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Validating the Allen Fire Department Simulation Training

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Certification Statement

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Abstract

The problem under investigation was the Allen Fire Department (AFD) has not validated that the computer-based simulation lab (SimLab) has prepared company officers for their responsibilities to effectively manage the emergency scene. The purpose of this applied research project was to validate the ability of the SimLab to prepare company officers for emergency scene management. Evaluative research was utilized to answer four research questions: (a) how does SimLab affect AFD company officers' situational awareness, (b) how does SimLab affect emergency scene communications, (c) how does SimLab affect AFD company officers' ability to manage their command assignments, (d) what are the main objectives that AFD company officers learn from SimLab training? To evaluate these questions, surveys were sent to all AFD company officers and AFD command officers, a personal interview was conducted with AFD Training Chief and the radio communications for twenty seven structure fires were evaluated. The results of the SimLab evaluation were mixed, with certain skills such as situational awareness and communications showing improvement, whereas other skills, such as air management and fire ground tactics failed to transfer from the SimLab to the emergency scene. The recommend approach for SimLab is to place more emphasis on the proper communications process, ensure all benchmarks are communicated, place more focus on individual command assignments, reevaluate the importance and practicality of certain objectives, establish a standardized post evolution critique and create an evaluation process to be completed by company officers after each SimLab training period.

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Validating the Allen Fire Department Simulation Training

The Allen Fire Department (AFD) recently implemented a new company officer training program that is completely based on computer simulation. Computer-based simulation training offers numerous technical and professional occupations a newer means of training. The fire service is one example of a profession that is experiencing changes in how training is conducted based on advances in computer-based simulation training. The problem is the Allen Fire Department (AFD) has not validated that the computer-based simulation lab (SimLab) has prepared company officers for their responsibilities to effectively manage the emergency scene. This potentially leads to ineffective communications, substandard decision making and inadequate scene organization that results in misallocation of resources, a lack of coordination and potential loss of life.

The purpose of this applied research project (ARP) is to validate the ability of the AFD SimLab to prepare company officers for emergency scene management. The purpose of the ARP shall be accomplished by thoroughly evaluating the competencies of AFD company officers based on the objectives taught in the SimLab in regards to situational awareness, emergency scene communications, personnel management and accountability. By validating the SimLab, the AFD can be assured that their company officers are receiving the training needed to effectively manage the emergency scene.

The research questions for this ARP are (a) how does SimLab affect AFD company officers' situational awareness, (b) how does SimLab affect emergency scene communications, (c) how does SimLab affect AFD company officers' ability to manage their command assignments, and (d) what are the main objectives that AFD company officers learn from

SimLab training? The research method that will be used in this ARP to validate the SimLab is evaluative research.

Background and Significance

The City of Allen (COA) is a compact suburban community largely composed of commercial developments, industrial districts, mid-rise office buildings, retail shopping centers (including one of the largest outdoor malls in the Southwest), multi-story hotels, restaurants, and large residential subdivisions. Allen is located 24 miles north of downtown Dallas in Collin County. Allen's residential population totals approximately 90,000 with a transient population averaging between 100,000 to 125,000 (City of Allen [COA], 2009). The land area of Allen is approximately 27.11 square miles, of which only 0.68 is unincorporated (COA).

The AFD currently operates out of four stations, consists of 103 personnel, and provides medical services, fire suppression, specialty rescue, emergency management, and fire prevention to the COA. The AFD currently has a total of 12 station captains who fulfill the role of company officer. The AFD also has a total of 12 drivers/operators/engineers (DOE) who fulfill the role of company officer in the absence of the station captain. The AFD currently has three battalion chiefs, with each assigned to a separate shift. Each battalion chief is assigned an administrative captain who assumes the role of acting battalion chief in the battalion chief's absence. The battalion chief or administrative captain fulfills the role of incident command (IC) on all working fires.

In addition to emergency response and management, the AFD offers other valued services to the community including the citizen fire academy, public education, CERT training, home and business fire inspections, fire safety education classes, and cardiopulmonary resuscitation training. The AFD frontline apparatus includes three engines, one ladder truck, four

mobile intensive care units (MICUs), one specialty rescue vehicle, one incident command vehicle, one brush truck, and two heavy rescue trailers.

In June 2008, the AFD adopted a new operational strategy that required strict use of National Incident Management System (NIMS) philosophy, scene organization and terminology. The AFD requires strict use of NIMS scene organization and terminology on the fire ground. The new operational strategy requires at a minimum that the IC utilizes the command assignments of groups and divisions on all working fires. This new operational strategy required that company officers understand the principles of NIMS scene organization and terminology.

The AFD established two standard operating procedures (SOP) to support and enforce the new operational strategy. SOP 240.01, Incident Management System (IMS), states the only accepted IMS for the AFD is NIMS and that NIMS will be utilized on all working fires (Allen Fire Department [AFD], 2009a). SOP 240.02, Incident Command, requires the IC to utilize the command assignments divisions and groups whenever possible to reduce the span of control and provide an effective command organization (Allen Fire Department [AFD], 2009b). SOP 240.02 states that divisions and groups shall be commanded by company officers or acting officers and when assigned as a division or group supervisor they are expected to account for all assigned companies, maintain communications with the assigned companies and command, complete objectives, maintain an accurate situational awareness, monitor work, coordinate actions with adjacent divisions or groups and provide command with frequent progress reports (AFD, 2009b). Both SOPs require company officers to possess a full understanding of NIMS and all the objectives division or group supervisors are expected to complete.

The new operational strategy and SOP 240.01 and 240.02 created a significant problem for the AFD since none of their company officers had ever received any “hands-on” training with

NIMS. Since AFD company officers had little to no knowledge of NIMS and very limited experience managing multiple companies as group or division supervisors, the AFD implemented a new company officer training program. The AFD broke the status quo of only training company officers with field exercises and implemented a new computer-based simulation training program.

The AFD established the SimLab as the primary tool to train all company officers. The SimLab utilizes a computer simulation program called Flame-Sim and consists of three separate rooms, with two of the rooms being divided into a total of nine separate cubicles. This creates places for ten active participants with each participant viewing and controlling their own computer. This setup allows a total of ten individuals to actively participate as company officers in each scenario. Each company officer is given an assignment by the IC, and depending on the assignment the company officer may be given multiple companies to manage. The company officer must safely and effectively manage their crew(s) and complete their assignment. The only way company officers can communicate with command or other company officers is over the radio. Each company officer must participate in the SimLab a minimum of six times a year.

The AFD relies on the SimLab as the main training tool to support the new operational strategy. The AFD utilizes the SimLab to teach company officers the main components of emergency scene management. At no point has the AFD verified that the components taught in the SimLab have been applied to emergency scene management by company officers. Company officers are expected to learn the components taught in the SimLab and to apply them on the emergency scene, but the AFD has not validated that the components taught in the SimLab are actually applied in the field.

There is no evaluative process to ensure SimLab training reinforces the main objectives of the new operational strategy. Upon completion of SimLab training, the AFD does not evaluate company officers' understanding of what is being taught in the SimLab. Participants do not complete a post-training evaluation form and no measure is currently applied to test their level of understanding or to seek their input.

The AFD assumes that the material taught in the SimLab is understood by the company officers and applied to the emergency scene. There is no certainty that all the company officers understand all or any of the components taught in the SimLab. The AFD has not evaluated or critiqued fire or other emergency incidents to verify the impact of SimLab on company officers' performance. The truth of the matter is the AFD has no valid idea if SimLab training prepares company officers to manage their responsibilities on the emergency scene.

This ARP and validating the SimLab for preparing company officers to manage their responsibilities on the emergency scene clearly ties to the key concepts and attitudes needed to improve executive leadership at the company officer level. There is a clear link between this ARP and several units of the Executive Leadership course, but preciously Unit 4: Decision-Making Skills (U.S. Department of Homeland Security [DHS], 2010). This ARP will potentially validate the SimLab as an effective training tool to improve company officers decision making process on emergency scenes, which is in accordance with the content of the Executive Leadership course (DHS). In addition, this ARP directly links with the United States Fire Administration (USFA) operational objective and goal for fire services to respond and recover from all hazards (U.S. Fire Administration [USFA], 2008). By applying the criteria of this ARP, the AFD will be better prepared to respond to all hazards by improving training at the company officer level.

Literature Review

Technology has impacted many facets of how organizations operate and train. The fire service is no different. The Department of Homeland Security (DHS) established as one of its top priorities to help develop technologies and systems that will assist fire service organizations in preparing and responding to hazards (Dittmar, 2008). Computer-based simulation training is designed to better prepare firefighters and officers to face the challenges of hazard mitigation (FireRescue1, 2006). Simulation incorporates advances in technology to provide fire service organizations new means to train fire officers. A large body of evidence does exist that validates the correlation between the use of computer-based simulation for training and the transfer of increase in skill levels (Hall, 2010).

