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Providing Optimal Fire Protection to the Chesterfield County Airport

Timothy M. McKay

Chesterfield Fire and EMS

Chesterfield, VA

CERTIFICATION STATEMENT

I hereby certify that this paper constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

Signed: *Timothy M. McKay*

Abstract

The personnel of Chesterfield Fire and EMS are not prepared to handle an aircraft emergency at the Chesterfield County Airport. The purpose of this research was to prevent death, injuries property damage and to minimize the disruption of local commerce by providing the optimal level of fire protection at the airport. Both descriptive and evaluative research was used to answering the following questions:

1. What are the measured performance levels during response to an aircraft emergency at the Chesterfield County Airport?
2. What performance measures and response standards are used by other departments required to provide fire protection at reliever airports?
3. How do other fire departments required to provide fire protection at reliever airports train and prepare their personnel for this responsibility?
4. What resources are needed to improve the Chesterfield Fire and EMS response to aircraft emergencies at the Chesterfield County Airport?

The procedures for the study included a document analysis of applicable codes and standards, interviews with relevant experts and a survey of fire departments that provide fire protection to similarly classified airports.

The results of the study indicated that the both the training of personnel and the availability of those trained personnel are paramount to providing the optimal level of response. In addition, some secondary needs in terms of equipment were identified.

The recommendations included the creation of an airport work group after identifying the key players in providing fire protection, the addition of more measured performance levels during aircraft emergency response, and a plan for improving the level

of training current personnel have. In addition, included are recommendations for a minimum staffing level at the airport fire station and a discussion of the importance of education and advocacy of department personnel.

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Introduction

The Federal Aviation Administration reports that at any given time, there are over 7,000 aircraft in the skies over the United States (FAA, 2011a). While travel by air is often touted by statisticians as the safest form of transportation, no jurisdiction in the United States is free from the worry of a potential aircraft incident within its boundaries. These risks undoubtedly increase with the presence of an airport in a community as its mere existence means increased aircraft operations in the area as opposed to simply occasional flyovers by planes at 30,000 feet.

Chesterfield County is home to the Chesterfield County Airport (FCI), and the Chesterfield Fire and Emergency Medical Services department (CFEMS) is tasked not only with the provision of fire, emergency medical services, technical and specialty rescue and emergency management within the county, but also with the fire protection for and emergency response to the Chesterfield County Airport. This added responsibility is a weighty one and is difficult for a structural firefighting department such as CFEMS to prepare for.

The problem is that the personnel of Chesterfield Fire and EMS are not prepared to handle an aircraft emergency at the Chesterfield County Airport. This lack of preparation translates directly into increased risk for the passengers and aircrew who utilize the airport, the employees who work there, and particularly to the firefighters who would respond there for an emergency. The purpose of this evaluative and descriptive research was to prevent deaths, injuries, property damage and the disruption of local trade and commerce by providing the optimal level of fire protection for the Chesterfield County Airport. The optimal level was ascertained by answering four research questions. First, what are the

measured performance levels during a response to an aircraft incident at the Chesterfield County Airport? Next, what performance measures and response standards are used by other departments required to provide fire protection at reliever airports? Third, how do other departments required to provide fire protection at reliever airports train and prepare their personnel for this responsibility? Finally, what resources are needed to improve the CFEMS response to aircraft incidents?

Background and Significance

The County of Chesterfield occupies 446 square miles in the central portion of Virginia near the capital city of Richmond from which it is separated to the north by the James River. It is bordered on the south by the Appomattox River and is one of the jurisdictions included in the Richmond Metropolitan Statistical Area (MSA). From a largely rural county with sprawling farms and small, isolated communities just thirty years ago, Chesterfield has grown into a living example of rapid suburban development with an increase in its population of over 100% in that timeframe to the current total of 316,000 citizens making it the third most populated county in the Commonwealth of Virginia (Chesterfield County, 2010).

While the southwestern portion of the county is still largely undeveloped, the north, east, and central sections are heavily populated and full of dense residential and commercial properties that have become “bedroom communities” for the large corporations which call Richmond home. The southern region of the county is home to the jurisdiction’s heavy industry and major transportation networks including railroads, U.S. Route 1, and Interstate 95.

