Utilizing Simulation and Game-based Learning to Enhance Incident Commander Training

Ronald W. Tarr, Eileen Smith
Institute for Simulation and Training/UCF
Orlando, FL.
rtarr@ist.ucf.edu , esmith@ist.ucf.edu

Eric Totten, Michael Carney, IST/UCF
etotten@ist.ucf.edu, mcarney@ist.ucf.edu
Chief Michael Wajda, OCFRD
Michael.wajda@ocfl.net

ABSTRACT

Across the country, Incident Commander training is viewed as a critical part of Fire Officer readiness and safety. However, this training can often vary from department to department and be rather passive and static. This is the exact opposite of most fireground scenes, which require Fire Officers to make split second life and death judgments in rapidly changing environments.

Unsatisfied with traditional training techniques, the Orange County (FL) Fire Rescue Department (OCFRD) partnered with the University of Central Florida's Institute for Simulation and Training (UCF-IST) to create a modernized training program for Lieutenant, Captain and Battalion Chief Incident Commanders (IC). For this project, UCF-IST conducted a rigorous performance and needs analysis on OCFRD's Incident Command Academy. This analysis identified key environmental cues and critical skills that led to specific decision points and tactical direction for ICs. With this in hand, UCF-IST created an engaging, performance oriented, multimedia training program and unique immersive simulator that allowed ICs to learn and practice critical skills through scenario-based learning. In addition, the open-ended nature of the simulation allows for multiple personnel to participate, increasing crew coordination through collective team training.

Since completion OCFRD trainers have run over 400 Fire Officers through the program which employs pre-training web modules, step by step instruction and e-learning activities designed to gradually ramp the Incident Commander into the instructional material and interactive technology, thereby improving their comfort level and acceptance of the program. The training academy classes were organized by Battalion, which improved unit cohesion while raising the tactical knowledge level of participating Fire Officers. OCFRD reports near unanimous improvements in the tactical IC performance and morale of Battalions and their acceptance of this modernized training academy.

Key Words
Individual and collective team training, crew coordination, game-based learning, and rapidly changing environments.

ABOUT THE AUTHORS

Ronald W. Tarr is a retired Lt. Colonel in the U.S. Army and currently the Program Director and Principal Investigator of the Research in Advanced Performance Technology and Educational Readiness (RAPTER) Lab at the University of Central Florida's Institute for Simulation and Training. He is the author of over fifty publications on simulation and training related topics.

Eileen Smith is a 24-year veteran of informal learning experience design, and currently the Program Director and Principal Investigator of the E2i Creative Studio at the University of Central Florida's Institute for Simulation and Training.

Eric Totten is a Curriculum Developer and Research Analyst for Research in Advanced Performance Technology and Educational Readiness (RAPTER) Lab at the University of Central Florida's Institute for Simulation and Training.

Michael Carney is an Experience Design researcher at the E2i Creative Studio at University of Central Florida's Institute for Simulation and Training, with over ten years in simulation design and development.

Michael Wajda is the current Operations Division Chief of the Orange County Fire Rescue Department. A career Fire Officer with 30 years of experience, Chief Wajda is the author of several publications related to the Fire Service and served as Training Division Chief during the project period.

INTRODUCTION

According to statistical analysis of the U.S. Fire Administration's Firefighter Fatalities in the United States in 2010 suggests that firefighter deaths during Incident Command operations have held relatively steady for the last decade (with the exception of 2001), with an average of 105 deaths a year (FEMA, 2011). Furthermore, the 2008 report states that 75% of fire ground operation deaths in the Fire Service occurred in structural fire incidents (FEMA, 2009). Experts contend that though firefighter deaths have proportionally gone down when viewed over a three-decade period, most casualties occur from preventable circumstances, like faulty situational awareness or decision-making (NIOSH, 2009; Hall, 2010). In addition, consistent casualty returns for the past decade signal that "line duty death reporting and lesson learned training" is not correcting the problem, thus more needs to be done to ensure the safety of the men and women in America's Fire Service (Hall, 2010). Clearly, decision making and situational awareness, especially in an Incident Command role, are essential to maintaining firefighter safety (Hall, 2010; McCaslin, 2010).