The emergency scene is very chaotic and even the most well managed scene can be disorganized at times, requiring impulsive decisions with limited or inaccurate data. In a fire incident, the environment is very dynamic with risk factors rapidly multiplying due to increases in super heated atmospheres, toxic products of combustion and the impending threat of structural failure or collapse (Grimwood, 2008). Company officers must lead their assigned crews into an unknown hazardous environment to coordinate or direct individual task-oriented activities which are assigned by the IC as part of the overall incident mitigation plan (Hall, 2010). Company officers must recognize and appropriately respond to the dynamic environment of a fire incident, using their experience and knowledge to assign an array of required tasks to multiple workers in a coordinated approach for successful incident conclusions (Flin & Arbuthnot, 2002).

In order to complete certain operational tasks assigned by the IC on the fire ground, company officers must be able to manage multiple crews (Hall, 2010). Using multiple crews to complete simultaneous tasks in a hazardous environment can be very challenging for company

officers. The ability of company officers to maintain personnel accountability correlates with their ability to understand and analyze their environment (Hall). Company officers must continuously assess the situation to effectively and safely manage their personnel. This is called situational awareness.

Situational awareness is the ability to perceive the environment elements within a defined amount of time and understand their meaning on the current and near-future situation (Endsley & Garland, 2000). Analyzing the situation to discovery new information allows company officers to gain a better understanding of their circumstances, which allows the situation to become predictable and controllable (Timmons, 2009). Gaining a better understanding of their environment provides company officers and the IC the information to make more informed decisions, which according to Hall (2010) enhances the decision makers' ability to manage their resources in more effective and safe manner.

Training in a simulator provides the participants (company officers) a means to develop their situational awareness skills in a safe environment. Simulators have the ability to provide training that facilitates real time experience and assessment for company officers, which improves their knowledge of the environment and ability to effectively and safely manage their personnel (Ross, 2002). Simulation training creates the type of individual and team environment that is the primary strategy for enhancing an individual's situational awareness (Stanton, Chambers, & Piggott, 2001). This type of training allows company officers to develop their situational awareness skills and obtain a better understanding of their environment.

Understanding the elements of the environment, allows decision makers to respond faster and in a more efficient and effective manner (Endsley & Kris, 1995). When the environment becomes

predictable and controllable, decision makers manage their resources in more effective and safe manner (Hall, 2010).

Simulation training improves situational awareness by providing participants an opportunity to evaluate their surroundings and receive immediate feedback. Simulation training teaches its participants to search for necessary clues to draw an accurate picture of their current situation and the situation in the near future (Murgallis, 2001). In addition, simulation exercises provide an opportunity to develop critical thinking skills in regards to their situation and receive feedback in real time on how their decisions impact their situation (Cohen, Freeman, & Thompson, 1998). The Texas Engineering Extension Services developed a simulation training center that teaches each company officer involved in the simulation that their decisions change the overall situation and impact all participants (Markley, 2008).

In addition to impacting situational awareness, simulation training provides an opportunity for fire service organizations to improve emergency scene communications. Simulation training can be used to enhance communications. The medical field uses simulation-based learning to improve doctors' ability to effectively communicate with patients, relatives, and other health care providers (Fatimah, 2010). Simulation allows individuals to interact in a controlled environment that mimics real incidents and receive immediate feedback. Simulation training develops teamwork and communication skills that are essential in high stress environments (Fatimah). Training communication skills requires practice in simulated environments where good communications skills can be learned and enhanced (Bosse et al., 2010).

In dynamic, stressful environments it is important for communications to be clear, concise and easily understood by everyone involved. For this reason, NIMS mandates that all

communication between organizational elements during an incident should be in plain language to ensure that information dissemination is timely, clear, acknowledged and understood by all involved (U.S Department of Homeland Security [DHS], 2008). In addition, the Department of Homeland Security (DHS) states for effective communications words must have a single definition (FEMA, 2008). NIMS provides specific instructions on how company officers and the IC are to communicate on the emergency scene (FEMA). By implementing a systematic process to communicate on the emergency scene company officers and ICs are better equipped and prepare to manage and track their personnel (DHS, 2008).

To ensure that the IC and company officers understand the communication process for emergency response and mitigation, it is important the process is ingrained through repetition and training. In order to manage incidents effectively the appropriate communication habits must be develop through training (FEMA, 2008). The best way to develop good communications skills is through training utilizing stimulations (Thiel, 1999). Several studies have shown that simulation is required for effective communication training (Bosse et al., 2010). Simulation training provides fire service organizations a controlled environment to develop and ingrain the communication process into its command and company officers.

Often on emergency scenes, company officers may be assigned multiple companies. It is imperative that company officers are able to communicate with their assigned resources and the IC (Thiel, 1999). Inadequate fire ground communication has a definite negative impact on the safety of emergency personnel and is repeatedly cited as a contributing factor in firefighter injuries or deaths (Thiel). To improve emergency scene communications, NIMS stresses the importance of a standardized communication process, common terminology and adequate training (FEMA, 2008).

To help ensure a standardized communication process is established on the emergency scenes, the AFD adopted SOP 230.02, Radio Communications, which require all communications at the scene of an emergency follow a basic format that will maintain consistency (AFD, 2009). According to SOP 230.02, to begin a radio transmission, the sender must identify both the unit initiating the message and the unit where the message is directed (AFD). The receiving unit will acknowledge that it is ready to receive the message at which point the sender will send the message. The receiving unit will acknowledge the receipt of the message by stating the receiving unit's identification number and a brief restatement of the message (AFD).

In addition to creating a standardized communication process, NIMS establishes command assignments for when the acceptable level of span of control is exceeded. NIMS directs the IC to assign command assignments of groups and/or divisions when the scope of the incident exceeds the IC's span of control, and on larger incidents the tactical assignment of branches is utilized (DHS, 2008). Per SOP 240.02, it is AFD's policy that the IC will assign groups and/or divisions as command assignments on all working fires (AFD, 2009b). Simulation training allows organizations to create scenarios where different tactical assignments can be used (Ross, 2002). This creates familiarity with the terms and concepts and allows organizations to expand or contract their communication model based on the scope of the incidents.

Based on NIMS, no one operating on an emergency scene that is not yet under control should have more than five personnel reporting to him/her (FEMA, 2008). NIMS creates the standardized command assignments, division and group, for when the number of resources exceeds the IC's or company officer's span of control (Phillips, 2010). NIMS also established the command assignment, branch, for large scale incidents when the span of control is exceeded

utilizing groups and divisions. In addition to NIMS, National Fire Protection Association (NFPA) 1500, Standard on Fire Department Occupational Safety and Health Program, states that the IC shall establish an organizational structure with sufficient supervisory personnel to control the position and function of all members operating at the scene, maintains an effective span of control and designates supervisors in charge of specific geographical areas or functions (National Fire Protection Association [NFPA], 2007).

For this reason, the AFD mandates that on all working fires and rescue emergencies the command assignments groups and divisions be utilized, and on larger incidents the command assignment branches be utilized. Divisions separate physical or geographical areas of operation within an incident, while groups separate functional areas of operation for the incident (DHS, 2008). Divisions always refer to a geographical assignment and groups always refer to a functional assignment and both command assignments may be used in a single incident (DHS). In addition, a single incident may require the use of multiple divisions and groups. Branches can incorporate both divisions and groups and are usually only utilized on large scale incidents (DHS).

Each division and group can be assigned multiple resources until the maximum level of an effective span of control is reached, which is usually five resources (FEMA, 2008). One individual usually a company officer from one of the first arriving apparatus is assigned as the group or division supervisor (FEMA). For example, the command assignment “Division Two” would indicate the responsibility for all tactical activities on the second floor and “Division Two” could be assigned two additional engine companies and one truck company (DHS, 2008). As the division or group supervisor, the company officer must be able to gather, update, and apply situation awareness relevant to the assignment, establish an organization structure within

the command assignment (division or group), reporting procedures, communicate effectively with IC and assigned resources, and account for all assigned personnel (National Wildfire Coordinating Group [NWCG], 2009).

In order for company officers to understand and effectively manage their command assignments, they must train in a realistic environment and build successful habits. NFPA 1561, Standards on Emergency Services Incident Management System, outlines guidelines for training the IC and positions of authority and requires training that provides realistic full scale exercises and simulations in order for individuals to become competent in their roles (National Fire Protection Association [NFPA], 2005). The Federal Emergency Management Agency (FEMA) strongly suggests an everyday application of NIMS and NIMS command assignments in order to develop the appropriate habits (FEMA, 2008). Simulation training allows company officers to rehearse their skills and gain a better understanding of their assignments (Halton & Nee, 1999).

Computer-based simulation is not a new concept. Multiple organizations use some form of simulation to teach specific objectives. The U.S. military has used simulators to train soldiers to become proficient in warrior tasks, battle drills and logistics (Hank, 2005). The medical field uses simulators to train students and faculty members on specific objectives such as: surgical techniques, ultrasound in trauma care, anesthesia and intensive care (Center for Medical Simulation, 2009). Simulation is an effective training tool to teach specific objectives to it participants.

The AFD implemented SimLab training as their primary tool to train company officers. The AFD identified six main objectives taught in SimLab that company officers should learn and develop, which are: scene organization, communications, company integrity, air management, personnel accountability and strategy/tactics (AFD, 2009c). These objectives are taught through

multiple scenarios. The AFD designed a lesson plan checklist to ensure that all objective benchmarks were met.

