PERSONNEL ACCOUNTABILITY – AN EVALUATION AFTER IMPLEMENTATION

EXECUTIVE DEVELOPMENT

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ABSTRACT

The problem was that the Greensboro Fire Department did not have an effective Personnel Accountability System (PAS) in place. The purpose of this research project was to determine the deficiencies and improve the current firefighter accountability system used by the Greensboro Fire Department. The project used Action Research to answer the following questions:

1. Are Personnel Accountability Systems required on emergency scenes?
2. What Personnel Accountability Systems are available and successfully utilized in the fire service?
3. Why are the challenges facing Personnel Accountability Systems throughout emergency incidents?
4. What actions are necessary to improve the existing Personnel Accountability Systems used by the fire service?

The procedures used to complete the research project consisted of a literature review of current magazines, books, and regulatory guidelines. Two personal interviews were conducted. Information was compiled and placed into categories to answer the four research questions listed.

The results of this research project identified significant research previously conducted by the fire service community. Two National Fire Protection Association standards identify specific requirements for PAS’s on emergency scenes. Many fire ground commanders have found the Passport System their system of choice. However, this researcher found areas in need of improvement with the Greensboro Fire Department version of the Passport System. Many challenges face incident commanders on emergency scenes. Fire service leaders need to fully support the complete implementation of personnel accountability and firefighters need to realize
the importance of functioning as a team and maintaining the group integrity throughout emergency incidents.

The recommendations included establishing commitment from all personnel, development of a secondary tracking system, having additional Passports on the scene, conducting additional training, and revising present General Operating Guidelines. Additionally, the fire service should continue to explore technology based personnel tracking systems.
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INTRODUCTION

At that instant, smoke began to fall around him, pouring down from the floors above, thick and oily, like a predatory fog. It fell suddenly and without warning. In less that five seconds, everything – the walls, the stairs, even his own hand held less that an inch from his face – had disappeared into darkness.

NcNamee had heard no sound, no loud pop or explosion over the roar of the flames. He wondered if the top floor had flashed, if hot gases had pushed into rooms coated with asphalt-infused cork and Styrofoam until everything had ignited. All he knew for sure, though, was that the smoke had pushed into the hallways and lockers, overflowing and pushing, pushing out until it collapsed down the stairwell, a force seemingly overwhelming, physics, a searing, noxious mist settling in on the floors below.

“I want everyone on the upper floors down to the ground now!” he hollered up the stairwell. “And I want head counts. I want everyone accounted for.” Then he gave the same command over the radio, fumbling for his face piece in the dark (Flynn, 2000).

The preceding words came from District Chief Mike NcNamee of the Worcester Fire Department describing a fire at the Worchester Cold Storage and Warehouse Company on the night of December 3, 1999. The next radio transmission was “We’re deep in the building, and we don’t know which way to go to get out”, by Paul Brotherton. Several minutes later Brotherton’s voice came over the radio again. “We’re on the floor, we’re buddy breathing. Hurry.” Twenty-five minutes after the initial dispatch, Paul Brotherton keyed his radio one last time. “Hurry, please hurry.” All together, 6 firefighters died that cold, December night in Massachusetts (2000).
According to Rita Fahy, NFPA manager of Fire Databases and Systems, “We need to recognize what has caused last year’s increase in fatalities, and take the necessary steps to reverse the trend.” “Incident management, the use of PASS devices and accountability systems, safe driving practices, and increased attention to firefighter health and fitness are essential to making real reductions in on-duty firefighter fatalities (NFPA, 2000).” Ms. Fahy goes on to say, It’s possible that changes in equipment and clothing have allowed firefighters to be more aggressive at fires. However, the lack of on-scene accountability of personnel operating at the fire ground as one component of incident management has exposed firefighters to greater dangers. Taking the time to re-evaluate departmental command techniques is an important means of reducing the risks with which firefighters are faced (NFPA, 2000).

The Greensboro Fire Department is not unlike any other fire department in the United States. “Personnel accountability is not taken serious enough”, according to Deputy Chief B.C. Cox of the Greensboro Fire Department.

The problem is that the Greensboro Fire Department does not have an effective Personnel Accountability System (PAS) in place and functioning properly throughout emergency incidents. The purpose of this research project is to determine the deficiencies and improve the current firefighter tracking system. Action Research was used to answer the following questions:

(1) Are Personnel Accountability Systems required on emergency scenes?

(2) What Personnel Accountability Systems are available and successfully utilized in the fire service?

(3) Why are the challenges facing Personnel Accountability Systems throughout emergency incidents?
(4) What actions are necessary to improve the existing Personnel Accountability Systems used by the fire service?

**BACKGROUND AND SIGNIFICANCE**

The City of Greensboro, North Carolina covers a land area of 113.06 square miles with a population of 213,003 (City of Greensboro, 2000). The fire department was established in 1828 and became fully paid in 1926 (Greensboro Fire Department, 2000). Today, the department operates on a schedule of three-24 hour shifts. Apparatus are staffed by a Captain (Company Officer), a Fire Equipment Operator (Driver), and two firefighters. The Department is divided into four Battalions and is managed on a daily basis by a battalion chief serving each. Each battalion has four engine companies. Seven ladder trucks are stationed throughout the City. Two Rescue Squads split two response districts. The Fire Department responded to over 20,000 emergency incidents in 1999 (City of Greensboro, 2000). Additionally, the Greensboro Fire Department responded to over 246 working structure fires during the past year (Assistant Chief of Planning & Research, D.A. Staley, personal communications, November 16, 2000).