In addition to this safety issue, crisis management experts state that the United States has a "chronic response problem […] related to interorganizational communication, coordination, collaboration, and leadership, among other challenges" (Jensen & Waugh Jr., 2014, pg. 6). This problem is compounded by "myriad organizations of multiple types with a range of individuals within them responding to different hazards, operating in different geographic areas, with different values, cultures, priorities, and resources in situations where emergent groups and volunteers will likely emerge and converge to render assistance" (Jensen & Waugh Jr., 2014, pg. 14). Though widely recognized and reported by government officials, Fire Officers, and scholars this problem persists among First Responder agencies (Auf der Heide, 1989; Jensen & Waugh Jr., 2014; National Research Council, 2006; Tierney et al., 2001).

This problem continues to affect interagency responses to critical incidents, despite the efforts of Fire Service, State, and Federal agencies to correct this problem. These agencies attempted to correct this problem through the usage of the Incident Command System (ICS), at various times, degrees, and for eclectic purposes. However, it was not until the creation of the National Incident Management System (NIMS), which came into effect in 2004, that there was a nationwide standard for on-scene response and incident management. However, ten years after the establishment of this standard, it continues to be "ignored, partially used, underused, misused, and used in organizations and jurisdictions in ways that are not necessarily compatible with the way the system is used in other organizations and jurisdictions" (Jensen & Waugh Jr., 2014). As proof of this startling assertion, Jensen and Waugh Jr. (2014) cite no less than 30 papers ranging from Fire Service Program research to peer-reviewed academic papers that discuss the implementation problems of NIMS and ICS. From this research, it is clear that the trouble with NIMS compliance is that no one understands how to build upon a shared "vocabulary" while resolving differing operational procedures within the perceived NIMS structure that cause issues with interagency cooperation.

This paper explores one project that attempted to address this dissonance between procedures, structures, vocabulary, and real work performance described above. The applied research project constituted a partnership between the Orange County (FL) Fire Rescue Department and the University of Central Florida's Institute for Simulation and Training, the conclusion of which resulted in the formation of a functioning Incident Command Regional Training Academy. This paper will detail the project: background, methods, limitations, curriculum and simulation design, implementation, evaluation, lessons learned, and relevant conclusions. Future articles will delve deeper into the intricacies of curriculum design, pilot studies, post-academy evaluations, and future work.

BACKGROUND

This project originally started after the Orange County (FL) Fire Rescue Department realized that they were suffering from the effects of a "brain drain" as their most experienced officers retired. These officer's replacements were usually less experienced than their predecessors, because of increasingly infrequent fires, due to better building materials, tactics, and prevention measures. OCFRD also recognized that this personnel and experience issue was also deeply connected to officer's use and comfort with NIMS and ICS structures and tactics, that are described in the previous section.

Prior to the Advanced Command School development project, OCFRD had been operating a successful 40 hour Command School for many years. OCFRD had realized tremendous benefits from the prior Command School,

including establishing a standard Incident Command terminology among the Department's fireground supervisors, developing common command and control behaviors, creating a common approach to firefighter accountability during high risk operations, and exposing emerging Incident Commanders to high risk, stressful decision-making situations prior to being deployed to real-life incidents.

Even with the resounding success of the prior training program, significant shortcomings were identified. In many cases the lessons taught were based upon the instructor's personal experience rather than standardized curriculum. Scenarios and software used to simulate incidents lacked variety, flexibility, and lacked the ability to present the student with the subtle visual changes that often precede catastrophic fireground events. Additionally, the prior simulation did not provide a visual representation of activities ordered by the Incident Commander, such as ladder placement, ventilation, firefighter deployment, and hose line placement. In short, the prior simulation program provided a useful sandbox for practicing elements of Incident Command, but it did not fully immerse the student into a believable virtual world representing the complex and chaotic environment encountered in real world emergency scenes.

As a result of this recognition, OCFRD applied for and received a FEMA funded "Technology and Development" grant to OCFRD to develop or acquire an Incident Command simulator that would form the basis of an Incident Command Regional Training Academy. The goal of this academy was to training 450 officers, ranging from Lieutenant to Battalion Chief, from Orange, Osceola, Seminole, and Lake County, located in Central Florida over the course of a year.