In addition to the objectives taught directly in the SimLab, SOP 240.02 lists several objectives that company officers are expected to meet when acting as a division or group supervisor. The objectives listed in SOP.240.02 include, account for all assigned companies, maintain communications with the assigned companies and command, complete objectives, maintain an accurate situational awareness, monitor work, coordinate actions with adjacent divisions and groups and provide command with frequent progress reports (AFD, 2009b). The objectives listed in SOP 240.02 mirror the objectives taught in the SimLab.

In review, research has shown that simulation is an effective training tool. Simulation allows its participants to learn the tools necessary to gain a better understanding of their current environment. In addition, by gaining a better understanding of one's environment their decision making ability is improved (Hall, 2010). Simulation is an effective training tool to improve situational awareness and communications. Professions like the military and medical field have been using simulation training for years to improve communication skills. Incorporating communications with simulation training creates familiarity with the terms and concepts and allows for the expansion or contraction of the communication model based on the scope of the incidents.

While advancing technology has changed the format of simulation training, simulation training itself is not a new concept. Numerous professions have been relying on simulation as their primary training tool for years. In addition, research has shown a correlation between the use of simulation and the transfer of skill level (Hall, 2010). Simulation allows the participants to learn key objectives, such as those outlined in SOP 204.02, in a controlled and safe environment.

Procedures

A survey of all AFD company officers was conducted (Appendix A). The AFD has 12 station captains and 12 DOEs. The DOEs were surveyed as company officers due to the reason that the DOE is expected to perform as the company officer anytime the station captain is not at work. The survey was sent to a total of 24 AFD employees. The survey was sent out utilizing the internet software “Survey Monkey.com” to all station captains and DOEs. The survey was sent out on October 8, 2010, and the researcher selected December 15, 2010, as the cutoff date for responses. The researcher selected December 15, 2010, to provide adequate time to compile the data obtained from the survey.

The survey sent to all AFD station captains and DOEs consisted of 27-questions. The survey consisted of 15 yes/no questions, nine multiple answer questions, one short answer/essay question, and two rating questions. The multiple answer questions allowed for more than one answer and were used to identify specific criteria. The essay question allowed the responder to explain answers that were specific to their experiences. The rating questions utilized a four-point Likert scale for responses. The four possible ratings for each criterion were poor, good, very good and excellent.

The purpose of the survey was to evaluate several key components of SimLab training and to obtain data on each component’s application on emergency scenes. It was the researcher’s intent to gain enough data from the survey to verify if the objectives taught in SimLab were being transferred to the field. In addition, the researcher intended to identify which SimLab objectives were successfully transferred to the emergency scene. Descriptive statistics were used to evaluate the data collected from the surveys. Frequencies of each question provided percentages for comparison among questions. The survey was limited to company officers and

DOEs due to the reason they were the active participants in SimLab and the ones who were expected to successfully complete the objectives based on the SimLab lesson plan and SOP 240.02.

A separate survey was sent to all battalion chiefs and administrative captains in the AFD (Appendix B). Since the researcher holds the rank of battalion chief in the AFD, he did not complete the survey. The second survey was sent to a total of 5 AFD employees. The survey was sent out utilizing the internet software “Survey Monkey.com” to all battalion chiefs and administrative captains. The survey was sent out on October 8, 2010, and the researcher selected December 15, 2010, as the cutoff date for responses. The researcher selected December 15, 2010, to provide adequate time to compile the data obtained from the survey.

The second survey consisted of 25-questions. The survey consisted of 16 yes/no questions, six multiple answer questions, one short answer/essay question, and two rating questions. The multiple answer questions allowed for more than one answer and were used to identify specific criteria. The essay question allowed the responder to explain answers that were specific to their experiences. The rating questions utilized used a four-point Likert scale for responses. The four possible ratings for each criterion were poor, good, very good and excellent.

The purpose of the second survey was to evaluate several key components of SimLab training and to obtain data on each component’s application on emergency scenes from the IC perspective. In addition, the researcher intended to compare the results of the command officers survey answers to the survey answers of the company officer. It was the researcher’s intent to gain enough data from the survey to verify if the command officers witnessed and/or believed the objectives taught in SimLab were being transferred to the field. In addition, the researcher intended to identify which SimLab objectives the command officers believed were successfully

transferred to the emergency scene. Descriptive statistics were used to evaluate the data collected from the surveys. Frequencies of each question provided percentages for comparison among questions. The survey was limited to battalion chiefs and administrative captains due to the reason they were the only AFD personnel who assumed the role of IC.

Both surveys were broken into four components based on the research questions. Questions evaluating environment conditions, current actions to mitigate hazards, and current needs to carry out mitigating actions were placed in the situational awareness component. Questions evaluating radio communications, communications with the IC, communications between different command assignments, communicating emergency traffic or mayday and evaluating the amount and conciseness of radio communications were placed in the communications component. Questions evaluating how the command assignment is understood, expectations of a group or division supervisor, personnel accountability and company integrity were placed in the command assignment component. Questions evaluating scene organization, communications, company integrity, air management, personnel accountability and strategy/tactics were placed in objectives component.

The limitations of this survey include delivery issues, misunderstandings, and return issues. The possibility of misunderstanding survey questions or bias could affect and limit the accuracy of the survey. It is possible the individual completing the survey could unintentionally select the wrong answer. In addition, it is possible the individual completing the survey could fail to save the survey answers before submitting the survey. It is possible the virus protection or firewall protection used by the AFD could block the delivery or return of the survey.

In addition to the surveys, a personal interview with Training Chief Jon Boyd was conducted (Appendix C). Chief Boyd is a key individual in creating the SimLab and conducting

SimLab training. Chief Boyd is responsible for creating SimLab scenarios, managing and scheduling SimLab training, and conducting and evaluating all training. Chief Boyd has given numerous presentations over the benefits and strengths of the AFD SimLab. Some of his presentations include fire departments from numerous states, the 2010 Fire Rescue International convention in Dallas and the 2010 International Association of Fire Chiefs convention in Chicago. The interview occurred on October 13, 2010, in the AFD Conference Room. The interview was tape-recorded for accuracy in transcribing all responses.

The limitations with the personal interview with Chief Boyd include bias and communication issues. Since Chief Boyd has been actively involved in SimLab from the planning phase through full implementation, he potentially possesses bias towards the benefits and strengths of SimLab. His active involvement with SimLab may limit his ability to objectively evaluate the program. In addition, it is possible Chief Boyd may have misunderstood a question or the researcher may have misunderstood an answer.

In addition to the surveys and the personal interview, the researcher listened to the radio communications for 27 working structure fires from January 2007 through December 2010 (Appendix D). The researcher did not have access to the recorded radio communications for all working structure fires during this time period. The researcher listened to the radio communications for all structure fires that were available during this time period. The researcher listened to the radio communications for a total of 27 structure fires. The researcher selected January 2007 as the beginning time period in order to provide numerous structure fires to listen to before SimLab training was implemented. The radio communications of ten structure fires was listened to before SimLab training was implemented in June 2008. The researcher selected December 2010 as the cutoff date to provide adequate time to compile the data. The radio

communications of 17 structure fires was listened to during or post-implementation of SimLab training.

The researcher evaluated the radio communications of each structure fire for the consistency in NIMS terminology and command assignments, proper procedure for conducting a personnel accountability report (PAR), proper process for communicating over the radio according to SOP 230.02 and communicating the six benchmarks listed in SOP 240.02, which are primary search, under control, PAR, secondary search, loss stop and a second PAR (AFD, 2009b). By evaluating radio communications prior to the implementation of SimLab training, during and immediately following SimLab, and several months post-implementation of SimLab, the researcher anticipated evaluating any changes or improvements in the performance of company officers' communications and objectives completion.

The researcher divided the structure fires into three different time periods. The first time period was from January 2007 through May 2008. This time period represents the structure fires that occurred prior to SimLab and includes ten structure fires. The second time period was from June 2008 through June 2009. This time period represents the structure fires that occurred during or within one year of the implementation of SimLab. There were nine structure fires that were evaluated during this time period. The last time period was from July 2009 through December 2010. There were eight structure fires evaluated during this time period.

The limitations with evaluating the radio communication of the structure fires include technological issues and miscommunications. It is possible during the editing phase that pertinent radio communication was unintentionally deleted. In addition, it is possible that the radio user at the structure fire experienced radio equipment failure and was not able to transmit radio communication. Since only the radio communications were evaluated, any face-to-face

communication cannot be evaluated. This creates the possibility that objectives or benchmarks were completed, but not announced over the radio. The potential for the researcher to misunderstand the radio communication also exists.