The Greensboro Fire Department implemented Incident Command by Alan Brunicini in 1986. Fire Chief, at the time, R.L. Powell approached Battalion Chief B.C. Cox after a devastating fire in Greensboro’s downtown fire district. “The Davie Street fire burned an entire block of structures” said Cox. Chief Cox contacted the Phoenix Fire Department for information on incident command systems. The end result from his research was, the Phoenix System was adapted to Greensboro and put into place. All officers participated in 40 hours of classroom and simulator training. Each fire unit was also brought to the Training Academy and taught strategy utilizing *Fire Command* (Deputy Chief of Administrative Services, B.C. Cox, personal communications, November 6, 2000). Implementation took approximately 1 year, according to
Chief Cox, who was the Training Supervisor at the time. The system was only modified in 1993 to include high rise firefighting and firefighter accountability(Battalion Chief K.R. Stanley, Assistant Training Supervisor, personal communications, October 23, 2000). In 1992, Chief David Spears, Assistant Training Supervisor at the time, attended the Fire Department Instructors Conference in Cincinnati, Ohio. “Personnel Accountability was the hot topic that year”, according to Chief Spears. The topic was also discussed at that year’s Regional Meeting held by the National Fire Academy - Training Resource And Data Exchange (TRADE)-Region IV. Chief Spears researched several Personnel Accountability Systems and was led to the Passport System developed by the Seattle Fire Department. “My original plan was to only track personnel assigned to each company”, said Spears. This turned out to be only the beginning of what would be developed for personnel accountability in the Greensboro Fire Department (Assistant Chief of Emergency Services, D.E. Spears, personal communications, November 16, 2000).

The Passport system utilizes a status board for collection of 2” X 4” plastic card with individual name tags attached. An Accountability Officer will track all resources committed to an incident. (GOG). Passports are maintained 24 hours a day with assigned personnel nametags and kept on the dash of each apparatus. The Passport is affixed to the dash by hook and loop material and easily removed. Additional individual nametags are attached to the underside of each firefighters helmet. All apparatus are equipped with a status board attached by hook and loop on the inside of the driver’s side door. These boards are used during incidents to collect company Passports for tracking personnel. Company officers are responsible for ensuring the Passport always reflects only currently assigned personnel (Greensboro Fire Department, 1996).

A Personnel Accountability Report, or PAR is required at various times during emergency incidents. A PAR is a confirmation that all members assigned to the crew are
accounted for. PAR’s will be required for 1) any report of a missing or trapped firefighter, 2) any change from an offensive strategy to a defensive strategy, 3) any sudden hazardous event, such as a flashover, backdraft, or collapse, 4) when initial search and rescue (primary search) is complete, 5) after 30 minutes of elapsed time, and 6) when the fire scene is under control (1996).

The first engine company to each geographic side of the incident will serve as the initial accountability location. All crews entering the incident will deliver their Passports to the accountability location closest to their “point of entry”. An accountability officer will be established as the incident escalates. The primary task of the Accountability Officer will be to track all personnel entering the “hazard zone”. The Accountability Officer may elect to establish an Accountability Sector or Group, at more complex incidents (1996).

Total scene accountability appears to be established, at first glance. However, on the actual fire scene, this is not always the case. In fact, when twenty-two students (all from career or combination fire services) in the Management of Change Course during August of 1997 were asked if their crews remained largely intact throughout incidents, all responses were negative. All reported that initial crews were often split or individually rotated for a variety of reasons throughout incidents (Murdock, 1998). Chief Cox mentioned an incident where he responded as a firefighter. His crew fought the fire until their self contained breathing apparatus were depleted of air, took a break, changed out air bottles, and went back to the fire. No one ever knew of their actions (Deputy Chief of Administrative Services, B.C. Cox, personal communications, November 6, 2000).

Why do fire companies split up on the scene? Why do firefighters “freelance” on emergency scenes? A reason for this may be the fact that original incident command standard
operating procedures scarcely mentioned personnel accountability. Another reason could be that in the past, locally, there have been no serious firefighter injuries or deaths as a result of not using the accountability system properly. Also, upper management does not always effectively promote, train, and support accountability (Murdock, 1998).

In the future, as fire service managers, we must be accountable to those that account to us. Management has an obligation to provide for the safety of its employees (1998). The fire service started tracking on scene companies when NFPA developed Fire Department Occupational Safety and Health Program in 1987 (1998). Present systems track crew assignments inside of structures but do not identify where inside the structure the crews are located (Coleman, 1997). Incident commanders must automatically integrate fire fighter safety and survival into the regular command functions. (NFPA, 1997) One key function in maintaining firefighter safety is keeping up with them. Incident commanders must maintain an awareness of the location and function of all companies on the emergency scene (1997).

Incident commanders are required by NFPA to implement an accountability system. However, the Standards do not specify a particular method. This research project explored the legal requirements of the need for accountability systems. This directly correlates to Unit 11-Legal Issues, of the Executive Development Student Manual (National Fire Academy, 1998). This chapter examined many implications of legal issues facing the fire service. Compliance with NFPA is just one of the many, fire service leaders must deal with in the 21st century.

**LITERATURE REVIEW**

**Requirements for Accountability on Emergency Scenes**

Chief Alan Brunacini wrote the book *Fire Command* in 1985. There is not a chapter titled Personnel Accountability in the text. However, he did spend considerable time referring to
safety. The fireground commander has many responsibilities on the scene, one being safety. In fact, everyone on the scene has the responsibility of safety for themselves. Chief Brunacini said that everyone on the fireground should operate under a general set of parameters while in the station and on the fireground. In relation to accountability of personnel he stated that these parameters “do not include wandering around, freelancing, hiding out, or splitting-up (divided crew). He went on to say that companies are operating properly when they are working together or as assigned by their Company Officer (Brunicini, 1985). Fire Command was written in 1983. Chief Brunacini wrote, “The Sector Officer must be able to account for the location and welfare of every worker in every crew assigned to his sector” (1985).

A pivotal year in the fire service took place in 1993. This was the year the National Fire Protection Association, Technical Committee on Fire Service Occupational Safety, spent considerable time incorporating the Tentative Interim Amendment to develop accountability systems on emergency scenes (NFPA, 1997). Fireground fatalities continue to plague the fire service. One recent study of fireground fatalities concluded that 25 percent, (34 deaths) that were not stress related were linked to the lack of an effective personnel accountability system (Murdock, 1998). The 1997 edition of the NFPA 1500 Standard on Fire Department Occupational Safety and Health Program clearly states the requirements for personnel accountability on emergency scenes. This Standard is a comprehensive document covering all aspects of safety. Chapter 6 titled Emergency Operations, Section 3 list the requirements for Accountability.

6-3.1 The fire department shall establish written standard operating procedures for a personnel accountability system that is in accordance with Section 2-6 of NFPA 1561, Standard on Fire Department Incident Management System, and that provides for
the tracking and inventory of all members operating at an emergency incident. The system shall provide a rapid accounting of all personnel at the incident scene.

