited experience, it was clear this is a very deadly game. There is no room for error because the stakes are very high for everyone involved.

Search and Rescue

The training program was broken down into rescue and firefighting phases. Rescue, saving of human life, was our first priority. Getting in before the hoseline was the preferred tactical search method. We reasoned that getting in before the line provided better visibility and the best chance for finding a victim and making the rescue (removal). Around the mid-1980s, we were taught-and passed on to those we were training with the best of intentions-to vent for life as you searched. The tactics of the day were as follows: More often than not, we would roll up to a house fire, force the front door, and get inside as quickly as we could for search, paying only minor attention to the developing fire conditions. We now know, thanks to Kerber, Dan Madrzykowski, et al., that these tactics provided air to the fire, increasing its rate and intensity during the time we moved deeper into the house. When you came to a window and the smoke conditions were bad, taking the window would allow the smoke to lift enough to improve your search. Unknowingly, we gave the fire enough air to drive it to flashover. By forcing the front door and then venting for life, we gave the rapidly intensifying fire a route to send the excess heat and spread the fire through the building, which Phoenix (AZ) Fire Department Chief (Ret.) Alan Brunacini so brilliantly called "fire socialism"-equal fire for all parts of the building.

The years and the fires rolled on, as they do for every fire service career. My engine company had stretched a hoseline toward a fire on the third floor of a very large Queen Anne-style home one evening. This fire would again produce the excitement we all live for. My partner and I advanced a dry line up the stairs to the second floor. While waiting for water on the landing, in the words of the day, "Man, that place lit up like a blowtorch over our heads!" The radiant heat drove us out (what were we doing in there without water, anyway?). The third floor flashed over; like most firefighters of the day, we did not understand the real life cycle of a residential fire.

Searching the modern house fire has become more hazardous at fires in homes that have been illegally divided into single-room occupancies or illegal apartments: gopher houses. As flashover conditions develop from a fire below, the search team members may find themselves trapped on an upper floor in a hallway among locked doors. Quickly ducking into a bedroom as an area of refuge when things get bad is not an option as it would be in a normal home. Sure, you can force them, but when you are getting burned and panicky and are in zero visibility, it may take you more time than you think and more time than the quickly growing fire is giving you. Gopher homes can be found in many areas of our nation including college towns, farm communities where migrant workers come in seasonally, and many immigrant communities where real estate markets are high. (See "The Dangers of Illegally Converted Dwellings," *Fire Engineering*, June 2011.)

Tactical changes to consider are raising awareness of this hazard among your members, recognizing the hazards during size-up, using vent-enter-isolate-search (VEIS) as more of a primary search method, special calling additional truck companies to counter the increased forcible entry issues of many locked doors, and always recalling the importance of getting water on the fire. To find gopher houses, drive around your first-due area at night. Look at attic and basement windows for the glow of televisions. Often, these homes are not obvious, but it is difficult to hide the amount of trash and the numbers of occupants' dish antennas and vehicles.

Progress?

In the early 1990s, our training center had been in operation about 15 years with the classic concrete, Class A live burn building, drill tower, flammable liquid pits, extinguisher props, and so on. Despite raging fires in the Class A burn building and long before NFPA 1403, *Standard on Live Fire Training Evolution*, 2012 ed. (not enough firefighters' blood had been spilled yet to write this standard), none of these fires ever went to flashover. Well-intentioned, we were not teaching the real life cycle of fire to new and old firefighters. Trainees could search as long as they needed to and push hoselines past the raging fire and upstairs to the fires we set up there-for reality, of course. The focus of the training was on those critical skills for which the course was named: search and rescue and fire attack. By

now, our turnout gear had thermal liners, TTP was a key term, and everyone had SCBA. "Get inside" was the mantra of the day.

The new, energetic, and visionary Rockland County Fire Coordinator Gordon Wren gathered the training staff to present his new training idea. He described how trainers and trainees would line this steel box with plywood, light a crib fire, close the doors lightly, and sit inside this large-scale wood stove until the fire blew over their heads. The meeting became very interesting, as you might expect. The training officers always suspected he was crazy; this proved it!

We now know this as a flashover training unit, and it is in use across the country and the world to show firefighters the real life cycle of fire and the flashover warning signs and how to react to them. What we learned was that firefighters did not understand the real life cycle of fire-not new firefighters, not experienced firefighters, not any firefighters. The concrete burn building never went to flashover, ever. In effect, we taught trainees not to monitor fire conditions but to get inside this burning house and simply do their job, for as long as it took. For most of my peers and me, flashover training was the first time we had the opportunity to calmly observe a fire through all its phases-most importantly, to flashover and thermal collapse.

