



Go Ahead — Blow Smoke

Positive-pressure ventilation and its cousin, positive-pressure attack, are among the best tactics for keeping firefighters safe when dealing with structure fires. **BY KRISS GARCIA**

Roughly a quarter century ago, a Bakersfield, Calif., fire chief named Cliff Allman crossed paths with an avid balloonist and entrepreneur named Dexter Coffman. Soon after they were working to develop a tactic that utilized high-pressure portable fans to assist firefighters in ventilating structures in a coordinated manner.

Today, one would be hard-pressed to find a fire department that does not use positive-pressure ventilation in one way or another. Given the fire service's traditionally conservative approach to change, the widespread acceptance of PPV occurred at the

speed of light. Indeed, the acceptance of PPV as an effective firefighting tactic by a majority of departments, in a mere 25 years, borders on a miracle.

Then and Now

In the early days of PPV, building construction tactics and fire loads, as well as the fans used to “pressurize” structures back then, were much different than they are today. Back then, according to the NFPA, fires took 14 minutes from the time a smoke detector would activate until that room would flash and the blaze would begin to aggressively move



Firefighters conduct live burns to gain familiarity with the use of fans in a coordinated attack. Notice the large amounts of smoke and flames outside the building. The more energy and lethal environments firefighters can exhaust as they enter, the better the results for them and potential victims.

through the structure. In contrast, today's structure fires flashover in less than four minutes. This is largely due to the fact that fire loads inside modern structures primarily are made of synthetics. Fire loads in today's structures can generate more than 15,000 BTUs of energy per pound. In contrast, fires of yesterday — when items inside our structures were made of ordinary combustibles — only would generate 5,000 BTUs per pound. Contributing to the problem is also the fact that the products of combustion that crews faced 25 years ago were much less lethal than they are today. The Centers of Disease Control and Prevention said the interior environments that today's firefighters face are a "soup of carcinogens."

On the other hand, while the best fans used by most fire departments 25 years ago were rated at 5,000 cfm, many of today's fans operate at 20,000 to 30,000 cfm. When matched with ample exhaust, coordinated pressurized attacks give today's firefight-

ers an option for removing massive energy and lethal environment; at the same time, victims that may be in the structures may have a better chance of survival than without a coordinated attack. Without adequate exhausts, crews effectively will create convection ovens inside the buildings, which may compromise what may have been survivable spaces for victims and firefighters.

A complicating factor is that today's structures are built with much less mass and with more engineered and adhesive-laden materials than ever before. For these reasons and more, today's roofs are no place for crews to operate when fires are burning below them if positive-pressure attack — the use of fans to remove the products of combustion during a coordinated attack to assist crews in fire knockdown — is a viable option. It is interesting that roofs meet most of the OSHA-established criteria for defining a confined space, yet firefighters often are on them after the fire has compromised the system, after the fire has been

extinguished, or when conditions are so aggressive that a large-enough hole cannot be opened to provide adequate relief for interior crews.

Ahead of Their Time

When fans first were introduced, people could not believe—or refused to believe—the statements that were made about them by manufacturers. Often, early instructors faced great opposition from classrooms full of great firefighters who were intent on protecting more-conventional tactics that had worked for years. Part of the reason was that new research and tactics rarely found their way into firefighting manuals, even though the fire environment was changing drastically. This put fire chiefs in a difficult position: blaze new trails on their own or maintain the same practices, which were beginning to create issues related to fireground safety.

When looking at fires through the

prism of the fire triangle, it is easy to see why change had to occur. Twenty-five years ago, fires typically did not reach the ignition point of carbon monoxide, which is approximately 1,200 degrees. Consequently, the smoke inside the burning structure was not nearly as thick or flammable. So, the introduction of oxygen—the third factor in the equation, along with temperature and fuel—during PPV was not nearly as potentially catastrophic as it is in today's fires.

Fast-forward 25 years: The vast majority of today's fires rapidly reach temperatures that exceed 1,200°. The smoke is much thicker, more flammable and full of potential energy and toxins. With the two sides of the triangle in place—temperature and fuel—the introduction of oxygen during PPV would place firefighters in a volatile and unpredictable environment. When cou-



pled with limited exhausts of yesterday, the situation becomes far riskier.

The implementation of PPA and PPV is not as simple as putting a fan at the front door and opening the back of the structure. These tactics must be implemented in a safe and thoughtful manner to ensure success. Start small with very predictable fire situations. For instance, it is suggested

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WHAT'S THE DIFFERENCE?

Positive-pressure ventilation (PPV):

The use of fans to remove the products of combustion after crews have entered the building, often after the fire has been knocked down.