6-3.1.1 The fire department shall consider local conditions and characteristics in establishing the requirements of the personnel accountability system.

6-3.2 It shall be the responsibility of all members operating at an emergency incident to actively participate in the personnel accountability system.

6-3.3 The incident commander shall be responsible for overall personnel accountability for the incident. The incident commander shall initiate an accountability and inventory worksheet at the very beginning of operations and shall maintain that system throughout operations.

6-3.3.1 The incident commander shall maintain an awareness of the location and function of all companies or units at the scene of the incident.

6-3.3.2 Officers assigned the responsibility for a specific tactical level management unit at an incident shall directly supervise and account for the companies operating in their specific area of responsibility.

6-3.3.3 Company officers shall maintain an ongoing awareness of the location and condition of all company members.

6-3.3.4 Where assigned as a company, members shall be responsible to remain under the supervision of their assigned company officer.

6-3.3.5 Members shall be responsible for following personnel accountability system procedures.

6-3.4 The personnel accountability system shall be used at all incidents.

6-3.5 The fire department shall develop the system components required to
make the personnel accountability system effective.

6-3.6 The standard operating procedures shall provide the use of additional accountability officers based on the size, complexity, or needs of the incident.

6-3.7 The incident commander and members who are assigned a supervisory responsibility for a tactical level management unit that involves multiple companies or crews under their command shall have assigned a member(s) to facilitate the ongoing tracking and accountability of all assigned companies.

NFPA 1500, Chapter 6, Section 3.1 refers to NFPA 1561. This standard deals specifically with the nuts and bolts of running a well-managed emergency scene (Gerner & Schaper, 1998). Chapter 2, Sections 6 and 7 specifically relate to Accountability. Chapter 2-6; Resource Accountability states:

2-6.1 The incident management system shall provide for resource accountability at the incident scene.

2-6.2 The Emergency Services Organization (ESO) shall adopt and routinely use a system to maintain accountability for all resources assigned to the incident. This system shall also provide a process for the rapid accounting of all personnel at the incident scene.

2-6.3 All supervisors shall maintain a constant awareness of the position and function of all personnel assigned to operate under their supervision. This awareness shall serve as the basic means of accountability that shall be required for operational safety.

2-6.3.1 The incident management system shall maintain accountability for the location and function of each company or unit at the scene of the incident.
2-6.3.2 Fire department personnel who respond to the incident on fire apparatus shall be identified by a system that provides an accurate accounting of those personnel actually responding to the scene with each company or on apparatus.

2-6.3.3 Personnel who arrive at the scene of the incident by means other than emergency response vehicles shall be identified by a system that accounts for their presence and their assignment at the incident scene.

2-6.4 The system shall include a specific means to identify and keep track of personnel entering and leaving hazardous areas, such as confined spaces or areas where special protective equipment is required.

2-6.5. The incident management system shall include a standard operating procedure (SOP) to evacuate personnel from an area where an imminent hazard conditions found to exist and to account for their safety. This SOP shall include a method to notify immediately all personnel as specified in 2-2.4. (This section simply states the system shall provide a standard method to give priority to emergency radio transmissions over routing transmissions).

Chapter 2-7 also refers to the requirements of Personnel Accountability and states:

2-7.1 The personnel accountability system shall be used at all incidents

2-7.2 The ESO shall develop the system components required to make the personnel accountability system effective.

2-7.3 The SOP shall provide the use of additional accountability officers based on the size, complexity, or needs of the incident.

2-7.4 Where assigned as a company/crew/unit, members shall be responsible to remain under the supervision of their assigned supervisor.
2-7.5 Members shall be responsible for following personnel accountability system procedures.

North Carolina General Statute 95-148 requires the North Carolina Fire and Rescue Commission to establish voluntary occupational safety and health standards for fire and rescue personnel. *North Carolina OSHA Guidelines, Subpart L, Fire Protection* mirrors the federal guidelines in relation to Accountability requirements. The State Legislature recognizes the importance of safety and have established these guidelines for all firefighters across the State. (North Carolina Fire & Rescue Commission, 1997c)

In summary, Accountability mandates have been around for many years. Formal standards were not developed until the late 1980’s, but tracking personnel on the fireground has always been a priority to fireground officers. NFPA does require an accountability system to be used on emergency incidents. One key point to note though, is that a recommended type of system is not made. That is left up to each individual department. Fire departments across the country utilize NFPA standards daily and refer to them as consensus standards (Greensboro Fire Department, 1998). NFPA 1500 and 1561 are no exception.

**Available Accountability Systems**

Personnel Accountability Systems range from the most simple, such as a clipboard and paper, to the most complex, such as Secure Laser Communication Technology. Fire Departments are bound by budget constraints and municipal priorities that may limit the type of system utilized. However, fire departments are mandated to track personnel function and location during emergency incidents. Accountability systems can be separated in 5 different types – Manual, Electronic Assisted, Radio Frequency, Personal Alert Safety Systems (PASS), and Electronic Status Monitors. Each have applications fire departments may find useful
Currently or in the future. Several are successfully being used throughout the country today. A brief description follows of each type listing pros and cons of each system.

**Manual Systems**

A daily roster is the least expensive method of personnel accountability. Incident commanders compare the day’s riding list to the on scene companies to determine who is at the incident. This method tells who is on the scene but does not tell where they are or what they are doing. (Coleman, 1997)

The clipboard and paper method is one of the least expensive methods. This system only requires someone to stand at the entrance to the emergency scene and write on a pad specific information such as name and time they entered the hazardous area. One critical obstacle to this method occurs during adverse weather conditions. Wind, rain, snow, etc. will make this method difficult to say the least.

The white board method is an alternative solution to using a pad and pen. Both of these methods require good communication to occur on the emergency scene for the system to perform efficiently. Both systems work well as long as personnel make the accountability officer aware of their location assignment (Gerner & Schaper, 1998a). The white board method has the same weaknesses as the clipboard and paper method during inclement weather. However, this problem can be overcome in both systems by using grease pencils or wax based markers.