Results

The first research question focuses on determining how SimLab affects company officers' ability to understand situational awareness. During the personal interview with Training Chief Jon Boyd, he stated, "SimLab forces its players (company officers) to constantly analyze their environment in order to make good decisions. The outcome of the scenario will vary depending on how the players (company officers) react to their environment" (Jon Boyd, Personal Communication, October 13, 2010). Chief Boyd stated he had witnessed a significant improvement in how AFD company officers analyze their environment in the SimLab since the implementation of the training. According to Chief Boyd, "There has been a major improvement in situational awareness with the progression of SimLab. It is impossible for the players (company officers) not to improve on how they analyze their environment in order to successfully mitigate the scenario (Jon Boyd, Personal Communication, October 13, 2010).

The results of the survey taken by company officers showed positive findings in regards to improving company officers situational awareness. Of the 24 who took the survey, 19 (79%) indicated their ability to analyze their conditions, actions and current needs has improved as a result of SimLab training. An overwhelming majority of 23 (96%) company officers stated they knew what information to communicate in regards to their current condition, actions and needs. Fifteen (62%) company officers rated the SimLab as "Good" and seven (29%) of company officers rated the SimLab as "Very Good" on situational awareness components.

The results of the survey taken by command officers (battalion chiefs and administrative captains) showed a small overall lower level of confidence in company officers situational awareness ability compared to the results of the company officer survey. Three out of the five command officers believe the SimLab improves company officers' ability to analyze their conditions, actions and current needs on the emergency scene. A slight majority 3 (60%) of the command officers indicated they felt company officers knew what information to communicate in regards to their current conditions, actions and needs. Four (80%) command officers rated the SimLab as "Good" and one (20%) command officer officers rated the SimLab as "Excellent" on situational awareness components.

Table 1 table shows the breakdown and comparison of company and command officers answers for all questions regarding situational awareness components. Any questions that addressed evaluating environment conditions, current actions to mitigate hazards and current needs to carry out mitigating actions are included. The number of responses is listed first as a numerical value, followed by the percentage in parentheses.

Table 1. Ratings and Comparison of Situational Awareness Components

Questions:	Company Officer (YES)	Commanding Officer (YES)
SimLab improves company officers' ability to analyze their conditions, actions and current needs?	19 (79%)	3 (60%)
SimLab improves company officers' knowledge on to what information to communicate in regards to their current condition, actions and needs?	23 (96%)	3 (60%)

The survey results and interview with Chief Boyd show similar findings with minor discrepancies in a few situational awareness components. A large majority of both company and command officers agree with Chief Boyd that SimLab has improved company officers' ability to analyze and communicate their current conditions, actions and needs. Both groups of officers gave the SimLab high ratings in the situational awareness components with a larger percentage of company officers giving it a slightly higher overall rating.

The second research question focuses on determining how SimLab affects emergency scene communications. Chief Boyd stated,

The biggest improvement we have seen since we started SimLab training is communications. Before we started SimLab the most common problem we had on structure fires was communications at all levels, the company officer and command. Now all I hear from everyone is how good our communications are. I have received messages from chiefs in neighboring fire departments on how good our radio communications sound. Look, we have established a training process that teaches proper communications based on NIMS and we are very consistent on the language and communication process we use. A small room and contents fire is not going to sound much different than a three-alarm structure fire. The same language and process will be used. You could go listen to a fire from all three shifts and there would be very little difference in the communications. A word different here and there, and that would be it. Our emergency scene communications are some of the best in the nation and it is all a direct result of SimLab training (Jon Boyd, Personal Communication, October 13, 2010).

The results from the company and command officer surveys show similar findings. Twenty-one (88%) company officers indicated their radio communications have improved as a

result of SimLab. All 24 (100%) company officers indicated that emergency scene communications across the whole department have improved due to SimLab training. An overwhelming majority, 23 (96%) believe that emergency scene communications are more concise since the implementation of SimLab. However, contradictory to Chief Boyd's opinion, only a little over half of the company officers, 14 (58%), feel that the terminology and communication process is consistent among all three shifts. Three (13%) company officers rated the SimLab as "Good", 13 (54%) of company officers rated the SimLab as "Very Good" and eight (33%) rated the SimLab as "Excellent" on communications components.

The findings from the command officers' survey showed similar findings for the most part. Just as the company officers, all five (100%) command officers answered that emergency scene communications across the whole department have improved due to SimLab training. In addition, all five (100%) command officers believe their communications have also improved as a result of SimLab. The command officers agree with the statements of Chief Boyd, with all five (100%) feeling that the terminology and communication process is consistent among all three shifts. Two (40%) command officers rated the SimLab as "Very Good" and three (60%) rated the SimLab as "Excellent" on communications components.

Table 2 shows the breakdown and comparison of company and command officers' answers for all questions regarding communications components. Any questions that addressed evaluating radio communications, communications with the IC, communications between different command assignments, communicating emergency traffic or mayday, and evaluating the amount and conciseness of radio communications are included. The number of responses is listed first as a numerical value.

Table 2. Ratings and Comparison of Communications Components

Questions concerning emergency scene communications	Company Officer		Command Officer	
	YES	NO	YES	NO
Have YOUR communications improved due to SimLab?	21	4	5	0
Have the Department's communications improved due to SimLab?	24	1	5	0
Has the company officer's ability to communicate emergency traffic improved due to SimLab?	13	4	0	1
Has the company officer's ability to communicate a mayday improved due to SimLab?	6	6	0	2
Is there less radio traffic since the implementation of SimLab?	13	11	4	1
Is radio traffic more concise since the implementation of SimLab?	23	1	5	0
Are communications consistent among all 3 shifts?	14	10	5	0
Have communications between different groups/divisions improved due to SimLab?	17	7	5	0

The results clearly show that company and command officers believe overall emergency scene communications have improved. Nearly all participants, both company and command officers, indicate that communications are more concise and improved due to SimLab training. Both groups gave the SimLab high ratings on communications components. These results support Chief Boyd's comments on the mark improvement he has seen in overall communications. However there is some discrepancy between the company officers and command officers responses on certain communications components. No command officer believes that the company officers have improved in their ability to communicate emergency

traffic or a mayday. Two (40%) command officers in the mayday component and one (20%) command officer in the emergency traffic indicated that the SimLab does a poor job of teaching these communication components.

In comparison, 13 (54%) company officers believe their ability to communicate emergency traffic has improved due to SimLab, with only 4 (17%) indicating the SimLab fails to adequately teach this component. Also, six (25%) company officers answered that their ability to communicate a mayday has improved due to SimLab, with another six (25%) indicating the SimLab fails to adequately teach this component. In addition, while all of the command officers and Chief Boyd feel the terminology is consistent among all three shifts, only a little over half of the company officers feel this way, with 10 (42%) indicating there was a lack of consistency in communications among all three shifts.

The results from evaluating the radio communications for the 27 structure fires showed mixed results. In the first time period, January 2007 through May 2008, NIMS terminology or assignments were not used on any structure fires. The researcher did not identify one structure fire that utilized NIMS terminology or command assignments as specified in SOP 240.02. The same holds true for using the correct process to conduct a PAR as dictated in SOP 240.02. The results showed that none of the ICs or company officers used the correct process to conduct a PAR on the ten structure fires evaluated during the first time period.

The results showed more consistency in using the correct process for radio communications as specified in SOP 230.02 and communicating the six benchmarks listed in SOP 240.02. For the radio traffic of all ten structure fires evaluated during the first time period, the correct process for communicating over the radio was used 81% of the time. Nineteen percent of the time the IC or a company officer failed to either respond at all to the request or

assignment given over the radio or acknowledge the message with a brief restatement of the message. The results for this time period also showed that all six benchmarks were communicated over the radio as required by SOP 240.02 on five (50%) of the ten fires.

In the second time period, June 2008 through June 2009, there was significant improvement in the percentage of time NIMS terminology and command assignments were used. On all nine fires, NIMS terminology and command assignments were used. On five (56%) of the nine fires, NIMS terminology and command assignments were used exclusively and in accordance to SOP 240.02. On the four fires where NIMS was not used in full accordance of policy, either the IC failed to use NIMS terminology on assignments or used the incorrect NIMS terminology for an assignment. In addition on all four of these fires, at least one company officer failed to use NIMS terminology or used it incorrectly.

The research also showed a marked improvement in utilizing the proper procedure for conducting a PAR. Four (44%) of the nine fires evaluated during the second time period utilized the proper procedure. On all five of the fires where the proper procedure was not used, a company officer failed to list a company assigned to their group or division. In all five incidents, the IC required the company officer over the radio to account for the company not identified in the PAR.

The evaluation of the radio communications for the nine structure fires in the second time period showed similar results in the consistency of using the correct process for radio communications and communicating the six benchmarks. For the radio communications of all nine structure fires evaluated during the second time period, the correct process for communicating over the radio was used 76% of the time. Similar to the first time period evaluated, 24% of the time the IC or a company officer failed to either respond at all to the

request or assignment given over the radio or acknowledge the message with a brief restatement of the message. The results for this time period also showed that all six benchmarks were communicated over the radio on three (33%) of the nine fires.

The third time period, July 2008 through December 2010, showed improvement over the second time period in the percentage of time NIMS terminology and command assignments were used. On all eight fires, NIMS terminology and command assignments were used. On seven (88%) of the eight fires, NIMS terminology and command assignments were used exclusively and in accordance to SOP 240.02. On the one fire where NIMS was not used in full accordance of policy, the IC used NIMS terminology incorrectly. On all eight fires, the company officers correctly used NIMS components as required by AFD policy.

