


GAME CHANGER

NYU-Poly and NIST researchers, in collaboration with the FDNY, conducted a study of wind-driven fire dynamics in high-rise structures. The experiment yielded critical information concerning modern fire behavior and the efficacy of certain firefighting tactics. Recognizing the value of this new information, NYU-Poly, the FDNY and NIST sought to share the results of their research with the nationwide fire service audience, in a way that could address the needs of both career service and volunteer firefighting communities. ALIVE was born of this challenge. The efficacy of ALIVE to provide effective training, rapid dissemination and diffusion of new firefighting interventions was scientifically proven by conducting a field experiment with the FDNY, the Chicago Fire Department and the Bloomington (Minn.) Fire Department.



ALIVE training tool helps bridge the gap between firefighting research & practice

STORY & PHOTOS BY JAMES M. DALTON, PRABODH PANINDRE, ERIK SMITH, RICHARD WENER & SUNIL KUMAR

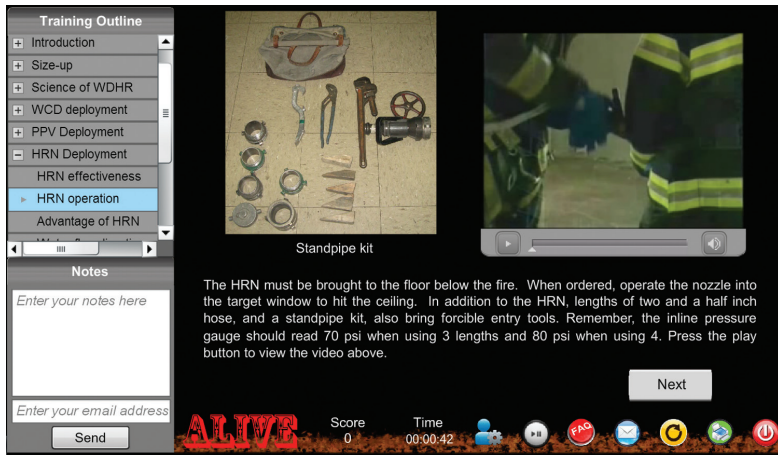


“**E**ngine 1 on scene; two-story, single-family residence; light smoke showing.” Is this “light smoke” an indicator of a small incipient fire or perhaps a potentially lethal ventilation-limited fire, fueled by modern synthetics, waiting to reach flashover conditions within 90 seconds after firefighters enter the building? Can we accurately identify modern structural components in this single-family residence and modify our operations to avoid being trapped by sudden collapse? Would the impact of 20-mph winds dramatically change operations at this fire? Do we base today’s tactical fireground assessments and decisions on the most current available knowledge?

Unanticipated fire behavior in modern residential structures, the performance of lightweight construction, open architectural layouts, and wind-driven effects have all proven catastrophic for firefighters. Due to disturbing trends that have been documented in line-of-duty death (LODD) investigations, the Department of Homeland Security’s Assistance to Firefighters Grant Program (AFG) has dedicated funding to determine the severity of the problem and to investigate ways to combat these disturbing trends. Groundbreaking research conducted by the National Institute of Standards and Technology (NIST), UL’s Firefighter Safety Research Institute and a host of other institutions is providing valuable insight into the modern fire environment.

Current research findings are challenging, and in some cases *rewriting*, our understanding of the fundamentals of modern fire behavior. In addition, leading institutions are developing new training materials, alternative firefighting tactics and innovative technologies with the goal of reducing firefighter injuries and deaths.

One significant hurdle remains: the problematic gap between firefighting research and firefighting practice due to ineffective dissemination methods. Moving forward, our challenge is to eliminate inefficiencies by ensuring that firefighter clinical and technical safety research moves quickly from publication to application for the more than 1.1 million firefighters currently serving in the United States.



The ALIVE training framework.

BRIDGING THE GAP

According to the USFA, there were 83 LODDs in 2011. Another 70,090 firefighters were injured. Many factors contribute to the significant number of deaths and injuries, but perhaps most troubling is the fact that many firefighters were likely not aware of advancements in firefighting methods that could have changed these tragic outcomes.