Chesterfield County's rapid growth has been a challenge for local government agencies, including Chesterfield Fire and EMS, a combination agency with now nearly 500 career staff and 150 active volunteers operating out of 29 fire and rescue stations strategically located throughout the county (CFEMS, 2009). All career staff is cross trained in both fire and emergency medical services. The agency responded to more than 34,000 calls for service in 2010, a nearly three percent increase over the previous year (T. Tucker, personal communication, June 10, 2011). Under the CFEMS umbrella are the responsibilities for suppression, prevention, education, emergency medical services, technical rescue, water rescue, hazardous materials response and emergency management. Chesterfield County's size, its diversity and its ever-changing landscape and demographics have been and continue to be challenges for department leadership.

As the county has grown, attracting businesses and promoting economic development rose to importance as increasing revenue to fund public safety, infrastructure, and schools became critical. A key component of the county's economic development plan is the Chesterfield County Airport. Over 16.8 million dollars in total annual economic activity is tied to the airport, including 266 jobs and over six million dollars in wages (Chesterfield County, 2011). Airport management has taken this responsibility seriously, and with its motto, "Your business trip starts here," strives to be the "executive gateway into or out of the Greater Richmond, Virginia area" (Chesterfield County, 2011).

FCI is designated a general aviation "reliever" airport by the FAA. General aviation airports are those airfields which handle private air traffic and the occasional unscheduled commercial flight such as an air taxi. Relievers serve predominantly as general aviation airports, but possess the facilities and amenities to handle increased levels of aircraft

operations to “relieve” a nearby major commercial airport of congestion. In this case, FCI is a reliever for Richmond International Airport, located about 15 miles to the northeast. In fulfilling its role as a reliever, the airport continues to grow and expand, having already completed all of the goals in its 1994 Master Plan several years early. An updated master plan is being crafted now which will include additional infrastructure upgrades, including a runway lengthening project to accommodate larger and more varied types of aircraft (Chesterfield County, 2011).

Completed in 1973, FCI now boasts a state of the art terminal building, maintenance facility, new Instrument Landing System (ILS) and lighting, and a 5,500 foot runway capable of handling nearly all types of general aviation aircraft, as well as some smaller commercial planes. There are an average of 159 aircraft operations (take offs and landings) per day and 129 aircraft are based at the airport including 10 jet and 23 multi-engine airplanes (AirNav.com, 2011). The Virginia Civil Air Patrol is based at FCI as is the headquarters and Chesterfield base of the Virginia State Police Aviation Division which operates a number of fixed wing law enforcement aircraft and a helicopter air medical service (J. Green, personal communication, June 20, 2011).

Fire protection at the airport began with the airport manning a pickup truck, the bed of which was full of dry chemical fire extinguishers. Later, the traditional wheeled airport dry chemical extinguisher cart was introduced. The nearest fire company was Station 11, located approximately 4 miles from the airport grounds. In 1989, then Fire Chief R. L. Eanes oversaw the construction of Fire Station 15, which is located immediately adjacent to the airport property. Several years later, the department acquired a 1989 Oshkosh P-19 Aircraft Rescue and Firefighting (ARFF) vehicle which is housed at Station 15 (P. Mauger,

personal communication, June 23, 2011). Today, Station 15 houses the ARFF vehicle, one engine, an ALS transport unit and is home to the department's hazardous materials team. Staffing levels are three on the engine and two on the medic unit. The hazardous materials unit and ARFF unit remain unstaffed until needed, at which point either the medic or engine must go out of service in order for them to be able to respond. If the Station 15 units are out of service for any reason, from training and call activity to maintenance, no staffing is available for the ARFF vehicle and the next closest engine would respond to an aircraft emergency.