Due to UCF-IST's concentration of Human Performance outcomes and the institute's prior work with Orange County, OCFRD's Fire Chief decided to partner with the university to aid in the creation of this academy. After initial consultations, it was decided by the Fire Chief and UCF-IST researchers that technology alone was not enough to solve the department's training issues. Instead a complete training package would have to be created that leveraged appropriate technology, instructional strategies, and traditional training methods that would result in any substantive increases in Incident Commander performance.

LITERATURE REVIEW

Given the widespread enunciation of training, implementation, and standardization of the Incident Command System across First Responder organizations throughout the United States, the project team surmised that there would be a great deal of peer-reviewed, empirically-based research regarding ICS training. A review of the literature supported that assumption, with ICS related papers appearing across professional magazines, student theses and dissertations, peer-reviewed journals, and national and international publications. Due to space, a thorough literature is not possible in this article, though a broad description of research areas and publications arenas is possible. Samples of areas of ICS research include: Command and Control (Tierney et al., 2001); Participatory Action, (Njå & Rake, 2008); Distributed Learning, (Anderson, 2005); Participant Workload, (Young et al., 2013); simulation-application (Hall, 2010; McCaslin, 2010); and synthesis studies (Jensen & Waugh Jr., 2014). In addition, the literature can also be broken up by industry publications, student papers, publications based on empirical research, and publications not based on empirical research (Jensen & Waugh Jr., 2014).

Clearly, there are a great many publications and research avenues on the subject of ICS research. Researchers found that the field amply describes the issues associated with ICS training. Furthermore, the literature satisfactorily describes various technological applications for ICS training. However, the field lacks literature on how to create properly structured and organized curricula content that is delivered through modern blended-learning mediums. Furthermore, most of the studies that explore the creation of new ICS training are too narrowly focused, analyzing only one department or single component of learning mediums. Furthermore, these narrow studies fail to generalize their processes in order to provide blueprints for widespread implementation across the nation.

This presented researchers with the conundrum of having ample literature on various issues, applications, and differing content, while at the same time providing very scant practical implementation information. Despite this deficiency in ICS literature, researchers focused on works that provided a solid foundation of blended-technology research (Hall, 2010; McCaslin, 2010). An example of this foundation is exemplified by McCaslin's assertion of the benefits of simulation in Incident Command training when he stated: "The results of the statistical analysis validated [simulation as] [...] A valid supplement to traditional IC training programs […] which can enhance both student

decision-making and their safety" (McCaslin, 2010). This paper seeks to help fill the gap in implementation studies described above, by illustrating the limitations, process, results, and lessons learned of blended-learning ICS training.

LIMITATIONS

This research encountered numerous complications that resulted in limitations to the overall project. The limitations resulted from numerous factors, like: delayed awarding of grant funding, grant parameters, retiring OCFRD personnel and leadership transitions, public union and training scheduling constraints, policy discrepancies and institutional differences, and infrastructure capabilities. Though these limitations impacted researchers ability to utilize certain technologies and conduct immediate evaluations, the constraints forced researchers to creatively work around these issues, ultimately producing a customized training intervention that leveraged modern learning theory with appropriate technology.

First and foremost, as most researchers have experienced, the awarding of the FEMA grant to Orange County was delayed, forcing a proposed two-year project into a tight thirteen months. This delay substantially cut into beta testing and evaluation phases, which—along with union, scheduling, and grant parameter issues—prevented a thorough collection of performance data and survey responses. Furthermore, though some demographic and testimonial data was collected, the lack of empirical performance-based data resulted in a quasi-experimental design, requiring further analysis. This planned future analysis will follow the officers who took part in the new academy into the field and track improvements to command vocabulary, ICS usage, and after-action reports.

In addition to delay in the grant award, the parameters of the grant also created conditions that did not allow for a proper experimental design. These parameters did not allow UCF-IST and OCFRD to conduct strictly experimental research, meaning instead the goal of this funding was to create a focused and modern Incident Command Academy, which was required to train 450 Fire Officers in less than a year. Due to these stringent time and scope constraints, the project was required to focus on the creation of this academy, while also providing tools for future evaluation efforts, after completion of the training for these officers.

Furthermore, before the grant award, the OCFRD Fire Chief retired, ushering in an Interim Fire Chief at the start of the project. By the end of the project, a final Fire Chief assumed leadership of OCFRD. Needless to say, three leadership changes created divergent opinions about the overall project's future at the OCFRD. However, there was the constant presence of the Training Division Chief who contributed a consistent vision and objective for this project.