The research also showed a marked improvement in utilizing the proper procedure for conducting a PAR. Seven (88%) of the eight fires evaluated during the second time period utilized the proper procedure. On the one fire where the proper procedure was not used, a company officer failed to list his/her company as assigned to their group or division.

The evaluation of the radio communications for the eight structure fires in the third time period showed lower results in using the correct process for radio communications and communicating the six benchmarks. For the radio communications of all eight structure fires evaluated during the third time period, the correct process for communicating over the radio was used 56% of the time. Of the 44% of the incidents where the proper process was not followed, nearly every time the individual receiving the message did not provide a short restatement of the message.

The results for this time period also showed that all six benchmarks were communicated over the radio on only two (25%) of the eight fires. Table 3 shows a percentage breakdown and

comparison for the structure fires that were evaluated during the three time periods for the following criteria: correctly utilizing NIMS terminology and command assignments, proper procedure for conducting a PAR, proper radio communications and properly communicating benchmarks.

Table 3: Breakdown and Comparison of Structure Fire Radio Communications

Time Period	NIMS	PAR	Radio Communication	Benchmarks
First (1/07 – 5/08)	0%	0%	81%	50%
Second (6/08 – 6/09)	56%	44%	76%	33%
Third (7/09 – 12/10)	88%	88%	56%	25%

The third research question focuses on determining how SimLab affects company officers' ability to manage their command assignments. Of the 24 company officers who took the survey, 22 (92%) indicated they had been assigned as a group or division supervisor on an emergency scene. Of these 22 company officers, 19 (83%) answered that they were given multiple companies to supervise as a group or division supervisor. All 22 company officers indicated they believed they understood what was expected from them as a division or group supervisor. In addition, all 24 company officers who took the survey answered all questions testing command assignment comprehension correctly.

Of the 24 company officers, 11 (46%) feel the SimLab prepared them to understand their command assignment and 14 (58%) feel the SimLab has prepared them to know the IC's expectations based on their command assignment. Eighteen (75%) company officers indicated that the SimLab improves their ability to manage personnel accountability, but only five (21%)

indicated that the SimLab improves their ability to maintain company integrity. In addition, only three (13%) company officers indicated the SimLab has prepared them to complete multiple tasks with multiple companies. Two (8%) company officers rated the SimLab as “Poor”, 14 (58%) rated the SimLab as “Good”, seven (29%) rated the SimLab as “Very Good” and one (3%) rated the SimLab as “Excellent” on the command assignment components.

The results of the command officer survey are similar to the results of the company officer survey. Of the five command officers who completed the survey, two (40%) feel the SimLab prepares the company officer to understand their command assignment and three (60%) feel the SimLab prepares the company officer to understand the IC’s expectations based on the command assignment. Only two (40%) command officers indicated that the SimLab improves company officers’ ability to maintain company integrity, but all five (100%) indicated the SimLab improves the company officers’ ability to manage personnel accountability. No commanding officer indicated that the SimLab prepares company officers to complete multiple tasks with multiple companies.

There was a significant difference in how the command officers rated the SimLab compared to the company officers in the command assignment components. Four (80%) of the command officers rated the SimLab as “Very Good” and one (20%) rated the SimLab as “Excellent”. Table 4 shows a breakdown and comparison between the company and command officer results based on the command assignment components.

Table 4: Ratings and Comparison of Command Assignment Components

Question:	Company Officer	Commanding Officer
SimLab improves company officers' ability to:	(YES)	(YES)
Understand Their Command Assignment?	11 (46%)	2 (40%)
Understand IC's Expectations based on Command Assignment?	14 (58%)	3 (60%)
Manage Personnel Accountability?	18 (75%)	5 (100%)
Manage Company Integrity?	5 (21%)	2 (40%)
Manage Multiple Tasks with Multiple Crews?	3 (13%)	0 (0%)

While the results of the two surveys were similar with only the SimLab improving company officers' ability to manage personnel accountability showing a strong majority in both surveys, Chief Boyd feels the SimLab does an excellent job improving company officers' ability to manage their command assignment. According to Chief Boyd, "The SimLab allows company officers to understand their command assignment, what the IC expects from them and allows them to practice completing multiple tasks" (Jon Boyd, Personal Communication, October 13, 2010). Chief Boyd explained that the SimLab creates an environment where each company officer gets to perform different command assignments during each day of training, which in turn gives the individual an opportunity to fully understand what they are expected to complete. "This type of training," according to Chief Boyd, "allows company officers to master the complexities of their command assignments" (Jon Boyd, Personal Communication, October 13, 2010).

Chief Boyd feels strongly what the company officers learn in the SimLab, in regards to their command assignment, has lead to significant improvement in their performance on the emergency scene. Chief Boyd explained that is not unusual at all for a company officer to be

fulfilling the role of group or division supervisor and have three or four companies assigned to them. “They (company officers) are expected to complete multiple tasks simultaneously with multiple companies and for the most part, they perform excellent. This is something we could not have done prior to SimLab, now we do it without hesitation” according to Chief Boyd (Jon Boyd, Personal Communication, October 13, 2010).

The fourth research question identifies what objectives company officers learn from SimLab. The results of the company officer survey indicated that the SimLab is very effective at teaching scene organization, communications and personnel accountability. Communications received the highest overall ratings with eight (33%) of the 24 company officers rating the SimLab as “excellent” and 13 (54%) rating it “very good” in this category. On the essay question, the communications objective only received positive comments such as, “SimLab does an excellent job of improving communications” and “Great for communications”. In addition to communications, scene organization received similar marks with seven (29%) rating SimLab as “excellent” and eight (33%) rating it “very good”. Scene organization also received only positive comments in the essay question, such as, “Very good for scene organization” and “Very beneficial for scene organization.”

The results also showed that company officer felt the SimLab did an average to poor job of teaching other objectives. Company integrity received average to slightly below average ratings from the company officers with a majority, 15 (63%), rating the SimLab as “good” and three (13%) rating it “poor”. Company integrity received no comments, positive or negative, in the essay question.

Air management and strategy/tactics received very low ratings from the company officers. Eleven (46%) company officers rated the SimLab as “poor” and ten (42%) as “good” in

air management. Only negative comments were received in regards to air management in the essay question, such as, “The air management objective is very unrealistic.” Strategy/tactics received slightly higher remarks, but still well below the ratings of the other objectives, with 12 (50%) rating the SimLab as “good” and six (25%) rating it “poor”. Also strategy/tactics received only negative comments from the company officers, such as, “Not realistic at all and gives people a false sense of what tactics work on fires.”

When asked how they felt about SimLab’s overall ability to improve their performance on emergency scenes, an overwhelming 22 (92%) of the 24 company officers indicated their knowledge and ability have improved as a result of SimLab. The same number of company officers indicated they have witnessed an improvement in the command officer’s performance on emergency scenes since implementation of SimLab.

The command officer survey showed that the command officers, compared to the company officers, believe the SimLab does a better job at teaching all objectives. No objective received a “poor” rating from the five command officers. Similar to the company officer survey, scene organization, communications and personnel accountability received the highest ratings. Communications, once again, received the highest ratings with three (60%) command officers rating the SimLab as “excellent” and two (40%) rating it “very good”. Communications received only positive comments from the command officers with comments like, “Very effective at teaching communications.” Scene organization also received strong ratings with two (20%) rating the SimLab as “excellent” and three (60%) rating it as “very good”. Scene organization also only received positive comments like, “great for teaching scene organization.”

The results also showed that command officers rated the SimLab very similar to company officers in the company integrity objective. Company integrity received slightly higher ratings

from the command officers with four (80%) rating the SimLab as “very good” and one (20%) rated it “good”. Once again, the company integrity objective received no comments, positive or negative, in the essay question.

The biggest difference between the company officer and command officer survey was in the air management and strategy/tactics objectives. While the company officers rated the SimLab low in these two objectives, the command officers gave average ratings. Four (80%) command officers rated the SimLab as “good” and one (20%) as “excellent” in air management. Strategy/tactics received similar ratings, with three (60%) rating the SimLab as “good” and two (40%) rating it “very good”. Neither the air management nor strategy/tactics objectives received comments, positive or negative, from the command officers.

When asked how they felt about SimLab’s overall ability to prepare company officers for the emergency scene, all five (100%) indicated they have seen an improvement in company officers’ performance since the implementation of SimLab. Table 5 shows a breakdown and comparison on how the company and command officers rated the SimLab on teaching the main objectives.