CFEMS personnel are given a four hour "home grown" course of instruction in recruit school concerning ARFF. There are no simulations, practical exercises, live fire training or site visits associated with this class. Personnel assigned to Station 15, through company level preplanning work and call activity become familiar with the airport property. However, no additional training is provided to members of CFEMS regarding airport or aircraft incident response. The airport's desire to provide quality fire protection to attract more business clientele, led to their funding the attendance of six firefighters from Station 15 at a basic ARFF certification course, the first members to do so (T. Trudeau, personal communication, June 16, 2011).

Recognizing the increased risk to life, property, the environment, as well as the threat to local commerce and businesses as the airport continues to grow and more aircraft operations are conducted in the area, CFEMS must strive to determine what level of fire protection is the most favorable, and still attainable, for the Chesterfield County Airport. Only then can a plan be created to work toward achieving that optimal level of protection.

This research project furthers two of the United States Fire Administration's strategic goals. First, in supporting goal #2 of improving local planning and preparedness, this project utilizes, as suggested in goal #2's operational objectives, "modern data and information analysis in local planning and preparedness". The data obtained through this project will aid CFMES in continuing to plan and prepare for the emergencies of the future. Next, in support of goal #3 of improving "fire and emergency services capabilities to respond to and recover from all hazards", this project will improve not only the efficiency of the CFEMS response to aircraft emergencies, but the safety of those responses as well. This translates into less line of duty deaths and injuries that might occur as a result of improper preparation, planning, and response (USFA, 2010).

The project also ties in closely with the Executive Analysis of Fire Service Operations in Emergency Management (EAFSOEM) course at the National Fire Academy. The objectives for that course include ensuring that the student "will be able to analyze their department's and community's level of preparedness" (NFA, 2010). Using the data collected during this project, the level of preparedness at both Chesterfield Fire and EMS as well as at FCI will be analyzed and used to improve response capabilities.

Another objective of the EAFSOEM course is to secure the ability of the student to "perform Vulnerability and Capability Assessment for Target Hazard and Infrastructure Sites" (NFA, 2010). This research project takes a look at the hazards and vulnerabilities specific to the Chesterfield County Airport as a critical piece of the county's infrastructure.

Literature Review

A review of pertinent material previously written and published was performed on the subject of response to aircraft and airport emergencies. A thorough search using the Internet was conducted to determine not only what standards or regulations might apply, but to locate applicable policy, procedure or guidelines from other departments as well. The Clover Hill Public Library in Chesterfield County, VA, the Farmville-Prince Edward Public Library, as well as the Learning Resource Center at the National Fire Academy was used to locate additional published information on the topic. Specifically, this review was an attempt to determine what other professionals and practitioners have discovered and published with regard to the research questions.

A discussion of the literature associated with aircraft emergency response must begin with a review of codes and standards applicable to ARFF and the provision thereof. The first is Federal Aviation Regulation (FAR) 14 CFR Part 139, known simply by practitioners as Part 139. Part 139 requires operators of airports who are certificated under this section to provide ARFF services while air carrier operations are ongoing (FAA, 2011b).

Airports are required to become certificated and comply with the provisions of Part 139 only if they choose to serve certain air carrier operations. Specifically, if the airport serves passenger aircraft providing scheduled service in aircraft designed for more than nine passengers or aircraft providing unscheduled service in aircraft designed for more than 31 passengers, then Part 139 applies and compliance is mandatory (FAA, 2011b)

Another source of information on applicable standards is the National Fire Protection Association (NFPA). The NFPA has published several standards which deal

with ARFF and they provide the “how to” part of providing the required firefighting services. First, *NFPA 403 Standard for Aircraft Rescue and Firefighting Service at Airports, 2009 edition*, enumerates the requirements for ARFF services at airports. This includes numbers and types of equipment, staffing, and capabilities. It also discusses the importance of predetermined mutual aid agreements for aircraft incidents to ensure the proper resources make it to the scene. From the introduction, the standard explicitly relates survivability of an aircraft incident to how effective the rescue equipment is, how well trained the rescuers are and how efficiently the two can be used together (NFPA 403, 2009).