Concurrent with the personnel transitions that OCFRD experienced, certain union agreements pertaining to promotional academy scheduling, testing, and evaluation criteria also influenced the project. These issues which many organizations experience, limited immediate UCF-IST abilities to record human performance data. Due to the fact that many of the materials created and piloted occurred during previous scheduled promotional academies, it is understandable that these union rules required personnel confidentiality.

As stated above, the FEMA grant contained certain parameters, one of which was the creation of an Incident Command Academy capable of training officers from four Central Florida counties. Though the grant and project focus was on OCFRD, other counties requirements and policies had to be considered, to maximize validity and transverse organizational differences. The resulting curriculum and simulation was specific enough to meet the needs of OCFRD's policies and compliance with NIMS and ICS requirements, while being broad enough to aid adjacent counties and foster regional cooperativeness.

Lastly, the technological capabilities of OCFRD's fire stations, current training center, proposed future training center, and changing learning management systems (LMS) created other limitations on the overall project. Researchers early on determined that most fire stations contained dated equipment, software, and limited bandwidth. Furthermore, initial capability assessments were reassessed after the academy was relocated to another facility. Changes to OCFRD's LMS, also resulted in changing capabilities, requirements, and separation of training records.

The following section describes the method that researchers utilized to get around these limitations and the project work that resulted in a functioning Incident Command Academy.

PROJECT METHODS

The research team used a project methodology that is based on a functionally validated model (Tarr, et al 1996, 2002; Morris & Tarr, 2002) called the Advanced Performance Technology Model (APT) illustrated in **Figure 1**. The model is comprised of seven components, with corresponding application to this project: (1) Front-end performance analysis, (2) identify the audience make-up and environment, (3) identify the technology alternatives, (4) design of learning strategy, (5) develop training scenarios, (6) implementation and feedback and (7) continually evaluate the effectiveness of each step to meet required performance.

Figure 1: The Advanced Performance Technology Model (APT)

First, researchers conducted a thorough literature review that detailed national training issues in the Fire Service. Findings concluded that due to fewer fires and the retirement of senior personnel, current Incident Commanders have fought only a fraction of the fires that their forbearers did. In addition, the Orange County Fire Rescue Department now forbids the use of live-fire training exercises, due to the risks for participants and the experience of personnel loss in such training sessions in previous years. Thus, any training intervention would require substantial simulation capabilities that could provide the necessary "virtual experience" and confidence to perform Incident Command functions on the fire scene.

Researchers then viewed the current training program, which consists of a two-week academy for Company Officers or Battalion Chiefs. Battalion Chiefs as instructors deliver lecture content and supervise Company Officers during low-fidelity simulation exercises. Lecture content is kept off site on a Battalion Chief's personal thumb drive, with no access granted to students until they are in the classroom. No central textbook is used, rather, an amalgamation of points from various textbooks are correlated into brief classroom discussions.

Additionally, the research team reviewed the intended intervention audience and the available training environment infrastructure. The grant intended for Company Officers, Captains, and Battalion Chiefs to undergo one week's worth of Incident Command training. This eclectic mix of officers meant that the training audience could contain Engineers with less than five years of experience to Battalion Chiefs with nearly thirty years of experience. Despite this audience complication, the taxonomy discussed above allowed for a tailored approach of various different types of content that could be adjusted to meet the audience's skill level.

After a thorough review of the existing training program, researchers met with several subject matter experts to analyze and document in detail the exact cues, decisions, and performances required of Incident Commanders in the field. These meetings resulted in the creation of Incident Commander Performance Skill Taxonomy, which detail the 150 separate actions that an Incident Commander performs during a variety of incidents. The taxonomy listed the actions taken, the frequency of said actions, measurements of success, conditions the performances can occur under, and critical failure points, as per NIMS requirements and OCFRD Standard Operating Procedures (SOP).

During this same period, researchers inspected and tested the training environment and infrastructure of OCFRD to understand the available technology alternatives. The OCFRD Training Center can accommodate an estimated class size of 10-20 fire fighters. The training center contained twenty outdated computers that supported a Microsoft 2003 software package and basic Adobe flash software. In addition, the training center contained a smart board where a low-fidelity simulation that is housed on Orange County servers, is utilized. This system requires fourteen role players, each sitting at an individual computer station, along with a dispatcher, and two lead instructors to run the simulation.