Tactical Agility Saves a Life

A few firefighters from very busy units claimed this training was nothing more than a barbeque for firefighters and had little training value. As time progressed, we learned that there was (and still is) very little training of firefighters in the real life cycle of fire from incipient through flashover. Many experienced firefighters criticized the training, saying they got to see it in "real life" at real fires. Undoubtedly, they did, but for the bulk of the American fire service, there were not enough fires to get inside and repeatedly develop the required experience and expertise. It was this training experience that would teach them what to look for so they could escape (and survive!) prior to a flashover. What was clearly in question was the ability of these highly experienced veterans to observe and reliably record and recall conditions while they were very thoroughly physically and mentally engaged in conducting a search or operating the hoseline or, in too many cases, trying to save themselves from the deadly and now painful and sometimes fatal flashover itself. Today, how many "close calls" would have appeared on the Web sites that would pay for this valuable experience? How many firefighters could not relay their story because they were killed? Flashover training is now a staple at FDIC.

At the Rockland County Fire Training Center, I helped develop the flashover training plan and conducted these burns on a regular basis. Researching the program, we studied 30 case histories of firefighters who experienced a flashover, those who were killed by it, those who survived with burns, and those who took extreme actions to save themselves. Most of

these case histories occurred at house fires. Nationally, very experienced firefighters were getting burned to death at the "routine" house fire.

Several interesting conclusions resulted from this: Experienced firefighters were getting killed or involved in very, very narrow escapes (now called close calls). Often, it was luck and not their training (flashover was not even a common term) that determined if they lived or died. We also learned that our beloved turnout gear did not provide much protection at all from flashover training. Additionally, mental and physical toughness or years of fireground experience in all cases did not contribute to their survival and could not overshadow the pain, terror, and panic common to all survivors' experiences. Many of these experiences were told by survivors such as Mike Spaulding of the Indianapolis (IN) Fire Department at FDIC presentations.

The tactical agility that resulted from our training experiences in "The Can" (flashover unit) is that we train firefighters to monitor conditions for impending flashover to determine their next tactical move. The choices are simple-immediately get out of the fire flashover area or kill it with lots of water.

Two weeks after one of our flashover training classes, a firefighter came into the training center and was grateful, claiming emphatically that she was alive today because she recognized flashover conditions and exited the house just before a violent flashover occurred. Tactical agility, in this case, training based, increased fireground survivability for individual firefighters and entire fire departments.

Our flashover survival training program did and still does focus on three key facts:

1. Knowledge. Gain an understanding of the real life cycle of a residential fire and the sudden rapid fire development phase.
2. Prevention. Teach firefighters not to get caught in a flashover by monitoring conditions and looking for the warning signs
3. Action. If you see the warning signs, get out immediately; or, if you have the line, kill the fire and the impending flashover.

While I presented the program just outside of St. Louis, a firefighter asked me, "Don't all fires present the warning signs of flashover?" The answer was yes-high heat, dense smoke, free burning fire, rollover, and vent point ignition. Not all fires will go to flashover, but if you read the conditions and think the fire is going to flash over, you must react immediately: Use one of your two tactical choices. From my research and interviews, those who reacted immediately survived; those who did not generally did not survive.

Flashover survival training has become a standard part of HOT training at FDIC and is undoubtedly saving firefighters' lives all across the country. Why is there so much continued emphasis on understanding and recognizing flashover? The modern house, inside and out, is crammed full of synthetic and oil-based plastics that release heat at extreme rates. This leads to faster and more deadly flashovers. Change has overturned the 20-minute rule of the previous generation of firefighters. Thankfully, we used our tactical agility and have adapted to those changes.

More Battlefield Changes

At FDIC 2012, Chief Kevin Gallagher from the Acushnet (MA) Fire Department enlightened us on the dramatically different fire conditions we could expect at modular constructed homes. His presentation was based on his diligent research published by Fire Engineering in 2009.9 In short, because of a variety of construction features unique to these homes, fire departments should expect extremely rapid fire spread in these homes. Further increasing the danger to firefighters is the fact that fire penetrates to structural systems early in the fire.