Another applicable NFPA standard is *NFPA 1003 Standard for Airport Fire Fighter Qualifications, 2010 edition*. Whereas NFPA 403 discusses the firefighting services required, 1003 tackles the qualifications of the firefighters themselves. It lists the minimum job performance requirements (JPR) for airport firefighters. Airport firefighters must meet the same qualifications as a Firefighter II as defined in NFPA 1001, Standard for Firefighter Professional qualifications and be certified to the hazardous materials operations level. In addition, according to NFPA 1003, airport firefighters must demonstrate knowledge of ARFF personal protective equipment, aircraft traffic patterns, runway and taxiway markings and lighting, and aircraft fuels (NFPA 1003, 2010).

The FAA has published Advisory Circular 150/5210-17B, also known as *Programs for Training of Aircraft Rescue and Firefighting Personnel*. This 2009 document encourages training programs to comply with NFPA 1003 discussed above. It states that, “proficiency is the key to a successful ARFF training program” (FAA, 2009b, p. 2). This document lists the required components of an ARFF training curriculum:

1. Airport familiarization
2. Aircraft familiarization
3. Rescue and firefighting personnel safety
4. Communications
5. Use of fire hoses, nozzles, turrets and other appliances
6. Application of extinguishing agents
7. Emergency aircraft evacuation
8. Firefighting operations
9. Adapting structural firefighting equipment for ARFF
10. Cargo hazards
11. Airport emergency plan

The training curriculum is required to be augmented with live fire drills, first aid instruction and hands on training on the types of aircraft that will be served by the firefighters (p. 2-7).

Tackett, (2000) in his work, *General Aviation Firefighting for Structural Firefighters*, states that in most localities, the local fire department is most often called upon to respond to and mitigate all types of emergencies. Usually, the personnel from these agencies have only structural fire training. They are ill prepared to handle an incident involving an aircraft or the airport.

In the *Resource Guide to Aircraft Fire Fighting and Rescue*, the Aviation Safety Advisory Group says that, “A well designed training program for accident first responders will save lives, stop loss, and return the airport to normal as soon as possible” (p. 3). This document states that while non-commercial airports in more suburban and rural

communities do not have to be Part 139 compliant, it is “desirable to have at least one aviation specialist on duty at all times” who is familiar with the needs, risks and intricacies of aircraft emergency response. This specialist should have:

1. aircraft and airport familiarization,
2. hazardous materials training,
3. knowledge to adapt structural firefighting equipment to ARFF,
4. the ability to communicate effectively with air traffic control, and
5. the ability to identify hazards to response personnel (p.3).

In addition, the guide emphasizes the importance of hands of training to ensure aircraft familiarization, but does remark that when this is not feasible computer based training is a viable alternative (p. 11).

In 2010, Cobb wrote, in *Crash Course for the Airport Firefighter*, that “when municipal firefighters step onto airport property, they step into a very specialized part of firefighting.” He reiterates that while most aircraft incidents happen within close proximity to the airport, nearly 80% happen off of airport property. He uses this data to make the argument that it is imperative for structural firefighters to train in aircraft emergencies as they will often be the first to arrive. In the absence of formal ARFF training, he suggests books, manuals, working groups, aircraft schematics and computer resources as valuable sources of potential information. Finally, he reminds the reader that airports are unique in that they present multiple hazards and can be a mercantile, assembly, storage, high hazard, and business occupancy all housed under one roof or at least in the same general location.

Eyewitness Report: United 232 uses the words of Captain Al Haynes to recount the story of his United Airlines DC-10 which crash landed in Sioux City, Iowa in July of 1989.

While many died, 184 souls survived the crash, and to this day it is touted in the aviation industry as an example of a successful emergency landing. Captain Haynes gives much of the credit to the emergency responders in Sioux City. First, he acknowledged that they had about 40 minutes to prepare, which allowed them to move resources into position. But, had they not had a solid plan already in place, this time would have most certainly been wasted. He applauded the fact that they had a recent drill simulating almost the identical scenario they would now face for real and in between the real drill, they performed “paper” or tabletop exercises. He stated that although the circumstances weren’t identical, “by having practiced the drill, they were able to act effectively” (p. 9).