Researchers at the New York University Polytechnic School of Engineering (NYU-Poly) are seeking to remedy this problem by creating a dissemination tool called ALIVE (Advanced Learning through Integrated Visual Environments). This Web-based, interactive multimedia, general methodology tool will assist in firefighter education, training and information retention. In collaboration with the FDNY, the Chicago Fire Department (CFD) and the Bloomington (Minn.) Fire Department (BFD), NYU-Poly scientists conducted research to evaluate, quantify and compare the efficacy of current training methods and the new Web-based, interactive method to determine the most effective tool for dissemination, training and diffusion of new firefighting interventions.

But where did this all begin? In 2008, NYU-Poly and NIST researchers, in collaboration with the FDNY, conducted a revolutionary study of wind-driven fire dynamics in high-rise structures. The experiment yielded critical information concerning modern fire behavior and the efficacy of certain firefighting tactics. Recognizing the value of this new information, the FDNY collaborated with NYU-Poly to train its 11,000-plus firefighters, and the research changed the department's standard operating procedures (SOPs).

After completing this locally based project, NYU-Poly, the FDNY and NIST next sought to share the results of their research with the nationwide fire service audience, in a way that could address the needs of both career service and volunteer firefighting communities. ALIVE was born of this challenge.

ALIVE features training modules that divide firefighting topics into multiple stages. Each stage

presents new research data via images, videos and audio. Users progress through the stages of each topic section, learning about various fire principles and firefighting techniques. This information is reinforced with questions regarding actual situations or simulated scenarios.

In a real fire, incident commanders (ICs) make approximately 80% of their fireground decisions within one minute. ALIVE simulates this decision-making process, providing users with multiple firefighter intervention options, each of which will alter the situation in a different way. Users must use the new information from the training to determine the best possible method for tackling the fire situation. Every incorrect answer prompts an explanation citing the principles that make that selection inferior, and the user is given an opportunity to make another selection, repeating the process until the optimal answer is chosen. This allows users to learn from their mistakes. User responses are automatically saved to a database to track material usage levels and performance.

CURRENT TRAINING METHODOLOGIES

Current firefighter training generally consists of formal lectures given on designated training days. Trainers review materials provided by subject-matter experts to create their own lesson plans and disseminate the information to firefighters (via in-person instruction or through printed or electronic materials). Firefighters are then given practical exercises or hands-on training to determine how well they grasped the information. Unfortunately, these methodologies fail to furnish substantive feedback on the quality of training, or to determine how much of the training firefighters truly comprehend and retain.

Moreover, asking firefighters to simply read or watch prepared material has a low impact on performance. Lectures require a time commitment from firefighters and their departments, and also demand the availability of trained instructors, an infrastructure to coordinate training, and a culture of continuous education. Augmenting these methods with simulated fire training requires significant resources and personnel.

Further, consider the logistics of lecture-based training: If a new intervention is deemed so important that a team is assembled to lecture and demonstrate at the 30,000-plus fire departments across the United States, then fewer than 1% of the fire departments in the country can be reached in one year. In other words, it may take decades for subject-matter experts to adequately train each department. Clearly, a more efficient means of disseminating critical new information is needed.

The takeaway: Not only is effective basic training difficult to accomplish, it is also nearly impossible to

ALIVE =
Advanced
Learning
through
Integrated
Visual
Environments



successfully spread the word about innovative firefighter safety research and the resulting changes to tactics in a timely and efficient manner.

FIELD EXPERIMENT

Following the creation of ALIVE, the NYU-Poly researchers and their FDNY partners sought to test the tool's value in disseminating information directly to the individuals who needed it most. The research hypothesis was that ALIVE training—with its multimedia interactive features, online access and logistical advantages—would be at least as effective as high-quality classroom training in different firefighting-related topics. The CFD (the second-largest career department in the United States) and the BFD (a large and well-trained volunteer department) were selected as additional partners in this research.