The radio roll call method of tracking personnel is simple yet it can be somewhat expensive. A substantial supply of portable radios are needed. This system requires the accountability officer to request information such as location, status, and condition from each unit operating on the scene. The portable radios may be equipped with an audible alarm to
indicate when a firefighter is trapped or down, making it easier to locate the incapacitated firefighter.

A Ring based system uses a series of tags and hooks or rings to identify personnel on the scene. Identification tags attached to a hook or ring are brought to a centralized command location to track personnel on the scene. This method has proven to be overwhelming during larger scale events causing the system to break down. It also proves to be inadequate to rapidly determine the location of personnel on the scene (Murdock, 1998.)

The hook and pile (commonly referred to as Velcro™) attaches two pieces of fabric to the helmet or gear of the firefighter. Many departments use a variation of this method known as the Passport System. Passports are maintained 24 hours a day and identify who is assigned to a responding unit. When the fire company arrives on the scene, the Passport is attached to a status board in a specified location. One key advantage the Passport system has over the ring based method is that it allows for crew rotation and alternate points of entry. New Passports may be made up on the scene with extra nametags usually attached to the underside of the helmet. This system is flexible and meets NFPA recommendations (United States Fire Administration [USFA], & Federal Emergency Management Agency [FEMA], 1999). Accountability officers are established during larger scale incidents. As with many of the other manual accountability systems, this method requires good communication between crews and the incident commander.(Dittmar, 2000b)

Card punch technology is used primarily during wildland firefighting. This system tracks a crew’s assignment rather than exact location. This system does not easily allow for reassignment of crews and cards are usually not durable over the long term. Municipal departments could adapt this method to track training levels, personal medical information, and
identification numbers. The fire department would need to determine a method to track crew reassignments and possibly laminate the cards to provide extended use (USFA & FEMA, 1999).

**Electronic Assisted**

Bar code technology is similar to that of bar codes used in retail operations. Unlike retail operations that can only store 1,850 ASCII characters per inch, two dimensional bar codes allow for more than 29,000 characters per inch. In addition to text information, photographs, graphics and even audio information can be stored on two dimensional bar codes. The firefighters carry the bar code on their gear or helmets. Each firefighter is scanned into the system once they arrive on the scene. The incident commander is then able to track who is on the scene, task assignment, training level, blood type and practically any information the department deems necessary (Fire International). Probably the largest drawback to this system is that it currently requires each firefighter to be scanned from one location. Prototype systems are just now entering the market with the ability to communicate with each other via radio links (USFA & FEMA, 1999).

Radar technology has many possibilities in the future that are not available today. This technology was implemented in 1989 and has increased in sensitivity 10 fold since that time. This technology is similar to that of Computerized Axial Tomography (CAT) scans. Any motion is able to be tracked including a heart beating. This type of system may eventually be able to plot a grid on a computer screen identifying the location of victims and track movements of the firefighters attempting rescue efforts. (USFA & FEMA, 1999).

**Radio Frequency Technology**

Radio-transmission based systems utilize a combination of accountability systems. Each crew must have a radio. Someone must listen to all radio communications and track assignments
manually. One system uses a set of potential prearranged assignments to track personnel. A company communicates their actions over the radio and the accountability officer uses a computer program to quickly identify assignment from a selection list. This system will break down if all radio transmissions are not heard by the accountability officer.

Radio-frequency (RF) identification is not yet available to the emergency services, except for electronic transmitting PASS devices. In the future this system will allow for automatic data gathering on personnel and equipment. One method being developed now uses a matchbox size receiver on the firefighters helmet or Self Contained Breathing Apparatus (SCBA). Other methods include sewing the receiver into the turnout gear or uniforms which would be available on every emergency scene. However, since none are in existence today, it is hard to determine if this technology will become commonplace (USFA & FEMA, 1999).

RF motion sensors could eventually prove to assist in accountability efforts, however it is not commercially available currently. This technology sends RF signals through nonmetallic objects to detect movement from the other side. This type of system could assist in looking for downed firefighters in a particular area of a structure and “see” there is no movement (USFA & FEMA, 1999).

Global Positioning System (GPS) based systems have current and future uses in the emergency services field. A GPS uses a network of 24 satellites in precisely controlled orbits. Two types of systems are available – multiplexing receivers and parallel channel. The multiplexing are the least precise yet also the least expensive. Multiplexing receivers do not lock into the satellite signal like the parallel channel system. Multiplexing systems only sample the data from as many as 3 satellites and then makes a “best guess” of the location of the object. Parallel systems lock into the satellite signal to give more reliable information. However, these
systems are considerably more expensive. GPS is best used over large areas, such as during wildland firefighting or search and rescue over a large land mass or water. Firefighters could manually report their coordinates back to the command post or in some newer technology, automatically report their location. In the future, GPS and PASS devices may merge. This would allow for information such as motion detection, ambient temperature, and even vital signs to be sent to the command post. This technology is advancing rapidly, therefore it is hard to determine the exact accountability uses in the future (USFA & FEMA, 1999).

**Personal Alert Safety System Devices**

PASS devices are not necessarily a form of accountability but may be used as a component of the system. PASS devices may be integrated into the SCBA either fully or partially. Past experiences were recognized by NFPA in the last revision (1999) of NFPA 1982 – *Standard on Personal Alert Safety Systems for Firefighters*. Information gathered indicated firefighters often fail to turn on their PASS device for a variety of reasons. Fully integrated PASS devices offer the assurance that the device will be used on the incident scene. Fully integrated systems are considerably more expensive than partially integrated but does not allow for the firefighter the option not to use the device. Partially integrated systems add the flexibility of being able to remove the device for use when SCBA is not needed.

Temperature sensitive PASS devices activate when a firefighter is exposed to high heat. An alarm will activate instantaneously when exposed to an extremely hot area and delayed with a moderate buildup of heat. The temperature sensing audible alarm is different from the non-motion alarm allowing firefighters to distinguish from the two (USFA & FEMA, 1999).

Electronic Transmitting PASS Devices transmit a radio frequency signal to a receiver to indicate various information including name, identification number, medical information, etc.
These devices will indicate to the incident commander which assigned PASS devices are on the scene and if they have been turned on. A signal is sent to the receiver at the command post if the firefighter stops moving. The incident commander would then contact the crew to determine firefighter status.