Airports like FCI, which have no scheduled flights, do not have to be Part 139 compliant. This is pointed out in by Chief Kunkel in Gier’s article, *Unfriendly Skies*. She points out that there are absolutely no formal legal requirements for a local fire department to provide any type of ARFF services at a non-certificated airport (Gier, 2008).

Because aircraft incidents can happen anywhere, all firefighters should be trained and prepared to handle an aircraft incident regardless of their assignment or their departments’ predominant mission. This is the belief of Captain Ellis of the Salt Lake City Fire Department. All firefighters have the potential to face an emergency of this nature, and should therefore take steps to be properly prepared (Ellis, 2005).

The FAA, in *Airport Emergency Plan*, otherwise known as Advisory Circular 150/5200-31C discusses the steps to create, revise and maintain the required airport emergency plan and states that, “Airports differ in complexity, but each has unique features” (2009a, p. 1). However, it quickly goes on to point out that while they are all unique, all are subject to emergencies and incidents. It encourages airport management,

who are ultimately responsible for the plan, to address the four components of comprehensive emergency management:

1. Mitigation
2. Preparedness
3. Response
4. Recovery (p. 6)

In determining how large a disaster to potentially plan and train for, planners are encouraged to use the largest aircraft normally serving the airport and to consider the largest aircraft that could potentially utilize the airport in an emergency situation (p. 111).

Finally, Chesterfield Fire and EMS Operational Procedure 27- Aircraft Emergencies, details the department's response in the event of an aircraft incident (Appendix A). The first part of the procedure details the unit assignments for this type of emergency, not only in dictating which units will respond but outlining the responsibilities of the first arriving units. The response includes not only CFEMS resources but the Virginia State Police, FAA, and the Chesterfield County Police Department. The procedure mentions reporting requirements for aircraft incidents, discusses communications protocol, and the need to potentially close the affected runway to ensure the safety of responders. An addendum to the procedure details when the National Transportation Safety Board (NTSB) must be notified of an incident (CFEMS, 2005). Of note is that the procedure has not been updated since 2005 and the link to the Airport Complex Map is not functional. The new airport emergency plan will include a grid map of the airport property that will be distributed to CFEMS stations and apparatus for future use.

Procedures

Methodology

The first-hand knowledge of the author of the lack of training provided to the personnel of CFEMS for aircraft incident response and the increased air traffic and risk at the airport served to help formulate the problem statement for this project. This knowledge, coupled with data regarding projected growth at the airport and the importance of its continued success as a marketing tool to bring business to Chesterfield County provided the background and significance. It is critical to assess the preparedness of CFEMS to respond to an aircraft emergency as well as the capability of CFEMS to perform safely and effectively at the scene. In addition, it is important to benchmark with other agencies serving similar airports to help establish the optimal level of protection in Chesterfield.

A combination of evaluative and descriptive research was used to answer four research questions:

1. What are the measured performance levels during response to an aircraft emergency at the Chesterfield County Airport?
2. What performance measures and response standards are used by other departments required to provide fire protection at reliever airports?
3. How do other fire departments required to provide fire protection at reliever airports train and prepare their personnel for this responsibility?
4. What resources are needed to improve the Chesterfield Fire and EMS response to aircraft emergencies at the Chesterfield County Airport?

Question one was answered with evaluative research to compare the response levels currently measured by CFEMS to any standards set forth by the FAA or local jurisdiction.

The current response levels were obtained through reports from the National Fire Incident Reporting System (NFIRS), the CFEMS Computer Aided Dispatch System (CADS) and through departmental training records.

Questions two and three were answered through the application of descriptive research. A survey was utilized to help determine best practices for providing fire protection at a reliever airport along with interviews with two subject matter experts.

Finally, question four was answered through descriptive research by comparing the data obtained in questions two and three to both the subject matter experts' recommendations and to the current resources available at CFEMS.

Document Analysis

Document analysis played a role in assisting with answering question one as the Part 139 document as well as NFPA 403 and the applicable FAA Advisory Circular had to be examined critically to determine to what degree, if any, those requirements applied to the Chesterfield County Airport. These documents were analyzed for content, their applicability to the situation in Chesterfield, and their usefulness in assisting with establishing an optimal level of protection.