Table 5: Ratings and Comparison of SimLab Objectives

Objectives:	Poor		Good		Very Good		Excellent	
	Company	Command	Company	Command	Company	Command	Company	Command
Scene Organization	0 (0%)	0 (0%)	9 (38%)	0 (0%)	8 (33%)	3 (60%)	7 (29%)	2 (40%)
Communications	0 (0%)	0 (0%)	3 (13%)	0 (0%)	13 (54%)	2 (40%)	8 (33%)	3 (60%)
Company Integrity	3 (13%)	0 (0%)	15 (63%)	1 (20%)	5 (21%)	4 (80%)	1 (4%)	0 (0%)
Air Management	11 (46%)	0 (0%)	10 (42%)	4 (80%)	3 (13%)	0 (0%)	0 (0%)	1 (20%)
Personnel Accountability	3 (13%)	0 (0%)	10 (42%)	0 (0%)	8 (33%)	4 (80%)	3 (13%)	1 (20%)
Strategy/Tactics	6 (25%)	0 (0%)	12 (50%)	3 (60%)	3 (13%)	2 (40%)	3 (13%)	0 (0%)

Discussion

Previous research and the data collected clearly show that computer-based simulation is an effective training tool. A large body of evidence does exist that validates the correlation between the use of computer-based simulation for training and the transfer of knowledge and skill level (Hall, 2010). Computer-based simulation increases fire officers' skill set and knowledge base to allow them to face the challenges of hazard mitigation (FireRescue1, 2006). The data collected showed that 92% of the company officers felt their ability to effectively mitigate hazards on emergency scenes has improved due to SimLab training and 100% of the

command officers indicated that the company officers' performance has improved as a result of SimLab training.

In order to effectively mitigate emergency scenes and make better decisions, company officers must understand their current environment and reasonably predict their near-future environment. Company officers must recognize and appropriately react to the dynamic environment of emergency scenes by realizing their situational awareness (Flin & Arbuthnot, 2002). Simulation training creates the type of environment that enhances an individual's situational awareness skills (Stanton et al., 2001). The data collected supported this by showing that the SimLab is an effective tool to help company officers learn to analyze their environment.

A large majority of the company officers believe their ability to analyze their current environmental conditions has improved due to SimLab training. Simulation training develops critical thinking skills in regards to situational awareness (Cohen et al., 1998). A majority of AFD company officers believe the SimLab has not only improved their ability to analyze their current conditions, but also to realize what actions are needed to effectively mitigate the hazard and identify their current and future needs.

A majority of the command officers who fulfill the role of IC on emergency scenes also feel company officers' ability to analyze their situational awareness has improved. The IC's are directly impacted by the decisions company officers make based on their situational awareness and must create and adjust their operational plan based on the situational awareness information they receive from company officers. A majority of the command officers have seen an improvement in company officers' performance in this area on emergency scenes, which provides the IC with more accurate information to drive the decision making process. Simulation training teaches its participants to search for necessary clues to understand their situational

awareness (Murgallis, 2001). Based on the research results, this is what the SimLab has accomplished for the AFD company officers.

Not only do a majority of company officers believe SimLab improves their ability to analyze their current situation, a staggering 96% indicated they know what information to communicate in regards to their situational awareness. When company officers understand their situational awareness and are able to effectively communicate it, other company officers and the IC are provided key information to make better decisions (Hall, 2010). Chief Boyd supported the findings in regards to SimLab improving company officers' situational awareness. He commented that the AFD has seen a significant improvement in how company officers analyze and communicate their environment. From Chief Boyd's perspective, company officers' ability to analyze and communicate their situational awareness improves with each SimLab training evolution (Jon Boyd, Personal Communication, October, 13, 2010).

While it is important to note that Chief Boyd's comments regarding improvement in company officers' ability to analyze their situation only refers to the SimLab, he is in a central position to critique and compare company officers' performance on emergency scenes. Chief Body strongly believes company officers' situational awareness skills transfer from the SimLab to the emergency scene (Jon Boyd, Personal Communication, October, 13, 2010). Chief Boyd concludes that while he does not have any empirical data to show how company officers' ability to analyze their environment has improved since the implementation of SimLab training, he feels strongly that it has based on his observation at structure fires.

Previous research supports Chief Boyd's positive position on the benefits of the SimLab. According to Ross (2002), simulators improve participants' knowledge of the environment and their ability to effectively and safely manage their personnel. In addition, Hall (2010) proved that

computer-based simulation was effective at teaching situational awareness. From Chief Boyd's experience, this is what has occurred with the company officers. The findings from the two surveys also supports Chief Boyd's position and previous research, with a majority of company and command officers indicating the SimLab improves the participants' situational awareness skills.

In addition to improving situational awareness, the data collected showed that the SimLab is very effective at improving the communications process. Of all the findings, SimLab's ability to improve communications is the most pronounced. All command officers and 88% of the company officers felt that communications across the whole department have improved due to SimLab training. The results of the data collected are supported by previous research. Simulation training has been used in the medical field to improve healthcare professionals' ability to effectively communicate with patients and colleagues (Fatimah, 2010). Several studies have shown that simulation is required for effective communication training (Bosse et al., 2010). The data collected, with support from previous research, shows that the SimLab is a very effective training tool for improving emergency scene communications.

In addition to improving communications across the whole department, the results clearly showed that overwhelming majorities of command and company officers believe communications are more concise and consistent since the implementation of SimLab training. According to Thiel (1999), simulation training is the best method to develop good communications skills. As Training Chief for the AFD, Chief Boyd agrees with results of the data collected. He has seen a significant improvement in the consistency and conciseness of emergency scene communications and feels AFD emergency communications are one of the best models in the nation.

NIMS mandates that all communication during an incident should be in common language to ensure information dissemination is timely, clear, acknowledged and understood by all involved (DHS, 2008). The results of the structure fire radio communications critique showed the SimLab is meeting NIMS requirements for using common terminology. There was steady improvement in the use of NIMS terminology and components with SimLab training. By the third time period, NIMS terminology and components, including the PAR process, were used 88% of the time. The SimLab successfully reinforces NIMS requirements, by improving the consistency of NIMS terminology and components.

The evaluation of structure fire radio communications did show a steady decline in the radio communication process that is required by SOP 230.02. This policy requires the message receiver to acknowledge the receipt of the message by stating a brief restatement of the message (AFD, 2009). Before the implementation of SimLab, the correct communications process was used over 80% of the time. After a year of SimLab training, the correct communications process as required by SOP 230.02 was used less than 60% of the time. In addition, the announcement of benchmarks over the radio as required by SOP 240.02 decreased by 50% from the first time period to the third time period.

It appears the SimLab is an effective tool to reinforce the use of NIMS terminology and components over the radio, but is counterproductive in reinforcing the correct communications process and announcing benchmarks as dictated by AFD policy. Nearly all failures in the radio communications were due to the message receiver not stating a brief restatement of the message. It is possible the command and company officers have become complacent with their radio communications due to their belief in their increased knowledge and performance in regards to communications. The receiver feels the message is so clear and concise that it is easily

understood by all, and therefore, a brief restatement is not warranted. It is also possible the SimLab instructors do not enforce the correct communications process as diligently as the common terminology component.

It is clear from the survey results that the company and command officers believe their communications abilities have improved due to SimLab. However, the critique of the structure fire radio communications shows the SimLab has decreased the percentage of time the correct communications process according to AFD policies is followed. Company and command officers are not as cognizant about following the correct process as they are about using common terminology and keeping their messages consistent and concise, and this shows on the emergency scene.

Of all the survey results, SimLab's biggest impact has been on the improvement of emergency scene communications. Nearly all command and company officers believe emergency communications have improved by becoming more consistent and concise, however the results show the SimLab does an inadequate job of improving the communications process for emergency and mayday traffic. There is some discrepancy between the company and command officers on emergency traffic. All command officers agree that the company officers have not improved in their ability to communicate emergency traffic, but a little over half of the company officers believe their communication ability on this specific component has improved. Yet, a good portion of company officers did indicate that the SimLab fails to adequately teach the emergency traffic communication process. Both company and command officers agree that the SimLab does a poor job of teaching the mayday communication component. Based on the research, SimLab does an inadequate job of teaching the emergency traffic and mayday communication processes.

The data collected shows that the SimLab improves emergency communications. Nearly all officers have seen improvement in their performance and their colleagues' performance in emergency scene communications. Clearly the SimLab is an effective tool for teaching communications. However, there are specific components to the communication process taught in the SimLab that need to be reevaluated. More emphasis needs to be placed on ensuring the correct communications process is followed and that company officers understand the emergency traffic and mayday communications processes.

In comparison to the research findings for situational awareness and communications, the SimLab has less impact on how AFD company officers manage their command assignments. NIMS creates command assignments such as groups and divisions to allow the IC to have an acceptable level of span of control (DHS, 2008). It is AFD policy that the IC utilizes the command assignments divisions and groups on all working fires (AFD, 2009b). Past research has shown that simulation training allows organizations to create scenarios where different command assignments can be used (Ross, 2002). All company officers have trained on the different command assignments in the SimLab and nearly all have been assigned as a group or division supervisor on an emergency scene, with a majority being assigned multiple companies.

The research from the surveys showed that only about half of the command and company officers believe the SimLab prepares them to understand their command assignment and to know the IC's expectations based on their command assignment. After two years of training in the SimLab, half of the company officers still do not understand certain command assignments and are unsure of the IC's expectations. While Halton and Nee (1999) state that simulation training allows company officers to gain a better understanding of their assignments, the survey results

show that approximately half of the company officers are still unsure of certain command assignments.