Key activated PASS devices use a key attached to the device as an accountability tag. Specific information about the assignment of the device is on the key. This system requires the firefighter to turn in the key to the accountability officer before entering the hazardous area. If the PASS is activated, only the key can be used to turn it off. This type of system is commonly used in Great Britain (USFA & FEMA, 1999).

**Electronic Status Monitors**

These type of systems have been developed primarily for military use. Monitors can be either carried or worn by the user. Electronic status monitors transmit data about the person wearing the unit to a centralized command center. This technology is not likely to be used in emergency service activity until some time well into the future. Sensors being developed include sensor vest used to collect information about the wearer, noninvasive medical sensors are a type of sonar used on the body for medical purposes, silicone rubber optical fibers used to monitor respirations, foot force sensors used as motion sensors, heart/lung sound project used to detect abnormalities in the heart and lungs, hands-off arrhythmia monitors used to detect abnormalities in heart rate, and secure laser communication used to relay personnel status to command post (USFA & FEMA, 1999).

In summary, personnel accountability systems are required by NFPA. However the standards do not specify a particular method of performing the assignment. Several types of accountability systems, many by the military, were developed and have now filtered into the
field of emergency services. Many different types of systems are currently available today and many more are just over the horizon.

**Accountability Challenges Throughout the Incident**

According to Battalion Chief John F. Coleman (1997) of the Toledo, Ohio Fire Department, personnel accountability is doomed for failure. Many of the current systems used today only tell us who is on the fireground or inside a specific hazardous area. They really do not “account” for anything. He said, “The goal of an accountability system should be to enable us to track crew members at all times and to identify the location of any and all units inside a structure or other hazardous area.” Most systems do not tell the incident manager where the firefighters are inside of the structure. This does not fulfill the goal of accountability (Coleman, 1997)

Six problem areas have been identified through previous research by other Executive Fire Officer students. Johnny I. Murdock’s (1998) comprehensive research paper on Accountability Systems lists these as:

1) Senior fire department management displays a lack of commitment to PAS’s by inconsistent use.

2) PAS implementation is not supported by a comprehensive Standard Operating Procedure covering how it is to be used.

3) The PAS is implemented without the thorough training of firefighters expected to participate in the system and/or the officers expected operate the system.

4) A PAS is implemented which fails to meet NFPA criteria.
5) Instead of the system designating and assigning accountability officers, the Incident Commander or safety officer at an incident is expected to operate/manage the PAS.

6) Firefighters perceive that the PAS is compromising aggressive fire attacks.

(Murdock, 1998)

Chief Coleman describes a reality not listed in the previous six problem areas. He refers to what he calls the “assignment cycle”. That being, “Staged – Assigned – Rehab”. It is in the last area that causes the problems. Crews exit the building and go to Rehab to recuperate. They change their air bottles, take a break, and return to their previous work area and look for something else to do without letting the incident commander know of their actions (Coleman, 1997).

Chief Coleman sums up the question of scene accountability throughout the incident. “I want to know where my crews are and what they are doing at all times while they are in the structure and the fire is not under control.” Accountability is: crews working together, staying together, and letting their supervisor know of their actions (1997).

**Actions Needed to Improve Accountability Systems**

Fire Chief Steve Howard of the Basalt Colorado Fire Department measures his success of personnel accountability by asking fireground personnel a few questions (Dittmar, 2000b). First, ask any officer, “who is working for you, where are they, and what are they doing?” Second, ask any firefighter, “for whom are you working, what are you supposed to be doing, and where are you supposed to be?” If he gets the correct answers from both groups, that is successful accountability. How do we get to that point on a daily basis (2000b)?
First, and most importantly, fire departments must hold company officers accountable for their personnel. This means every fire response. Company officers are supposed to be doing this anyway. It is plain and simple, a “discipline” thing (Coleman, 1997).

Second, as required by NFPA 1561, the incident manager shall maintain accountability for the location and function of each company or unit at the scene of the incident (NFPA, 1561 2-6.3.1). This can be accomplished by giving incident specific assignments. When crews arrive on the scene, the incident manager gives an assignment, i.e. Topside ventilation. The incident manager then tracks this assignment on some type of “status” board or incident worksheet. (Coleman, 1997)

Third and fourth, crews must be required to remain intact and tell what they are doing throughout the incident. This is the basis of on scene accountability. The incident manager assigns entire crews to tasks. When these tasks are completed, the crew must notify the incident manager. If the crew decides to engage in another required activity in another area, this must be relayed to the incident manager. Without good communication, the system will fail (Coleman, 1997).

The Department of Public Safety (Fire Safety Standards Committee) of the Mat-Su Borough in Wasilla, Alaska reviewed the 1992 edition of NFPA 1500 in 1993 and compared their personnel accountability system to the standard. Their research developed eight criteria for Personnel Accountability Systems.

1) Must identify all personnel operating at an incident
2) Must identify the members of each crew and all supervisors
3) Must be flexible by allowing for on-scene crew formation, the splitting of initial crews, and the assignment/rotation of individuals to and from existing crews
4) Must identify the location and assignment of each crew or supervisor within the hazard zone of an incident

5) Must identify when a firefighter, crew or supervisor is delayed or missing from an assignment so that a search can be initiated

6) Must be simple enough to use so that it can be implemented without delaying aggressive firefighter efforts

7) Must be usable and appropriate for routine incidents, but must be expandable and adaptable to the unusual, large and/or extended incident

8) Must possess the potential for regional adoption, including the ability to incorporate fire personnel from several agencies (Murdock, 1998)

With all of the above said, in summary, fire departments must follow the current NFPA standards relating to personnel accountability. Simply put, hold officers accountable for their subordinates, track personnel location and assigned function, require crews to stay together and report their activity to the incident manager.

**PROCEDURES**

**Definition of Terms**

**Accountability.** A system or process to track resources at an incident scene (NFPA, 2000).

**Personnel Accountability System.** The method used for tracking all firefighters location and function on an emergency scene (Greensboro Fire Department, 1998).

**Status board.** White boards with a series of Velcro™ strips on their lower portions used as collection points for incident managers at emergency scenes (Seattle Fire Department, 1999).
**Hazard zone.** An area that requires a self contained breathing apparatus or an area in which a firefighter is at risk of becoming lost, trapped, or injured by the environment or structure (Greensboro Fire Department, 1996).