Interviews

Interviews and personal communications were also used extensively in completing this research. Interviews were conducted with two subject matter experts, and it will be shown that much of the established literature on the subject corroborates their opinions. Both subjects were asked identical questions which can be found below and in Appendix E.

1. What performance levels should Chesterfield Fire and EMS measure to improve the effectiveness and efficiency of its aircraft incident response?

2. What preparation and training should Chesterfield Fire and EMS provide for its personnel to handle airport and aircraft emergencies?
3. Describe the optimal level of fire protection for a reliever airport, and specifically for the Chesterfield County Airport.
4. If you could improve, change or impact one facet of the Chesterfield Fire and EMS response to aircraft and airport emergencies, what would it be?

Brief biographical information establishing their foundations as experts was obtained and can be found in Appendix F.

The first interview was with Thomas Trudeau, Airport Manager of the Chesterfield County Airport. The interview took place in his office at the Chesterfield County Airport on June 22, 2011. The interview lasted 21 minutes. A follow up interview for the purposes of clarifying responses and ensuring accuracy was held on July 21, 2011, again at Mr. Trudeau's office. This interview lasted approximately 20 minutes.

The next interview was with Thomas Phelan, ARFF Program Chief for the Virginia Department of Fire Programs. The interview lasted one hour and 45 minutes and was conducted at the Eanes-Pittman Public Safety Training Center in Chesterfield, VA on July 20, 2011.

Survey

The need to survey other fire departments faced with providing protection to similar facilities was obvious. Using the FAA website, the author obtained the names of the reliever airports in the region, including the states of Maryland, Virginia and North Carolina. Excluding the Chesterfield County Airport, there are 17 designated reliever airports in that geographic area. Internet research was completed and phone calls were

made to determine the fire department responsible for providing protection to each reliever airport (Appendix B). Once the department was determined, contact was made to obtain a valid electronic mail address for the individual responsible for airport response. In the case of career agencies, this was the Deputy Chief of Operations in all but one case, and in the volunteer agencies contacted, this was the fire chief.

An electronic mail was sent to 17 individuals, representing the departments identified as having responsibility for protection of reliever airports. A cover letter (See Appendix C) explained the reason for the survey, how the data would be used and instructions for completing the survey. The author provided contact information in the event a respondent had questions or technical issues. The letter contained a hyperlink to a secure portal on the Survey Monkey website where respondents completed the survey. The survey remained open for one week to allow for responses at which time it was closed at the results collected and analyzed.

The survey itself contained two parts and can be found in Appendix D. The first part was designed to answer research question two regarding what data other fire departments collected regarding airport response and what performance levels they measured. Survey question one asked if the departments collected data specific to aircraft response. Survey question two followed up with a list of choices of various performance levels and asked the respondents to select all of those which their agency measured. Included was a box marked other, and if used, question three gave the respondent the opportunity to list other data they collect.

The second part of the survey was designed to provide data to answer research question three regarding preparation and training for aircraft incidents. Survey question

four asked if the department provided dedicated staffing for ARFF response and five inquired about specialized equipment that their agency carries and utilizes for such incidents, again giving the respondents the opportunity to elaborate on any answer of “Other”. Next, the focus shifted to training and respondents were asked if their department provided ARFF training, if so what kind, and then further, how else did their department serve to prepare its personnel for the responsibility of ARFF response.

Assumptions and Limitations

In selecting the subject matter experts to be interviewed, the author makes the assumption that each, based on work experience and work history provided in Appendix F are qualified not simply for their respective positions, but to provide quality information for this project. Further, we must assume that the individuals who were identified as being responsible for aircraft incident response in their jurisdictions were actually the ones who completed the survey. A final assumption is that we consider the data used to answer Question one obtained from CFEMS departmental records is valid. There is currently not a method by which to verify the veracity of the data used other than knowing that it was obtained via the department’s computer based records management system.