When asked specific questions about the responsibilities of different command assignments, all of the company officers answered correctly. This indicates the command officers do understand the responsibilities and expectations of being a division or group supervisor outside of training and on the emergency scene. It is possible the company officers become uncertain of their command assignment responsibilities when multiple command assignments are created and operating on the same emergency scene. Company officers are uncertain where their responsibilities end and another command assignment's responsibilities begin. With half the company officers falling to understand their command assignment and the IC's expectations in training or on the emergency scene, but being able to identify command assignment responsibilities outside these environments, shows the SimLab is failing to adequately define and identify the responsibilities of each command assignment when multiple assignments are established on the same emergency scene.

The survey results also show that the SimLab does not prepare company officers to complete multiple tasks with multiple companies. While Ross (2002) indicates simulation training allows organizations to train on command assignments and Halton and Nee (1999) state that it allows company officers to gain a better understanding of command assignments, the SimLab fails to create an environment that teaches company officers how to complete multiple tasks with multiple companies. It is highly probable that managing multiple companies to complete multiple tasks in a controlled environment like the SimLab, where face to face communications is not impaired by a self contained breathing apparatus, there is good lighting and no physical stressors like anxiety exists, does not replicate an emergency scene environment. The AFD

company officers' ability to manage multiple crews to complete multiple assignments is not improved due to SimLab's inability to create a realistic real-world emergency scene.

The research also showed the SimLab is very effective at teaching certain objectives, while failing to address others. The AFD established six main objectives to be taught in SimLab: scene organization, communications, company integrity, air management, personnel accountability, and strategy/tactics (AFD, 2009c). Previous research shows that computer-based simulation has been used for years in the U.S military to train soldiers on specific objectives (Hank, 2005). In addition, the medical field has used simulators to train faculty on critical objectives such as: surgical techniques and anesthesia (Center for Medical Simulation, 2009). The results supported the previous research on the scene organization, communications and personnel accountability objectives. Both the command and company officers felt the SimLab succeeded in teaching these objectives.

From the data collected, it is clear that the SimLab accomplishes the goal of teaching the scene organization, communications and personnel accountability objectives. All three objectives received high ratings and positive comments from both command and company officers. The strongest objectives from both groups were scene organization and communications. The SimLab is on target for teaching these three objectives to the company officers.

The company officers do not recognize the other objectives taught in SimLab to the same degree. Company integrity received average ratings, but air management and strategy/tactics received very low remarks. Air management received the lowest remarks and it is clear the company officers feel this objective is unrealistic. The negative comments show that the air management and strategy/tactics objectives need be reevaluated. Hall (2010) did show a correlation between the use of computer-based simulation and the transfer of increase skill level.

However, for the SimLab to successfully teach these three objectives to the company officers, the AFD needs to reevaluate its training methods.

Once again, it is highly probable that the SimLab's inability to create a realistic enough emergency environment impacts its ability to teach these three objectives. While the company integrity objective received average ratings, the gap between it and the three successful objectives was wide enough to indicate that it also needs reevaluation. Enough of the company officers indicate this objective is inadequately addressed in SimLab to warrant further evaluation.

Recommendations

The AFD's SimLab is clearly an effective training tool. The data collected showed both command and company officers acknowledge improvement in their performance on the emergency scene. In addition, the results from the personal interview with Chief Boyd and evaluating the structure fire radio communications indicated improvement by both command and company officers in certain components. It was the intent of this research to validate the ability of the SimLab to prepare company officers for emergency scene management. Through the validation process several components were identified where the SimLab has succeeded in improving company officers' performance on the emergency scene, but a few components were also identified that fail to meet their intended goal.

By maintaining the components that have successfully improved company officers' performance and reevaluating the components that are inadequately taught in SimLab, the AFD can create a comprehensive training tool that improves company officers' performance in a variety of areas. The following recommendations are provided to address the issues identified through this research study:

- The research validated the situational awareness components as being successfully transferred by the company officers from the SimLab to the emergency scene. It is recommended that the AFD maintains its current approach to teaching the situational awareness components in the SimLab.
- While the research did show that emergency scene communications have improved through SimLab training, areas of improvement were identified. It is recommended that the AFD places more emphasis on ensuring both command and company officers follow the proper communications process as required by SOP 230.02. The SimLab instructors should be retrained on SOP 230.02. The instructors should also identify anytime the proper communications process is not followed in SimLab training, identify the individual and address the problem in a post evolution critique.
- Add one emergency traffic or mayday scenario to each SimLab training period.
- Have the SimLab instructors retrained on SOP 240.02 to identify the six benchmarks listed for structure fires. The instructors should identify anytime one of the benchmarks is not communicated on a scenario in the SimLab and address the issue in a post evolution critique.
- Have all AFD employees retrained on SOP 230.02 and 240.02
- Conduct more small scale evolutions to ensure company officers understand all command assignments. Instead of only conducting full scale evolutions, incorporate evolutions that only involve one command assignment at a time. Have at least one evolution per training period that only focuses on one command assignment. Allow all company officers to see the responsibilities and expectations of that particular command assignment and how to manage multiple companies completing multiple

assignments simultaneously. By having the full attention and all resources one on command assignment, the smallest details can be addressed.

- Maintain the scene organization, communications and personnel accountability objectives. The research validated the company officers understanding of these objectives.
- Reevaluate the company integrity objective. Stop each evolution at one random time and ask each company officer to identify the location of each of their assigned crews and their current task assignment.
- Remove the air management and strategy/tactics objectives. The SimLab's inability to create a realistic real-world emergency environment hinders these objectives. Both these objectives can be addressed through other training means.
- Conduct a thorough post evolution critique of each evolution on a standardized form
- Have all participants complete an evaluation form at the end of each training period on what they considered positive and negative about the SimLab training for that particular day.

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Appendix A

SimLab Validation Company Officers

1. Have you been assigned as a Group or Division Supervisor on an emergency scene since 01/01/2009?

- Yes
 No

2. As a group or division supervisor were you assigned multiple units?

- Yes
 No

3. Do you believe you understand what is expected from division and group supervisors?

- Yes
 No

**4. What components of the simulation training do you understand the best?
(Select all that apply)**

- Personnel Accountability
 Radio Traffic
 CAN Reports
 Organization (groups and divisions)
 Strategy and Tactics
 Emergency Traffic
 Transferring Supervisor Role of Group/Division
 May Day
 Air Management
 Communications between different Groups/Divisions

Other (please specify)

5. Which components taught in the simulation lab do you understand the least?

- Radio Traffic
 CAN Reports
 Organization (groups and divisions)

- Strategy and Tactics
- Emergency Traffic
- Transferring Supervisor Role of Group/Division
- May Day
- Air Management
- Communications between different Groups/Divisions

Other (please specify)

6. As a group/division supervisor do you understand how to report a PAR to command?

- Yes
- No

7. Have you given a PAR as a group/division supervisor on the emergency scene since 01/01/2009?

- Yes
- No

8. If so, was the PAR communicated correctly?

- Yes
- No

9. You are the OIC on T2 and have been assigned as the division 1 supervisor. Division 1 has been assigned E3 and M2. What is the proper way to communicate a PAR for Division 1?

- Division 1 has PAR
- Division 1 has PAR with E3 and M2
- Division 1 has PAR with T2, E3 and M2

10. Do you feel your emergency scene communications have improved from simulation lab training?

- Yes
- No

11. Do you feel emergency scene communications have improved in general for the whole department from simulation lab training

- Yes
- No

12. Do you understand what information is required in a CAN report?

Yes

No

13. Do you feel there is more or less radio traffic after simulation lab training?

More Radio Traffic

Less Radio Traffic

14. Do you feel radio traffic is more or less concise following simulation lab training?

Less Concise

More Concise

15. Do you feel the terminology used in emergency scene communications is consistent among all three shifts?

Yes

No

16. When assigned as Division 2 what is your responsibility?

Fire control on the second floor

Search on the second floor

Fire control on the first floor

Mitigate all hazards on the second floor

17. You are assigned as the ventilation group, what are your responsibilities?

Vertical ventilation

Horizontal ventilation

Ventilation in a specific area

Ventilation for the whole structure

**18. What are your most significant challenges as a division/group supervisor?
(mark all that apply)**

Company integrity

Completing multiple tasks

Communications

Understanding expectations

Understanding assignment

Communicating with other divisions/groups

Other (please specify)

19. What areas do you feel you are the most prepared for as a group/division supervisor? (mark all that apply)

Company integrity

Completing multiple tasks

Communications

Understanding expectations

Understanding assignment

Communicating with other divisions/groups

Other (please specify)

20. What areas do you feel simulation lab has best prepared you to manage your command assignment?

Company integrity

Completing multiple tasks

Communications

Understanding expectations

Understanding assignment

Communicating with other divisions/groups

Other (please specify)

21. As a division/group supervisor do you have difficulty managing multiple companies?

Yes

No

22. What are the main objectives you have learned from the simulation lab? (check all that apply)

Scene organization

Communications

Company integrity

Air management

Personnel accountability

Strategy/tactics
 Other (please specify)

23. Please rate how well you believe the simulation lab prepares you for the emergency scene?

- Excellent
- Very Well
- Well
- Sort of
- Not at all

24. Have you seen a positive change in your performance on emergency scene as a result of training in the simulation lab?