**Incident commander/manager (Fireground Commander).** The person who assumes overall command of personnel and apparatus at the emergency incident scene (Brunicini, 1985).

**NFPA.** (National Fire Protection Association) A private, voluntary, non-profit association whose activities include the production of technical and professional standards using a consensus approach in the development of standards (Bryan & Picard, 1979).

**Rehab.** Area Providing an organized response to the safety and welfare of all fireground personnel (Brunicini, 1985).

**Topside ventilation.** Tactical tool used to relieve smoke and heat conditions vertically from inside of a structure (Greensboro Fire Department, 1998).

**Research**

Action research was used to determine: if there is a need for personnel accountability systems on the emergency scene, what systems are available to the fire service, problems faced while using an accountability system, and what is needed to improve available systems.

This researcher originally began the project while attending the Executive Development Class in the Executive Fire Officer Program (EFOP) in August of 2000. The National Fire Academy Learning Resource Center provided the initial information to determine the need for the study of the chosen topic. The idea was confirmed by the amount of previous research already conducted by EFOP students in the past.

After returning to Greensboro, a more thorough, in depth process took place. An outline was developed for the overall project to include all of the areas required in the *Applied Research*
Guidelines manual provided by the National Fire Academy. Initial research began on the internet from numerous fire service related sites. From there, a review of personal reference material was conducted. The Greensboro Fire Training Section provided resources in the form of periodicals, national standards, and departmental operating guidelines. Two interviews were conducted with local fire service leaders to provide personalization of the project. Index cards were used to collect points of interest provided by the source/material. This portion of the overall process lasted until November of 2000.

As previously mentioned, two interviews were conducted for the project. First, Deputy Chief B.C. Cox was interviewed due to his involvement in establishing an incident management system in the Greensboro Fire Department. An informal discussion took place via telephone conversation on November 6, 2000. The interview lasted approximately 45 minutes. Chief Cox was assigned to the Fire Training Section when the Fire Department established an incident management system in 1986. He, along with Assistant Chief P.D. Brooks, researched the topic and developed a training outline and standard operating procedure for the department. He explained the training process and implementation procedures. Interview questions centered around where we have been to where we are now in relation to tracking firefighters on emergency scenes.

The second interview with Assistant Chief D.E. Spears took place via telephone conversation as well. This interview took place on November 16, 2000 for a duration of 1 hour. Chief Spears was assigned to the Fire Training Section when the Department implemented a Personnel Accountability System. Chief Spears provided insight to why the current system was chosen. He had attended the Fire Department Instructors Conference in Cincinnati, Ohio in 1992. The “innovative” topic of Personnel Accountability Systems was on the agenda that year.
Also, NFA-TRADE – Region IV discussed the topic that year at their regional meeting. Other departments were utilizing the Passport System originating from the Seattle Fire Department. He conducted his own research, presented the program to the department staff officers, and developed a system based on Seattle’s program. Chief Spears answered questions revolving around the implementation schedule and procedure, problems encountered, and future considerations regarding personnel accountability.

End Product Developed

The research indicated a need for a type of status board to be used by incident managers to track the location, as well as the function, of on scene firefighters. A tracking board was developed using polycarbonate glass or plexiglass™, clear plastic and Velcro™. Appendix A and B provide a computer generated drawing of the model. The Greensboro Fire Department already had a method of tracking who was on the scene but did not have a method of identifying their exact location and function on the fireground.

Assumptions and Limitations

This researcher conducted a literary review by researching periodicals, reference books, and personal interviews. It was assumed the written information was valid and correct. Interviews were personal viewpoints of the individual only. Research focused primarily around fire departments with paid, full time staff. The Greensboro Fire Department does not utilize volunteer firefighters and therefore does not have a need to track personnel who may arrive on emergency scenes in personal vehicles. Research was limited to material written within the past 5 years, with only a few exceptions used to verify particular points. Types of accountability systems included an array of possibilities but this researcher provided specifics on those affordable and currently on the market to the fire service.
RESULTS

Research Questions

Are Personnel Accountability Systems required on emergency scenes? This is the first question answered by this researcher. National standards are not always established as a requirement. However, many standards have become what is known as consensus standards and are enforced on a routine basis. Therefore it is in the fire departments best interest to conform to the national standards (D.E. Spears, personal communications, November 16, 2000). In 1993 the NFPA developed personnel accountability standards to be utilized in the fire service. Fireground deaths continued to plague the fire service and many reasons pointed to lack of accountability on the emergency scene. The 1997 edition of NFPA 1500, Chapter 6, Section 3 lists the requirements set by the NFPA 1500 Technical Committee. NFPA 1561, Chapter 2, Section 6 list identifies the mechanics of operating an Accountability System.

Also, local requirements set by the State of North Carolina are identified in North Carolina OSHA guidelines, Subpart L (North Carolina Fire & Rescue Commission, 1997c). With the sources identified, the answer to the original question is, yes. Accountability systems are required on emergency scenes.

The second question is: What Personnel Accountability Systems are available and successfully utilized in the fire service? Systems range from simple to complex. One specific item used in determining the type of PAS used by a fire department is that of budgetary constraints. Albeit, the fire service has many options as described by this researcher. The catagories can be divided into 5 different types: (1) Manual systems include – daily rosters, clipboard and paper, white board and grease pencil or wax marker, radio roll call, ring based system, hook and pile, and card punch systems; (2) Electronic Assisted include - bar code and
radar technology; (3) Radio Frequency Systems include – RF motion sensors and Global Positioning Systems; (4) Personal Alert Safety Systems are not necessarily a type of system but are used in conjunction with other systems and include – SCBA integration with temperature sensing devices, electronic transmitting radio frequencies, and key activated devices; (5) Electronic Status Monitors are not used in fire service yet but are being developed and possibly include -sensor vest, non invasive medical sensors, silicone rubber fibers, foot force sensors, heart/lung monitors, hands off arrhythmia monitors, and secure laser technology (USFA & FEMA, 1999).

NFPA standards do not specify the type of PAS required on emergency scenes. Many systems are operational since the Accountability Standard’s inception and many more are in the future of the fire service.