Researchers reviewed available web- and computer-based technologies that could be employed in this project. The goal was to find a system component that could disseminate the required training materials through a learning management system (LMS) or through a HTML page based system. Based on the input from the previous two APT phases, researchers determined that the OCFRD infrastructure would not support many advanced learning applications due to size, data streaming, and computer availability at individual stations. In addition, due to county firewalls and web-page blockers, HTML-based web-pages would encounter significant issues when pulling material from online. In all cases, these materials could then be transferred to a LMS, upon an internal upgrade of OCFRD infrastructure.

PROJECT STRATEGY

With the literature review, skills matrix, performance taxonomy, and OCFRD infrastructure accounted for, researchers developed a Training Intervention Strategy. This strategy was designed around the use of digital materials combined with constructivist learning theory, which states that retention and knowledge come from sustained access to information, practice with such information, close remediation, and self-assessment after the fact (Ismail, 2002; Fabianic, 2002; Tsai, 2003; Zhang, 2006; Tsai, 2009). The strategy was first conceptualized and then refined over the course of two months of consultations with OCFRD trainers and subject matter experts. Understanding the limitations of union and contract requirements, facility operation, and administrative organization was imperative, as it provided a real world framework that had to be accounted for in the Training Design Intervention Strategy.

After consultations with OCFRD trainers, the team refined this strategy that utilized pre-training, in-class training, web-based training, desktop simulation, and immersive simulation, that were interwoven together, which provided a consistent body of instruction for Incident Commanders. **Figure 2** illustrates the overall course level view of the Training Design Intervention Strategy and the interrelation between curricula components within the one-week training period.

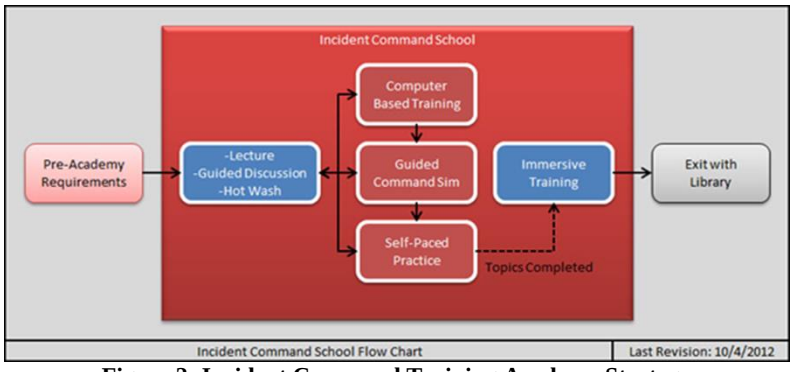

Figure 2: Incident Command Training Academy Strategy

This strategy resulted from the APT Model, which determined that a series of training interventions would be required to build up a student's knowledge, confidence, and skill competencies before reentering the field. The first step was providing student's access to a series of Pre-Academy materials, which constituted a reference textbook and eleven self-paced distributed learning Pre-training modules. These materials would prepare the student for more fruitful in-class training. The in-class portion of the academy constituted standardized lectures, guided discussions on case studies, and review "hot washes" that provided reflective exercises on the day's topics. In addition, in-class training was paired with computer-based activities, created in *Captivate*, which would serve as additional practice for students. OCFRD's existing low-fidelity flash-based program was updated and served as another wrung of practice for students. Self-paced practice items constituted a remedial option for instructors to target student deficiencies on a class-by-class basis. The immersive training portion served as a high-fidelity Incident Command simulator, which will be described further in the next section. The academy was completed with continual access to a digital library, containing all OCFRD training materials.

SIMULATION DESIGN

The simulation design relied on the diverse skillsets of both instructional designers and gaming and simulation developers who investigated existing firefighter simulation models, applications, and hardware. Researchers discovered that current over the counter simulators were more geared towards firefighter role players than an Incident Commander. In addition, other command simulators either provided too much visual information that Incident Commanders do not have access to, or did not provide enough immersive feedback. This lack of feedback does not allow for review and critique of specific skills, such as: situational awareness, hazard recognition, accountability, and decision-making. Based on these combined efforts, researchers determined that many of the other simulators on the market did not adequately target the necessary Incident Command skills that are important to success on the fireground, requiring the creation of a new system for OCFRD.