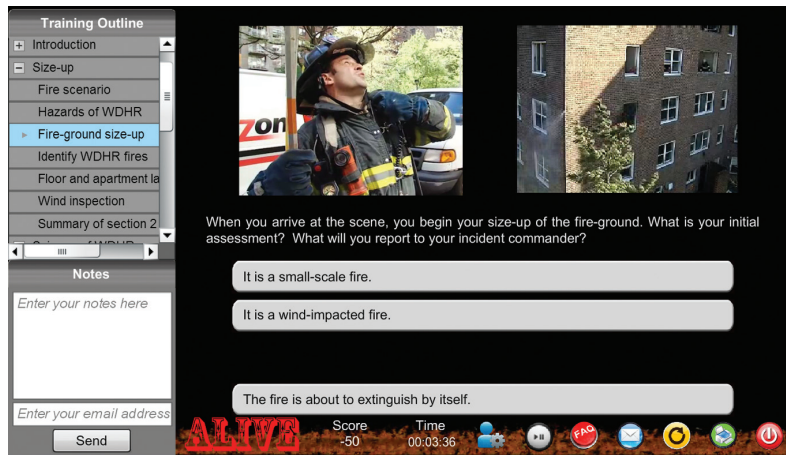
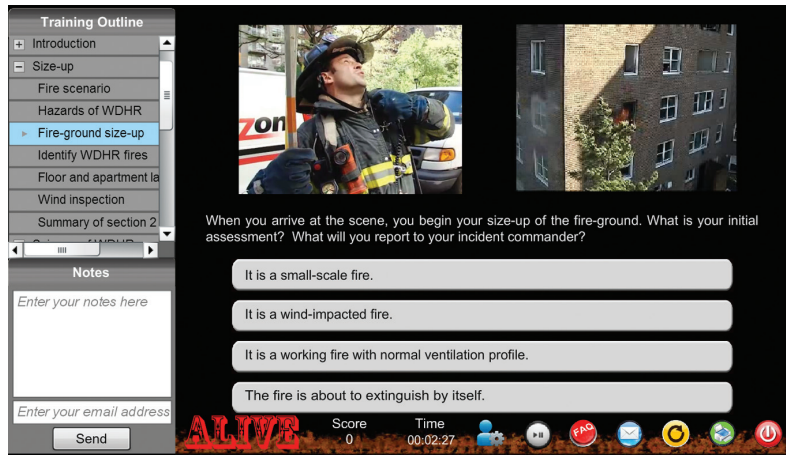
The study, conducted with the support of an AFG grant, was designed to be a field experiment rather than a laboratory experiment. A field experiment would test the training experience in as realistic a way as possible, increasing the likelihood that the results would be valid for fire departments around the country. Firefighters were trained in three different topics representative of diverse, important issues for firefighter safety and health: 1) wind-driven high-rise fires; 2) fires in modern, lightweight, residential construction; and 3) issues in fatigue management and sleep disorders.

In each of the three cities, firefighters were randomly assigned to either ALIVE training or classroom training. The ALIVE modules and the classroom courseplans for each of the three topics were prepared from the same subject outline and materials, covered the same range and depth of material, and were reviewed to ensure consistency of content. In each case, the lesson plan was designed to be completed in approximately one hour, although there were some slight variations. ALIVE training was provided through modules on individual computers.

For the classroom experience, each site chose its best and most experienced instructors, ensuring that the classroom training was of the highest quality for purposes of comparison. These instructors received intense training in the module topics from nationally recognized experts, and were provided with PowerPoint files to use in the classes. They were also observed and supervised during test presentations of the material.

Subject-matter experts created three types of tests to evaluate the efficacy of the training: 1) factual multiple choice tests of knowledge of the subject matter; 2) scales for firefighter self-assessment of their level of knowledge; and 3) scales for firefighters to indicate their satisfaction with the training.

Details of the research experiment and the ALIVE training modules are available at www.poly.edu/fire.