What are the challenges facing Personnel Accountability Systems throughout emergency incidents? This was the third research question explored. Current systems do a good job of identifying who is on the fireground but do little to identify their exact location and function. This is common ground for many fire service leaders (Coleman, 1997). Other problem areas can be summed into the following: (1) lack of commitment by senior fire department management; (2) accountability system is not supported by a comprehensive operating guideline; (3) lack of training in the use of the system; (4) system fails to meet NFPA criteria; (5) lack of personnel to operate the system on scene; (6) firefighters perceive system compromises attack efforts; (7) freelancing; (8) splitting up of crews; and (9) lack of communication between crews and incident manager (Coleman, 1997 and Murdock, 1998).

There is no particular order of the previously listed areas of concern. Each is a piece of the total accountability system. Battalion Chief John F. Coleman of the Toledo, Ohio Fire
Department identified his view of an efficient and effective accountability system to be: crews working together, staying together, and letting their supervisor know of their actions at all times (1997).

The fourth, and last research question: What actions are necessary to improve the existing Personnel Accountability Systems? Several recommendations were discovered while conducting the literary review. The requirements identified for improvement include: (1) identify all personnel on the fireground; (2) must be flexible to allow for on-scene crew rotation; (3) must identify when crews or individuals are delayed or missing; (4) must not compromise an effective fire attack; (5) must be usable for routine incidents and expandable for complex incidents to include multiple agencies (6) hold company officers accountable for their personnel – always; (7) incident managers must track personnel location and function while operating on the emergency scene; and (8) require crews to stay together and continuous notify the command officer of their actions (Murdock, 1998).

Fire service leaders have identified the issues facing personnel accountability. Chief Alan Brunacini, of the Phoenix Fire Department wrote in 1985, “The Sector Officer must be able to account for the location and welfare of every worker in every crew assigned to his sector.” This issue is still challenging officers in 2000.

**Unexpected Findings**

One particular point seemed to be prevalent in most of the accountability systems researched. Many systems struggle to identify the exact location and function of personnel. In fact, this point was not even addressed in many cases. The commonly used accountability systems are able to track personnel arriving on the scene and entering the hazardous area but do little to pinpoint exactly where they are in the building and what they are doing. The consensus
standards clearly state the requirement to do so. It is not enough only to know that a crew is inside of the structure. The incident manager must know where inside of the structure each company is located and exactly what they are doing. The ability to identify missing firefighters and where they were in the structure when a problem arises could prove to be the difference between a successful rescue and a recovery operation (Howes, 1997).

**Final Product**

The research indicated shortcomings in the Greensboro Fire Department’s personnel accountability program. Two key areas identified were: the need to track exact location and function of firefighters on emergency scenes and a need to revise the General Operating Guideline – Accountability to include recommended suggestions to program.

First, an additional status board was developed as indicated in Appendix A and B. The new board will not only track sector location of fire companies but will track their specific assignment while operating inside of the hazard zone. The board will be used on a trial basis in District 1 for a six month period. Battalion 1 chief officers will be briefed on the use of the status board. The assignment tags are pre-printed but will also include several blank tags to be “made-up” on the emergency scene. As companies are assigned to a particular area in the hazards zone, the incident commander can track their assignment. The Accountability Officer will continue to track firefighters as they enter the hazard zone allowing for an additional safety factor for the firefighters. For example, three engine companies are assigned inside of a structure. The Accountability Officer will put their Passport on his/her status board, identifying company and personnel names entering the building. The incident commander will make assignments for the three crews and track them on his/her status board identifying their specific assignment. Eventually, both boards will be used by the accountability officer.
Secondly, an addendum to the operating guideline was developed. The amendment to the guideline defines the method for splitting companies and radio designations (Appendix C). The Greensboro Fire Department has always allowed personnel to operate on emergency scenes with a minimum crew size of two as long as communications could be maintained. The previous low band radio system however, did not allow for more than one radio per apparatus. The new 800 MHz system allows the Department to place two radios per apparatus. Using the company officer as a team leader and the fire equipment operator as a second team leader, crews can split on the scene. The team leaders will “make up” Passports on the scene identifying their newly assigned personnel.

Firefighters will be trained during tactical training sessions. Each battalion conducts tactics training every Sunday morning worked. Computer simulations are utilized and require firefighters to function in command positions. Modifications to the Accountability Program will be incorporated with approval from the Training Supervisor.

**DISCUSSION**

The fire service continues to lose an average of 100 firefighters every year. Students, firefighters, and experts in the field of analyzing data suggest a need for a reversal in the trend, all according to previous research. My findings in relation to others are in agreement wholeheartedly. Research indicates due to improved equipment and protective clothing, firefighters are allowed to be more aggressive on fire scenes. According to Rita Fahy, NFPA manager of Fire Databases and Systems, there is an indication that the lack of on-scene accountability is one component of incident management that has exposed firefighters to greater dangers (NFPA, 2000). This researcher found not only a concern for the lack of on-scene
accountability, but an inefficient use of available accountability systems and in some cases a lack of support by senior fire service leadership.

The National Fire Protection Association has written two specific standards outlining accountability standards for firefighters. NFPA 1500 and 1561 have sections identifying when, where, why, and how to implement an accountability system. Each fire department then has the responsibility to implement a program of their choice that coincides with the required components in the Standards. This researcher found several accountability systems available, with the Seattle Passport system the one of choice. Conflicting points of view were noticed throughout the research process. Research indicated two schools of thought. One is, the fire department has developed their method of on scene accountability and it meets the needs of the particular department. The other thought is, a system is in place but it does not tell the incident manager exactly where the firefighters are located and what they are doing. In reality, this researcher agrees with the August, 1997 class at the National Fire Academy (Strategic Management of Change). The class was asked the question, do your crews remain intact throughout incidents? Twenty-two students answered the question with a negative response (Murdock, 1998). The Greensboro Fire Department uses a variation of the Passport system. However, once the first self contained breathing apparatus bottle is depleted, the system breaks down. NFPA 1500 and 1561 give the fire service a guide to track firefighters and provide the safest possible working environment.

This researcher determined a need to identify the types of accountability systems available. Unlike many of the previous applied research projects, an additional publication was available. The U.S. Fire Administration and the Federal Emergency Management Agency developed a manual to provide the fire service a technology assessment of personnel
accountability systems. The manual also included systems from very basic to extraordinarily complex. In one concise location, an array of knowledge was presented. In this researcher's opinion, accountability systems are heading toward technology-based systems. However, one must remember, the incident manager must not become complacent with automated systems. The ultimate responsibility will continue to be in their hands.