- Yes
- No

25. Have you seen a positive change in your Battalion Chief's performance as a result of training in the simulation lab?

- Yes
- No

26. Please rate the simulation lab on the following objectives.

	Poor	Good	Very Good	Excellent
Scene organization	<input type="checkbox"/> Scene organization			
Communications	<input type="checkbox"/> Communications	<input type="checkbox"/> Communications	<input type="checkbox"/> Communications	<input type="checkbox"/> Communications
Company integrity	<input type="checkbox"/> Company integrity			
Air management	<input type="checkbox"/> Air management			
Personnel accountability	<input type="checkbox"/> Personnel accountability			
Strategy/tactics	<input type="checkbox"/> Strategy/tactics	<input type="checkbox"/> Strategy/tactics	<input type="checkbox"/> Strategy/tactics	<input type="checkbox"/> Strategy/tactics

27. Please state your opinion on the simulation lab's ability to prepare company officers for the emergency scene.

Appendix B

SimLab Validation Command Officer

1. Have you assigned Groups/Divisions on the emergency scene since 01/01/2009?

- Yes
 No

2. Did you assign the group/division supervisor multiple units?

- Yes
 No

3. Do you believe all your company officers and DOEs understand what is expected from division and group supervisors?

- Yes
 No

4. What components of the simulation training do your company officers and DOEs understand the best? (Select all that apply)

- Personnel Accountability
 Radio Traffic
 CAN Reports
 Organization (groups and divisions)
 Strategy and Tactics
 Emergency Traffic
 Transferring Supervisor Role of Group/Division
 May Day
 Air Management
 Communications between different Groups/Divisions

Other (please specify)

5. Which components taught in the simulation lab do your company officers and DOEs understand the least?

- Radio Traffic
- CAN Reports
- Organization (groups and divisions)
- Strategy and Tactics
- Emergency Traffic
- Transferring Supervisor Role of Group/Division
- May Day
- Air Management
- Communications between different Groups/Divisions

Other (please specify)

6. Do group/division supervisors understand how to report a PAR to command?

- Yes
- No

7. Are fire ground PARs communicated correctly on a consistent basis by all your company officers and DOEs when groups/divisions are utilized?

- Yes
- No

8. Do you feel your emergency scene communications have improved from simulation lab training?

- Yes
- No

9. Do you feel your company officers and DOEs emergency scene communications have improved from simulation lab training?

- Yes
- No

10. Do you feel emergency scene communications have improved in general from simulation lab training

- Yes
- No

11. Are CAN reports communicated with all the required information on a consistent basis by all your company officers and DOEs?

- Yes
- No

12. Do you feel there is more or less radio traffic after simulation lab training?

- More Radio Traffic
- Less Radio Traffic

13. Do you feel radio traffic is less or more concise following simulation lab training?

- Less Concise
- More Concise

14. Do you feel the terminology used in emergency scene communications is consistent among all three shifts?

- Yes
- No

15. What are your company officers and DOEs most significant challenges as a division/group supervisor? (mark all that apply)

- Company integrity
- Completing multiple tasks
- Communications
- Understanding expectations
- Understanding assignment
- Communicating with other divisions/groups

Other (please specify)

16. What areas do you feel your company officers and DOEs are the most prepared for as a group/division supervisor? (mark all that apply)

- Company integrity
- Completing multiple tasks
- Communications
- Understanding expectations
- Understanding assignment

Communicating with other divisions/groups

Other (please specify)

17. What areas do you feel simulation lab has best prepared your company officers and DOEs to manage their command assignment?

Company integrity

Completing multiple tasks

Communications

Understanding expectations

Understanding assignment

Communicating with other divisions/groups

Other (please specify)

18. Do division/group supervisors have difficulty managing multiple companies?

Yes

No

19. What are the main objectives your company officers and DOEs have learned from the simulation lab? (check all that apply)

Scene organization

Communications

Company integrity

Air management

Personnel accountability

Strategy/tactics

Other (please specify)

20. Please rate how well you believe the simulation lab prepares your station officers and DOEs for the emergency scene?

Excellent

Very Well

Well

Sort of

Not at all

21. Have you seen a positive change in your company officers and DOEs performance on emergency scene as a result of training in the simulation lab?

- Yes
- No

22. Have you seen a positive change in your performance as a result of training in the simulation lab?

- Yes
- No

23. Please rate the simulation lab on the following objectives.

	Poor	Good	Very Good	Excellent
Scene organization	<input type="checkbox"/> Scene organization			
Communications	<input type="checkbox"/> Communications	<input type="checkbox"/> Communications	<input type="checkbox"/> Communications	<input type="checkbox"/> Communications
Company integrity	<input type="checkbox"/> Company integrity			
Air management	<input type="checkbox"/> Air management			
Personnel accountability	<input type="checkbox"/> Personnel accountability			
Strategy/tactics	<input type="checkbox"/> Strategy/tactics	<input type="checkbox"/> Strategy/tactics	<input type="checkbox"/> Strategy/tactics	<input type="checkbox"/> Strategy/tactics

24. How many of your company officers and DOEs fully understand all the components taught in the simulation lab?

25. Please state your opinion on the simulation lab's ability to prepare company officers for the emergency scene.

Appendix C

Personal Interview

Conducted on October 13, 2010 with

Jon Boyd, Allen Fire Department Training Chief

1. Do you believe the SimLab impacts its participants' situational awareness on emergency scenes?

“Absolutely, the SimLab has improved our Department’s situational awareness. I have seen a big improvement in how our folks analyze their scene. There has been a major improvement in situational awareness with the progression of SimLab. It is impossible for the players not to improve on how they analyze their environment in order to successfully mitigate the scenario. SimLab forces it players to constantly analyze their environment in order to make good decisions. The outcome of the scenario will vary depending on how the players react to their environment.”

2. Have you seen an improvement on the emergency scene?

“I do not have any hard numbers or data to show it, but yes. I think there is an improvement in how we analyze our environment on the emergency scene since we started SimLab. Just from talking with you and the other command officers and my observations on scene.

3. Do you believe the SimLab has improved how its participants communicate their situational awareness?

“There is no doubt. The CAN reports the IC receives are so much better and more detailed than before we trained in the SimLab.”

4. What impact has SimLab had on emergency scene communications?

“The biggest improvement we have seen since we started SimLab training is communications. Before we started SimLab the most common problem we had on structure fires was communications at all levels, the company officer and command. Now all I hear from everyone is how good our communications are. I have received messages from chiefs in neighboring fire departments on how good our radio communications sound. Look, we have established a training process that teaches proper communications based on NIMS and we are very consistent on the language and communication process we use. A small room and contents fire is not going to sound much different than a three-alarm structure fire. The same language and process will be used. You could go listen to a fire from all three shifts and there would be very little difference in the communications. A word different here and there, and that would be it. Our emergency scene communications are some of the best in the nation and it is all a direct result of SimLab training.”

5. How has the SimLab impacted how company officers understand their command assignment?

“It has improved how company officers, and everyone for that matter, understand their command assignment. I cannot tell you that it has the same impact in this area as it does on communications and situational awareness, but I think our company officers have a much better understanding now as compared to before SimLab. The SimLab allows company officers to understand their command assignment, what the IC expects from them and allows them to practice completing multiple tasks.”

6. You mentioned IC’s expectations and completing multiple tasks. You think SimLab improves company officers’ performance in these areas?

Sure, there is no doubt in my mind that SimLab improves company officers’ performance in these areas. This type of training allows company officers to master the complexities of their command assignments. They get to know the IC’s expectations simply by their command assignment. They are expected to complete multiple tasks simultaneously with multiple companies and for the most part, they perform excellent. This something we could not have done prior to SimLab, now we do it without hesitation.”

Appendix D
Radio Communications for Structure Fire

Time Period #1 Jan 2007 – May 2008		Time Period #2 June 2008 – June 2009		Time Period #3 July 2009 – Dec 2010	
Date	Address	Date	Address	Date	Address
Jan 2007	5 Victorian Place	June 2008	925 South Fork	Nov 09	1212 Aberdeen
Feb 2007	1417 McKenzie	July 2008	409 Nandina	Dec 09	513 Post Oak
March 2007	438 Daniel	Sept 2008	1207 High Meadow	Dec 09	1626 Warm Springs
May 2007	801 Fairlawn	Oct 2008	205 Bonham	Jan 10	504 Boyd
June 2007	708 Meadow Mead	Nov 2008	562 Cumberland	July 10	1405 Capstan
Oct 2007	1831 San Leanna	Feb 2009	1100 Exchange	Sept 10	1100 Greenville
Nov 2007	301 Greenville	March 2009	808 Willow Brook	Nov 10	1503 Comanche
Dec 2007	315 Chaparral	March 2009	616 Sunny Slope	Jan 11	1 Morningside
Feb 2008	561 Fisher	May 2009	301 Greenville		
March 2008	301 Jupiter				