The goal of the simulation design was to engage trainee's imagination and immerse them in the event with only the tools they would have on the fireground. The design necessitated direct, nonstop command interaction by the Incident Commander for successful completion. The immersive simulation required the trainee to make dynamic decisions based on both parameters set for them by their trainer, and events that the trainer chose to trigger during the immersive scenarios. The result gave each trainee a customized experience, while allowing their small cohort group to discuss each of their individual experiences in review sessions. These review sessions enabled trainers and students to discuss performance and operational nuances, as well to clarify tactical and policy considerations.

After the simulation team tested existing simulators, they concluded that the creation of a tailored immersive simulator for OCFRD was required to meet the project specifications. The immersive simulator was produced using contemporary gaming and simulation tools. The *Unity3D* game engine was used due to its low cost and high functionality ratio. *Unity3D* has been used in past projects, giving a degree of customization required to create the unique fire system in the simulation.

With this engine's capabilities and limitations in mind, researchers sat down with OCFRD senior personnel and painstakingly outlined absolutely critical environmental cues, fire behavior, and scene clues. These cues and behaviors serve as signal posts for Incident Commanders in the field, as it helps them determine proper strategy and tactics to mitigate the situation. Examples of these cues are: smoke color, smoke speed, smoke density, fire spread, and a structure's reaction to these factors. Furthermore, researchers determined that numerous scene clues needed to be modeled, to help Incident Commanders understand the full scope of the scene. Examples of clues include: propane tanks, presence of vehicles, toys/yard clutter, structure construction type, and hazards. The following subsections describe particular features of the simulation, which are particularly critical for Incident Commander decision-making.

Dynamic Fire Based on Construction Materials

The spread of fire was one of the driving features of the simulation, as Incident Commanders must understand how to recognize various building materials from looking at the structure from the exterior. So the capability of controlling various damage states for the structure, and their growth over time as scene events happen necessitating incident command actions was a key dynamic element. To add to the dynamic nature of the system, the operator was given the ability to add and erase fires anywhere on the exterior of the structure. This gave almost complete control over how the simulation was run while still working within the designed realistic automated system.

Dynamic Smoke Movement and Ventilation System

As reading smoke is one of the priorities of the simulation, the capability to understand how smoke moves through the interior of the structures were very important. Seasoned Incident Commanders have developed advanced understanding of how the heat level, volume of the room, air pressure and the amount of fire determine the seriousness of the event; the system needed to have the capability to evolve based on those same elements. Giving the incident commander the capability to have firefighters opening doors and breaking windows allows them to affect which direction fire & smoke spreads as their actions change the air pressure in a room allowing smoke and heat to travel elsewhere.

Figure 3: Example of Smoke State

Dynamic Smoke Visuals Based on Construction Materials and Fire States

Smoke reading is an essential part of Incident Command training and the simulation. In reading smoke, there are four properties that define it: color, volume, velocity, and density. This was a prime driver of the simulation design, because it is critical that for Incident Commanders to witness smoke evolution, so they may understand how direction and intensity can change from a variety of factors, like building construction materials. Overcoming uncertain and sometimes swirling wind directions, including a wind change causing the smoke to block the incident commander's view of the fire, were capabilities deemed essential to the training.

IMPLEMENTATION

UCF-IST implemented this training intervention during an Engineer's Promotional Academy in June 2013. Students were given access to pre-training items on OCFRD's LMS, prior to the academy's start. During this pre-training time, instructors were trained on the use of the new materials, technologies, best practices, academy objectives, and evaluating tools. This aided institutional buy-in and mastery of tools and materials by the trainers, which in turn improved the student's academy experience.

Figure 4: Example of Fire State

Student's went through the academy and provided valuable feedback on their experience, which researchers used to refine the simulation, curriculum, and academy schedule. Unfortunately, though the surveys were valuable to researchers, limitations described above prevented more thorough data collection during this initial implementation.