My findings are parallel to comments made by Battalion Chief John F. Coleman of the Toledo, Ohio Fire Department. He suggests that many of the current systems in use today only track who is on the scene and not exactly where they are located. If an immediate problem arises, we must know exactly where the firefighter or crew was last working. To the incident manager, it could mean the difference between a successful handled fire and a never-ending trail of guilt. Research conducted by Johnny I. Murdock (1998) in the Executive Fire Officer Program identified a comprehensive list of problems encountered by fire service leaders regarding accountability. Departments must implement an accountability system which must be supported by the senior staff. The program implemented must meet NFPA requirements and the firefighters need to be trained. This researcher found that when many departments implemented incident management training in the past, accountability was not a particular focus. It has been a difficult process to add this much-needed program to the emergency scene. Firefighters want to be aggressive on the emergency scene. In many cases, they have felt that placing a tag or swiping a card compromises their attack efforts. As fire service leaders, we must not force the program but rather prove the need for their safety.

In my opinion, the Greensboro Fire Department has already done a lot of things right. The Department routinely uses an incident management system, assigns an accountability officer on all working fires, and has a full-time position of department health and safety officer. The
findings of this research project indicate a need for the following: (1) hold company officers accountable for their personnel at all times, (2) hold incident commanders accountable for the exact location and assignment of their personnel on the emergency scene, (3) hold firefighters accountable to keep their company officer informed of their actions at all times, (4) require crews to remain intact, or use guideline addendum for splitting companies and, (5) require sector officers to communicate when assignments are completed to the officer in charge.

My interpretation of the study results lead me to believe that personnel accountability on the emergency scene is a universal problem. Firefighters will always do something, therefore they need leadership and direction. Tell them what you want and they will do it. Give them the tools and they will use them. Enforce the policies uniformly, and to everyone, and they will be followed. We need to track more than just who is on the scene, we must track what they are doing and their exact location. We currently have about one hundred firefighter deaths per year, not many compared to the number of firefighters in the United States. Many deaths are attributed to lack of accountability according the National Fire Protection Association. District Chief Mike McNamee of the Worcester Fire Department was put into a position that no fire service leader wants. The firefighters were aggressive. They did their job. But in this case, the fire won. “I want head counts. I want everyone accounted for (Flynn, 2000).” These are words no fire officer wants to say after a catastrophic event on the fire scene.

The implications of this study on the Greensboro Fire Department will be a better PAS. The Fire Department knows of the deficiencies and wants to improve to provide the best service possible. This applied research project will give senior leadership a tool to use along with their ideas to improve the current system. Technology well eventually provide affordable systems to the fire service. Adjustments to the current system will bridge the gap until that day arrives.
RECOMMENDATIONS

This researcher chose the topic of personnel accountability because I am a front line officer and realize the importance of the front line firefighter. They commit their lives to public safety everyday they walk in the fire station. A more efficient way of tracking must be developed. According to the research, several recommendations need to be implemented to improve the current system.

First and foremost, the department must recommit to the concept of personnel accountability. Once this is made, enforcement of the policy will play a key role in implementing the suggested strategies.

This researcher developed a secondary tracking board and revised the current personnel accountability policy. From this point, training will need to be conducted. The Greensboro Fire Department conducts tactics training within each battalion on Sunday mornings using a computer based simulation package. Each battalion chief is required to coordinate real life scenarios using digital photography from occupancies within the station’s jurisdiction. This time should include training on personnel accountability. Training scenarios will allow for firefighters to practice utilizing the status boards in a controlled environment.

Additionally, a policy addendum was written to allow for smaller crews on the fire scene. The policy changes must be included in any training conducted. Personnel must be informed on how firefighting crews will be separated into smaller teams. Additional training on radio terminology and team designation is also suggested during routine tactics training. Currently the Greensboro Fire Department conducts personnel accountability reports during emergency incidents. One additional piece of information is suggested with this report. The crew’s present assignment should be given along with unit name and company status.
Additional Passports will need to be purchased. Currently Passports are only available for each engine or ladder truck company. Blank Passports will need to be carried by every officer and fire equipment officer in order to “make up” companies on the emergency scene. Personnel will need to verify they have the designated (6) name tags in their possession. If not, additional tags will also need to be purchased.

And last but certainly not least, chief officers must make a genuine effort to track exactly where each crew is and what they are doing on the fire scene. No assumptions are to be made. Company officers must report their activities to the scene supervisor. Communications must flow to and from the company officer and the chief officer.

In the future, researchers will be challenged with additional technological advances in personnel accountability. Technology based systems will eventually become affordable to the fire service. The firefighter beginning a recruit academy today, in the year 2000, will have many opportunities to research and determine the way to track tomorrows firefighters in the next century.
REFERENCES


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APPENDIX B

Assignment Board (Rear)
**APPENDIX C**

*Addendum to Operating Guideline*

Subject: Safety  
Section: Accountability  
Page: 10 of 10  
Date: 1/1/2001  
Reference: Addendum to General Operating Guideline

**Overview**

Fireground tasks often require a minimal crew size. It has always been the intent of the Greensboro Fire Department to allow for a minimum crew size of two. However, in the past, the low band radio system did not allow for the Department to assign more than one radio to each company. The 800MHz system does allow for additional radios to be assigned more easily. Personnel location and assignment are required to be tracked by national standards throughout emergency incidents. This addendum allows for smaller crew sizes and insures incident commanders are aware of fireground actions at all times.

**Crew Splitting**

Fireground tasks requiring a minimal crew to complete will be made up as follows:

- Fire Equipment Operator (or Acting FEO) and (1) firefighter  
- Company Officer (or Acting Captain) and remainder of company

**Radio Designation**

Radio designation will be: company name and radio assignment, i.e. Truck 5 – Captain, or Truck 5 – FEO

**Passports**

Company officers will remove names of FEO and other team member and give to FEO to make up new Passport. Company Officer will make Incident Commander of new team. The Incident Commander shall then track both crews separately until assignments allow company to return as one unit.