Positive-pressure attack (PPA):

The use of fans to remove the products of combustion during a coordinated attack to assist crews in fire knockdown.

that PPA only be used when a coordinated attack can be made and when there is no doubt as to where the fire wants to exhaust. With fire and smoke showing, cleaning up the burn to decrease the incomplete combustion as crews enter in a clear environment — i.e., one that is not hampered by high obscuration or temperatures — is the basis of the newer theories regarding PPA. In effect, firefighters create a controlled burn as crews anchor their attack with a high-pressure fan, which enables the safe exhaust of the lethal environment away from them and from survivable victims. It is important to note that as crews start to make entry, if the space above the cone of air — when fans are placed 4-6 feet from the attack entrance — is laden with smoke or flames from the interior, this is an indication that there is not enough exhaust to safely use PPA and other attack options should be used.

There are numerous books and articles that address how to effectively implement new ideas or change. One approach that was developed by John Kotter, a professor at the Harvard School of Business, is commonly known as Kotter's Eight Step Change Model. Another model is the Plan-Do-Check-Act cycle developed by W. Edward Deming, the well-known expert on quality management and improvement. Leveraging Kotter's and Deming's concepts, here's a four-step system for those departments that have yet to implement PPA that easily can be adapted by both large and small departments.

1] Decide what specific problem, chal-

lenge or issue can benefit from the implementation. In terms of PPA, this means increasing firefighter safety, and providing a quicker method to remove heat and the products of combustion, which in turn will result in rescues and extinguishment being completed in a more timely fashion.

This is a collaborative step that

involves creating a sense of seriousness and immediacy among key players when presenting the issue in order to gain their support. Key players do not have to necessarily be from management, but should include a mix of personnel from your department. Clearly, firefighter safety is one of those issues that offer both seri-



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SUPPRESSION TACTICS

Training and education in positive pressure is necessary so that all members – including incident commanders – recognize the difference in fire behavior.



ousness and immediacy as reasons for seeking change. Look at the daily number of firefighter injuries across the country to understand that implementing PPA will have a positive effect on decreasing those numbers. On analysis, on-scene firefighter injuries often result from not being able to visualize the interior fire attack environment. At this point, identification and analysis of the problem(s) you want to address by implementing PPA should be clearly stated.

2] Develop and deploy an implementation plan. Many departments that have implemented PPA started by training their officers. Certainly, before ever using PPA on structure fires, development of a rigorous training program and an operating procedure are critical and necessary components of the planning stage. Initial plans should be simple and realistic and should start with using PPA for residential and small commercial structures that have flame and smoke showing. Some

departments have found that limiting the tactic to a specific company or battalion, rather than department wide, has been successful. These scaled-down plans are preferred because they allow for adjustments and improvements during the early stages of implementation. Taking the necessary time to ensure that your deployment plan is solid will translate into removing obstacles that are ever present during this period.

3] Evaluate the implementation plan.



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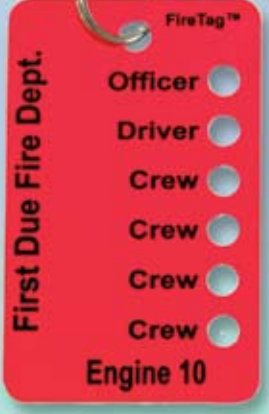
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SUPPRESSION TACTICS



Firefighters increase the pressure on the floor below the attic. Notice the limited amount of smoke as the fire burns clean and firefighters fog the attic out from safe positions below.

Were the anticipated results in line with the actual results during this initial deployment? If not, why not? Perhaps the training was inadequate. Analyze your results and make the necessary adjustments or improvements. If the plan is successful and you are ready to implement PPA department-wide, be mindful that communicating this plan is now a vital part of the overall deployment.

4] Deploy PPA department-wide. This final step requires strict command-and-control by company and chief officers. Of course, this starts with step 2, which is to ensure that firefighter training has been accomplished and can be verified by their performance. At this point, a decision will have to be made concerning whether to continue limiting the use of PPA or trust that the department's training and education are sufficient to implement PPA department wide. Reevaluation is necessary, which often leads one back to step 1.

The sustainability of PPA as a viable tactic depends in large measure on communicating successful applications, which in turn will enhance acceptance and ensure that the tactic is integrated into the department's culture. On that note, don't forget to thank those firefighters who enabled the difficult process of change. ■

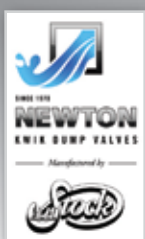
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