After the completion of the first pilot academy and relevant edits were made based on student feedback, UCF-IST handed over the final submission of all materials, tools, and technologies to OCFRD. This enabled OCFRD to tweak and adapt the materials that were successful in the pilot, while also providing another level of institutional buy-in. Since the hand-off, over 300 Fire Officers from four counties have been trained utilizing the new Incident Command curriculum and simulation, with nearly unanimous positive feedback from trainers and students.

LESSONS LEARNED

While it was immediately obvious that the high-tech virtual reality simulator provided an impressive audio and visual experience for the student, both UCF-IST and OCFRD realized from the very beginning that the only meaningful measure of success would be observable improvements in the decision-making, communications, and tactical orders employed by OCFRD Incident Commanders during real-world emergency operations. From the first weeks of the training program, obvious changes in Incident Command behaviors were observed in officers who graduated from the program. As one senior officer commented, "I immediately could tell who had been through Command School when listening to fireground radio transmissions. The improvements in communication, tactical decisions and confidence were that obvious." The Incident Command Academy provided OCFRD with a program to standardize Command terminology and provide fireground supervisors with a decision-making background that would have taken years of real-world experience to develop. The scenarios and visual cues provided by the virtual reality immersive simulator presented students with dilemmas that firefighters face every day in the community. As perhaps the greatest testament to the success of the Incident Command Academy, following the conclusion of an aggressive wildland fire that threatened multiple houses, an OCFRD Lieutenant reported to one of the authors "that was exactly like we practiced in Command School. The tactics, the positioning of the units- I felt like I had done this before."

Recognizing that firefighters work in close-knit teams, OCFRD managers decided to assign students to the Incident Command Academy in cohorts, alongside the officers that they worked with every day. Each battalion, consisting of seven lieutenants, one captain and a battalion chief, were relieved of their field duties and assigned to the 40 hour Incident Command Academy. Following this model, students were able to collaboratively learn with the teams who responded to emergencies together in the real world. In this way, command team cohesion was enhanced, battalion

chiefs were able to emphasize those points that most applied to their areas, and students were immediately able to apply the lessons learned when they returned to their battalions.

These lessons learned are applicable to defense and law enforcement organizations in numerous ways. First, the project illustrates that understanding the core competencies, skills, and in-the-field performances is necessary before training updates can occur, as to avoid unnecessary costs, wasted time, and too narrow of broad of a program scope. Second, though high-level discussions and work plans can help guide program work, researchers and managers need to be able to adapt to various limitations that present themselves throughout the project period. Third, team, battalion, or cohort training can increase unit cohesion, raise group tactical competency, while fostering a more open and positive environment. Fourth, materials and technology should be leveraged in a way to allow trainers to be highly adaptable in their application of such items, which will go above and beyond the original intent of the designers

CONCLUSIONS

This project represents the fulfillment of three years of planning and execution to improve the Incident Command Training Academy in Orange County and other Central Florida jurisdictions. From an initial exploration of front-end analysis in to the final submission of the new state-of-the-art training and simulation interventions, OCFRD and UCF-IST worked tirelessly and in close cooperation to meet the grant requirements and goals. It is the authors' opinion that this project represents a model for private enterprise, universities, and local organizations to come together to create common sense and cost effective training solutions for public agencies, like OCFRD.

UCF-IST in close conjunction with OCFRD created numerous materials that can improve the skills and performances of OCFRD Fire Officers. These materials include: standardized textbooks, standardized lectures, learner centered activities, supplemental computer-based activities, knowledge tests, evaluation forms, and a new immersive simulator. With these materials and with the training UCF-IST provided Fire Service trainers, OCFRD can implement the 80 hours of training content that will raise the level of Incident Commanders across the county. In addition, by cooperating with other Central Florida fire departments, OCFRD will help cultivate a system of best practices for Incident Command that will bolster mutual aid and bring all organizations standard operating procedures into a closer concert, thereby increasing safety and efficiency.

Future work will involve the collection of field performance data on tactical and vocabulary usage and standardization, to help quantify the improvement of Incident Commanders that was not possible under the current effort. Furthermore, future work will seek to model more cues, environments, and behaviors that were unable to be captured, due to time and funding constraints. Lastly, future work will expand upon the training's applicability to Engineer, Lieutenant, and Battalion Chief Incident Commanders, to involve Associate Chiefs, Division Chiefs, and Law Enforcement and other public sector stakeholder agencies. This expansion will delve into areas of Unified Command and Emergency Management, allowing for greater institutional coordination through cooperative training events.