The project was limited to the study and consideration of fire protection at reliever airports. There exists technology, tools and training for airport firefighting that were not discussed because they are applicable only to commercial airport operations, or Part 139 certificated airports. To aid in managing the scope of the project, the study was also limited, in its data collection, to the mid-Atlantic region of the country.

Results

What are the measured performance levels during response to an aircraft emergency at the Chesterfield County Airport?

This research question was answered by utilizing evaluative research to compare the current data collected by CFEMS regarding response to aircraft emergencies to any applicable standards essentially taking a critical view of the current response provide by CFEM to these incidents from a data standpoint. Document analysis played a key role in this process both in terms of looking at NFIRS and CADS reports, but in interpreting the applicable codes and standards as put forth in Part 139.

CADS data revealed that from 2008-2011 there have been 21 responses by CFEMS to the airport property. Only one of those has been for an aircraft related incident. In addition, there was one off airport aircraft incident as well. The majority of the responses were for medical calls, and several were for fuel spills (L. Luke, personal communication, July 8, 2011). There is a predetermined response assignment for aircraft emergencies, (See Appendix A.) which includes CFEMS resources as well as law enforcement agencies and the FAA.

CFEMS collects no data specific to aircraft emergencies other than the basic information necessary to complete a NFIRS report. The agency collects the same data as it would for any type of response. This includes a host of information about time benchmarks including alarm processing time, turnout and response times and time until the incident is marked under control. The use of mutual aid is also tracked through CADS, but no predetermined mutual aid is on the initial running assignment. ARFF resources outside the

jurisdiction are known, no planning has been done to determine the response time and availability of the resources for specific times, locations, etc.

No data is collected on ARFF operations in terms of their effectiveness. Casualties resulting from aircraft incidents are tracked through the NFIRS casualty module and property loss is calculated through estimation of pre-incident value compared to the damage sustained. There is also no mechanism for tracking the cost of having the airport closed for any given periods of time during an aircraft incident in terms of lost revenue due to the disruption of business (T. Tucker, personal communication, June 10, 2011) .

Other than in the planning phase of an incident operation by the appropriate individual in the incident command structure, no consideration is currently given to the continuity of air operations. Procedure 27 states that the runway or airport may be closed if needed for safety, but does not address to where inbound air traffic will divert (CFEMS, 2005).

The applicable standards clearly indicate that no fire protection is necessary at an airport that is not Part 139 certificated. Therefore, while there is clearly room for improvement, CFEMS currently meets all codified requirements. Personnel assigned to Station 15 generally have some familiarity with the airport grounds and have access to a preplan document. However, most are not familiar with the Airport Emergency Plan and most have virtually no knowledge of airport and aircraft operations. Six firefighters hold current certification as ARFF firefighters which they received in May of 2011 (B. Hobson, personal communication, July 20, 2011).

What performance measures and response standards are used by other departments required to provide protection at reliever airports?

Research question 2 was answered through the answers to question 1 in the interviews of Trudeau and Phelan and through the data returned in Part One of the survey. Interview question 1 asked, “What performance levels should CFEMS measure to improve the effectiveness and efficiency of its aircraft incident response?” Trudeau answered that from the perspective of an airport executive, he is concerned about continuing to attract business and executive customers to the airport. Larger personal and executive air carriers want to be assured that even though FCI might not be a Part 139 airport that adequate safeguards exist to protect their clients. He was less concerned with times and equipment stating that those were best left to the fire department to decide what was acceptable, as he was with having skilled personnel. He stated that the measurement he would look for would be the number of certified ARFF firefighters on duty at any given time.

Phelan, when responding to interview question 1, discussed several measurements he stated were important to improve effectiveness and efficiency. First, the numbers and types of responses were critical figures and stated that those numbers should include law enforcement responses that were separate from fire. He said that it is important, from a holistic public safety perspective, to determine just how large a problem or exposure exists at the airport.

Phelan went on to say that tracking and measuring all training associated with ARFF was important as well. He suggested not only committing the time spent and subject matter covered to writing, but actually creating a library from which future personnel assigned to Station 15 could benefit.