House Fire Tactical Challenges

Following are some specific areas where firefighters may need some tactical agility to safely and successfully meet their strategic objectives while combating house fires:

- Modern houses collapse rapidly under a fire load. The 20-minute rule is a thing of the past.
- Modular construction will allow very rapid fire spread throughout the building, endangering structural systems and firefighters without the protection of a hoseline.
- You may have to extinguish exterior fires before beginning interior operations because combustible exterior siding, soffits, and insulation have been enveloped in fire.
- Vinyl-framed windows will fail easily, allowing fire to enter upper floors and endanger search crews.
- Gopher houses, at one time single-family homes, may now have multiple family units or be cut up into illegal apartments.
- Solar power systems are becoming commonplace, not enabling firefighters to vertically vent and adding energized wiring if any light is present, including fire scene flood lights.
- Both career and volunteer departments face staffing issues. Consider automatic mutual aid as part of your first-due assignment.
- UL has provided and continues to provide spectacular opportunities for us to increase our tactical agility in terms of fire attack. Many departments have modified basic fireground procedures based on this research.

When considering any changes to your department, especially those as important as procedural strategic and tactical fireground changes, remember, no one knows how to run or operate your department better than you. It is a huge mistake to take the best big city tactic or strategy and apply it blindly to your department. Cut and paste, though very useful on the computer, is generally a bad idea here. There may be significant differences in the conditions under which you work and the fires to which you respond. Some of these variables include types of apparatus, staffing levels, building construction, unique occupancies, tanker operations vs. high-flow municipal water systems, and available mutual aid.



(5) Thermal collapse shown post-flashover in the flashover simulator.

Modernizing Training to Meet the Challenge

Earlier, I described our live burn training around 1980. Certainly, we need to continue our recruit level training in basic skills such as SCBA use, search, ventilation, ladders, and hose stretches and advancement. There is, however, a pressing need to improve our live burn training to match both the recent fire development and dynamics research described above and the new tactics, especially fire attack tactics. Simply, our training scenarios must match the real life house fire situations we expect to face. Here are some suggestions for modernizing your house fire training:

- *Exterior fire envelopment.* When your units arrive at the concrete burn building, advise the incident commander that the fire is covering the outside of the building on A, B, and D sides. The nozzleman should extinguish the exterior fire first. This means applying decisive amounts of water to the outside of the building to contain this fast moving fire. This tactic is challenging to execute and even to observe because it appears to be in conflict with the "get inside" to the seat of the fire mentality that is often the perceived purpose of burn building training. Experienced firefighters may dramatically and

boisterously oppose considering this tactic. Remind members that the outside of houses have changed. Aluminum and wood siding has been replaced by combustible vinyl siding. Hydrocarbon (oil)-based insulation material now burns at extremely fast rates with high heat release rates. Even the plywood sheathing has been replaced by OSB or chip board, which also burns vigorously and rapidly. We have been trained not to pass a room of fire. Why would we pass this outside inferno?

- *Attic fires.* At this same scenario, it is likely the fire has penetrated the plastic soffits and entered the attic. Discuss with your members while the nozzle is still dripping how fast it would be to open the nozzle and put water into the attic space from the outside through the soffits that have either burned through or could be lifted by the stream. Compare this time frame to repositioning the line inside to the upper floor, finding the attic access, and pushing the line up there or through a hole the truck company put in the ceiling. Remind your members that a floor in the attic and storage items will make a simple hole a time-consuming and maybe impossible task; in the meantime, the fire is growing uncontrolled in the attic. UL has shown the value of getting water in the attic from the exterior to be a very valuable option that requires our consideration.
- *First-floor fires.* At the classic burn building exercise, the goal is to perfect our interior fire attack skills. Certainly, this is a needed practice session since all our firefighting skills are perishable. Try this without fire: Open the windows and doors on the front of the building. Tell your nozzleman to direct a stream into the building from the outside through a first-floor window. Remind your members that the stream is reaching the seat of the fire, cooling the dangerous upper levels of flammable gases (the ones that will take the fire to flashover), and is being applied by one firefighter in a safe position. When the grumbling starts about how we all were taught never to do this, ask them this simple question, "If fire was pushing out the door we wanted to enter, would we crawl under the fire, get inside, and then start to flow water?" The answer, of course, is no. We would start water from the outside, directing the stream into and through the door. Is that not what we just did at the window? Did the door attack push fire? If it did, why did we do it? We have to create some doubt in our current tactics so we can review them, compare them to the UL research, and see which tactic we really want to execute on the fireground.
- *Second-floor fires.* Open the windows on the second floor of your burn building. Bring the trainees up and position them in a safe place. Tell your nozzleman, standing outside near the front of the building, to direct his stream against the ceiling of the room your trainees can observe. Ask them if *they think* that water distribution would control or extinguish the fire. Certainly, this is not a fire attack tactic you want to use every time, but it may be a very good option when staffing is really low, there is a delay in getting inside (high security on doors), or to simply knock down the fire to prevent a flashover before your crews get inside.