ACKNOWLEDGEMENTS

The research team would like to thank Fire Chief Otto Drozd III, Division Chief Michael Wajda, and the entire Orange County Fire Rescue Department for their support in this project and their ongoing public services that keep our citizens safe.

REFERENCES

Anderson, D. & Dix, M. (2005), 'Training the Masses; Teaching ICS Over the World Wide Web,' *19th International Oil Spill Conference*, Miami Beach, FLA, 2005.

Auf der Heide, E. (1989), *Disaster Response: Principles of Preparation and Coordination*, Mosby, Baltimore, MD.

Fabianic, D. (2002). "Online Instruction and Site Assessment." *Journal of Criminal Justice Education*, 13: 1, 173-186.

FEMA. (2002). Trends in Firefighter Fatalities Due to Structural Collapse, 1979-2002. Washington D.C.

FEMA. (2004). NIMS and the Incident Command System Position Paper. Washington D.C. http://www.fema.gov/txt/nims/nims_ics_position_paper

FEMA. (2009). *U.S. Fire Administration's Firefighter Fatalities in the United States in 2008*.Washington D.C.

FEMA (2011). *U.S. Fire Administration's Firefighter Fatalities in the United States in 2010*. Washington D.C.

Hall, K. (2010). *The Effect Of Computer-Based Simulation Training On The Fire Ground Incident Command Decision Making*. Dallas: University of Texas.

Ismail, J. (2002). The design of an e-learning system beyond the hype. *Internet and Higher Education*, 4, 329-336.

Jensen, J. & Waugh Jr., W. L. (2014). 'The United States' Experience with the Incident Command System: What We Think We Know and What We Need to Know More About,' *Journal of Contingencies and Crisis Management*, Vol. 22(1): 5–17.

McCaslin, C. (2011), *Validating the Allen Fire Department Simulation*. Allen, Texas.

National Research Council. (2006), *Facing Hazards and Disasters: Understanding Human Dimensions*, The National Academies Press, Washington, DC.

NIOSH (2009), *A Summary of a NIOSH Fire Fighter Fatality Investigation: Nine Career Fire Fighters Die in Rapid Fire Progression at Commercial Furniture Showroom*—South Carolina. Washington D.C. http://www.cdc.gov/niosh/fire/reports/face200718.html

Nja, O. and Rake, E. (2008), 'An Essay on Research Methodology: An Alternative Approach to Incident Command Research through Participatory Action Research', *Journal of Contingencies and Crisis Management*, Vol. 16, No. 2, pp. 91–100.

Tarr, R. W., Green, G., Jacobs, J. W., Moskal, P. J. (1996). 'Results of the TRADOC review of distributed Interactive Simulation (DIS) requirements (IST-TR-96-19),' Draft report submitted to the Army Training and Doctrine Command, Ft. Monroe, VA.

Tarr, R. W., Mulligan, P., & Parrish, D. (2002). 'Using Multimedia in an Air Force Modeling and Simulation Web-Based Course without Losing Instruction,' SISO, Spring Workshop, Mar 02.

Tierney, K., Lindell, M. and Perry, R. (2001). *Facing the Unexpected: Disaster Preparedness and Response in the United States*, Joseph Henry Press, Washington, DC.

Tsai, M. J., & Tsai, C. -C. (2003). Information searching strategies in web-based science learning: the role of Internet self-efficacy. *Innovations in Education and Teaching International, 40* (1), 43-50

Tsai, M. J. (2009). The Model of Strategic e-Learning: Understanding and Evaluating Student e-Learning from Metacognitive Perspectives. *Educational Technology & Society*, *12* (1), 34–48.

Young, P. M., Gibson, A. S., Partington, E., Partington, S., Wetherell, M. (2013) "Anxiety, Stress, and Perceived Workload during the Command and Control of Computer-Simulated Fire Service Training Environments", *International Journal of Emergency Services*, Vol. 2 Iss: 2, pp.119 – 130.

Zhang, D., Zhou, L., Briggs, R. O., & Nunamaker Jr., J. F. (2006). Instructional video in e-learning: assessing the impact of interactive video on learning effectiveness. *Information & Management 43* (2006) 15–27.