RESULTS

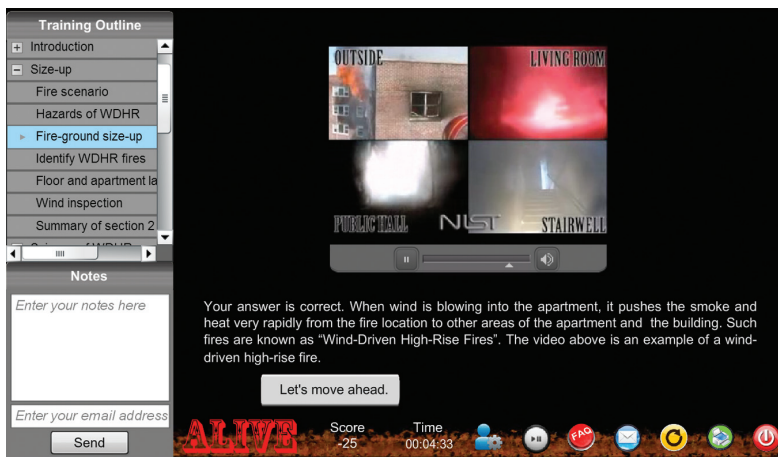
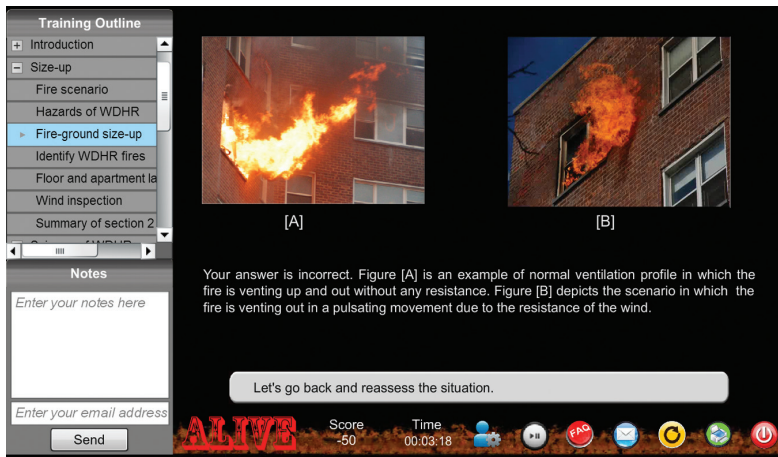
A total of 599 firefighters from the FDNY, CFD and BFD were tested. The experiment revealed that the ALIVE training outperformed classroom training at a statistically significant level in terms of quality of learning. While firefighters in both ALIVE and classroom situations significantly improved their knowledge levels (as measured by comparing scores in both a pre-training test and a post-training test), those in ALIVE scored better in the post-test, and improved at a greater level than did those in the classroom. These results held true for all three modules and in all three cities. Moreover, learning levels as observed in a retention test (two weeks after the training) remained higher for those trained with ALIVE. The ALIVE subjects also improved more from pre-test to retention test than did classroom subjects, indicating ALIVE's capabilities in enhancing retention.

Firefighters also rated their self-knowledge of these topics as significantly greater after ALIVE training than after the classroom experience. There were no significant differences in their rating of the quality of training.

BENEFITS OF ALIVE

The results of this study do not suggest that ALIVE will eventually replace traditional classroom learning.

ALIVE uses a decision-making process based on recursive looping scenarios (leading to correct choice only—reinforcement of optimal responses).



ALIVE includes an explanation of why the user response was correct or incorrect.

Instead, ALIVE *supplements* classroom training by monitoring progress to ensure that firefighters learn the information. Firefighter progress statistics are automatically stored in the ALIVE database, which can help training officers to effectively plan the use of instructor-led classroom sessions.

Currently the CFD is utilizing the ALIVE *Wind-Driven High-Rise Fires* module as a foundation for its High-Rise Positive Pressure Ventilation (PPV) training program. This 3-hour blended learning program begins with the ALIVE training module, continues with instructor-led department SOP training, and concludes with a hands-on application exercise utilizing PPV fans that were recently deployed to all CFD truck companies. A preliminary analysis of the 2,000 department members who have completed this training demonstrates results consistent with those of the original research study.

Another benefit of ALIVE is the consistency of the information provided. In traditional training, each classroom trainer modifies the information to suit their own teaching style, often including personal experiences to reinforce content. This inevitably leads to variations when the classes are delivered. Unfortunately, even minor inconsistencies in content delivery can affect how well firefighters receive that information, particularly when the topic is

technical in nature. Small volunteer fire departments do not have the same resources as large fire departments, but they all need the same vital information and skills to save lives. ALIVE cuts down on preparation time and provides uniform content and quality to all users, delivering the same information in the same manner.