- **Basement fires.** You and your crew pushed in through the front door of this house, and you and one other member fell through the I-joist-supported floor into the inferno in the basement. Do you still hold on to the tactic of not putting water on the fire from the exterior through the basement windows? Would this application of water keep you from burning to death while FAST members make their way into where you are? If you thought this was a viable option if your life was in danger, it may be an option to knock down the fire before your members enter this basement death trap. Narrow, unreliable, possibly burned-out interior stairs leading you down the chimney in a full frontal assault on a basement fire, is this your best option? It is very likely that lives are not in danger in the basement until you and your crew enter. Sure, we get paid to take manageable risks to save property. However, sometimes we get all caught up with trying to make the "great stop" and take stupid risks. Our first priority is life safety of occupants; when we enter the building, we are sometimes the only occupants. The others have already left the building.

This is the good news: Saving life and property are still the priorities, in that order. Good, fast, intense search operations supported by rapid fire suppression and coordinated ventilation are still the strategic plan. Firefighter safety, of course, overshadows all priorities

Endnotes

1. U.S. Fire Administration, weekly report on civilian residential fire fatalities, Dec. 14-20, 2014.
2. Ahrens, Marty, (2010) "Home Structure Fires," NFPA.
3. <http://community.fireengineering.com/profiles/blog/show?id=1219672%3ABlogPost%3A609885>.
4. NIOSH, 2008 <http://scfirechiefs.com/PDF%20Files/Home%20Structure%20Fires.pdf>.
5. NIST Report NBSIR 80-2120) <http://fire.nist.gov/bfrlpubs/fire80/art008.html>.
6. Knapp, Jerry, Tim Pillsworth and Christopher Flatley. "Nozzle Tests Prove Fireground Realities, Part 3," *Fire Engineering*, Feb. 2004. See also "Nozzle Tests Prove Fireground Realities"; J. Knapp, T. Pillsworth, S.P. White; *Fire Engineering*, Feb. 2003 and "Nozzle Tests Prove Fireground Realities, Part 2; Knapp, Pillsworth, and Flatley; *Fire Engineering*, Sept. 2003.
7. *Layman authored Attacking and extinguishing interior fires (1955) and Fire fighting tactics (1953)*, both published by the NFPA.

8. Madrzykowski, Daniel and Robert L Vettori, "Simulation of the Dynamics of the Fire at 3146 Cherry Road NE, Washington DC." NISTIR 6510, May 30, 1999, http://www.fire.nist.gov/CDPUBS/NISTIR_6510/6510c.pdf and "Firefighter Fatality Investigation and Prevention Program Death in the Line of Duty...Two Fire Fighters Die and Two Are Injured in Townhouse Fire-District of Columbia," Nov. 23, 1999, NIOSH #F99-21. <http://www.cdc.gov/niosh/fire/pdfs/face9921.pdf>.
9. Gallagher, Kevin, "The Dangers of Modular Construction," *Fire Engineering*, May 2009.

JERRY KNAPP is a 40-year veteran firefighter/EMT with the West Haverstraw (NY) Fire Department and a training officer at the Rockland County Fire Training Center in Pomona, New York. He is the chief of the Rockland County Hazmat Task Force, a former nationally certified paramedic, an adjunct professor teaching fire technology, and is on the technical panel for the latest UL study, "Impact of Fire Attack Utilizing Interior and Exterior Streams on Firefighter Safety and Occupant Survival." He authored the Fire Attack chapter in *Fire Engineering's Handbook for Firefighter I and II*.

Rapid Fire Spread at Private Dwelling Fires

House Fires: New Threats, New Tactics

House Fires: Modern Strategies and Tactics for Aggressive Operations

SECTIONS

MAGAZINE
COMMUNITY
PRODUCT CENTER
TRAINING GUIDES
FE TALK RADIO
HUMPDAY HANGOUTS

TOPICS

NEWS
TRAINING
LEADERSHIP
FIREFIGHTING
ZONE MICROSITES
APPARATUS
HEALTH & SAFETY
PREVENTION

ABOUT

CONTACT US
ADVERTISING
SUBSCRIBE

NETWORK

FIRE FIGHTER NATION
FIRE ENGINEERING
FIRE APPARATUS
FIRE RESCUE
FIRE BLOGS

SUBSCRIBE

Stay up to date on everything FireEngineering. Click the buttons below to learn more about how to subscribe.

[Magazine Subscription](#)

[Newsletter Subscription](#)

© Copyright 2018

[Privacy Policy](#) | [Terms & Conditions](#)