ALIVE's interactive multimedia platform can be easily accessed online using a computer or mobile device so that users can train at a time convenient to them. This is especially beneficial to volunteer firefighters who are challenged with complex training schedules.

Moreover, the modular format of this training allows firefighters to pause and resume training at their convenience. If a call comes in during training, firefighters would be able to respond and then pick up where they left off upon their return. If necessary, they can review earlier sections and repeat what they don't understand. Unlike classroom training, users can repeat the training as many times as they desire without incurring the staffing cost of additional instructor-hours.

IMPACT ON THE FIRE SERVICE

Studies show that firefighter performance can suffer during high-stress situations, but extensive proficiency training or "overlearning" can help automate appropriate responses and lessen the chance that firefighters will suffer from situational stress. The visual aides of the multimedia platform, computerized touch technology, and other interactive features of ALIVE help firefighters (particularly newer and future generations, who tend to be technology-savvy) effectively understand and implement new, safer firefighting techniques to tackle modern fires, and simultaneously provide training feedback to fire departments and decision-makers.

Successful firefighter training rests on three legs: 1) knowledge acquisition; 2) training on tactics and procedures; and 3) development of hands-on skills. The ALIVE platform can take over the knowledge-

ALIVE Study Results Summary

- In almost every case, ALIVE training outperformed classroom training at a statistically significant level in terms of quality of learning.
- ALIVE trainees scored better in the post-test, and improved at a greater level, than did classroom trainees.
- ALIVE trainees improved more from pre-test to retention test than did classroom subjects.

acquisition component, as well as portions of the tactical and procedural training operations, thereby freeing trainers to focus their time on hands-on skill development training.

Additionally, ALIVE will reduce the logistical requirements of instructor-led didactic presentations, while mitigating the stress on staffing levels inherent in conducting large-scale training sessions. This broad-based dissemination model, which we believe has the ability to ensure competency and to meet continuing education requirements, will serve a nationwide audience and may reduce strain on individual department training budgets.

AVAILABLE TRAINING

Two modules of ALIVE: *Wind-Driven High-Rise Fires* and *Fires in Residential Lightweight Construction*, have been released to the nationwide firefighter community free of cost. The iOS and Android versions of this training are also available at www.poly.edu/fire. The CFD and the Cleveland Fire Department are currently using ALIVE methodology to train their firefighters.

In 2012, with funding from the AFG program, the scientists from NYU-Poly and fire officials from the FDNY, CFD and BFD also collaborated with fire protection engineers from NIST and UL to develop training for modern fire dynamics using the ALIVE platform. Recently, they conducted small-scale burn tests and laboratory experiments to generate the necessary data, video and images. This training module is expected to be released by the end of 2013.

CONCLUSION

Officials from the FDNY Training Academy describe the importance of effective training in the following way: "If we do not train, we will not be good at what we do; for firefighters, that can be deadly." Firefighters risk their lives every day to protect others from harm. In bearing this burden, they require high-quality training that can increase their proficiencies in order to prevent injuries and fatalities. ALIVE can assist the nationwide firefighting community by delivering the newest information directly to firefighters, at their convenience, in a manner that will allow them to retain the knowledge and develop critical-thinking skills for optimal decision-making. ALIVE can enhance traditional methods by allowing trainers to focus on applying techniques, providing demonstrations, and answering questions, thus making overall training more efficient and effective. ☺

James M. Dalton is the Coordinator of Research and Development for the CFD. Prabodh Pandre is Senior Research Scientist at NYU-Poly. Erik Smith is an FDNY captain assigned to the 7th Division in the Bronx. Richard Wener is Professor of Environmental Psychology at NYU-Poly and co-Principal Investigator of this research study. Sunil Kumar is Primary Investigator of fire research projects at NYU-Poly. He is the Dean of Engineering at New York University Abu Dhabi and Professor of Mechanical Engineering at NYU-Poly.

Get Training

If your fire department is interested in utilizing this scientifically proven training, please contact the NYU-Poly Fire Research Group at fire@poly.edu.

Choose XX at www.firerescuemagazine.com/rs