A total of 13 departments responded to the survey out of 17 for a return rate of 76%, providing an appropriate sample size relative to the total to validate the results. The

author attributes the high rate of return to the initial contact made to secure good contact information which in essence notified the departments of the survey's impending publication. Survey question one asked, "Does your department collect data specific to airport and aircraft incident response for your jurisdiction?" Of the 13 responses, 53.8% , or 7, responded yes, and 46.2% responded no.

Survey question two asked, "What performance levels does your department measure with regard to airport and aircraft incident response?" Respondents were allowed to select as many of the choices as were applicable. Alarm processing time was selected by 80% of respondents and turnout and response time was chosen by 90%. Seventy percent reported that their agency tracked the time from the incident to notification and 80% measure staffing levels of apparatus responding to aircraft incidents. Tracking mutual aid requirements is tracked by 30% of department and the effectiveness and efficiency of mitigation strategies is recorded by 30%. Finally, only one agency who returned the survey measures the continuity of air operations during an incident. No respondents selected "Other" and therefore there were no responses to survey question 3, a free text field which allowed respondents to enumerate and explain what other performance levels their department measured.

How do other fire departments required to provide fire protection at reliever airports train and prepare their personnel for this responsibility?

Research question 3 was answered by evaluating the responses of the interviewees to interview question 2 which asked, "What training and preparation should CFEMS provide to its personnel to handle airport and aircraft emergencies. Trudeau responded with a list of ways CFEMS could train and prepare its personnel. Continuing to certify

additional personnel at the ARFF level should be a priority, as well as annual recertification training to maintain those who have already received certification.

He also placed an emphasis on scenarios, table top exercises and drills as means to utilize and familiarize CFMES personnel with both the airport and the Airport Emergency Plan. He stated that the airport and fire department should strive to “cover for the risk.” In other words, training should emphasize preparation for likely scenarios given the size and type of aircraft that routinely use the airport. Finally, he stresses the importance of “hands on the aircraft” in an effort to familiarize responders with specific hazards associated with different types of aircraft they would likely encounter.

Phelan, in his response to interview question 2, stated that the key to preparing for airport fire protection was to “treat it like its own jurisdiction”. He discussed the importance of formal training that results in certification and suggested that even if ARFF certification was unattainable due to budget or time constraints, a lesser class such the Virginia Department of Fire Programs’ General Aviation Firefighting for Structural Firefighters would be an excellent way to get at least an awareness level course to personnel.

He also stated that the fire department, the airport and community development need to be “married at the hip” in making decisions for the airport and its protection so that each entity knows and is familiar with the others’ interests. Finally, he suggested conferences, journals and working groups that would get CFEMS personnel “out of the state” to see how things are done in other jurisdictions.

Part two of the survey asked responding departments about their level of preparation for ARFF response. Fully 92.3% of respondents answered yes to survey

question 7 which inquired as to whether the department received any training in aircraft incident response. Survey question 8 then asked participants to list the training their agency received. Eleven departments (91.7%) reported that they do airport familiarization training and 50% do aircraft familiarization. In terms of formal certification courses, 25% receive the general aviation firefighting for structural firefighters program, and 16.7% have ARFF certified firefighters. All departments responding indicated that they receive training in hazardous materials response and the incident command system. In addition, 91.7% reported having training in EMS at some level.

Finally, survey question 9 asked, “Does your department participate in tabletop simulations, drills, or exercises to prepare itself for aircraft incident response?” Of responding agencies, only 38.5% stated that they did, with 61.5% indicating that they did not participate in this type of training.

What resources are needed to improve the Chesterfield Fire and EMS response to aircraft emergencies at the Chesterfield County Airport?

Responding to interview question 3, “Describe the optimal level of fire protection for a reliever airport, and specifically Chesterfield County Airport,” Trudeau provided suggestions as to some resources that CFEMS and the airport need to jointly work to acquire. First, he indicated a new ARFF vehicle should be purchased due to the maintenance costs of the existing one and the improvements in extinguishing agents that the older vehicle cannot accommodate. He stressed the importance of trained responders on each shift and usage of an Airport Emergency Plan that is current and up to date, “One that we can live with, but it needs to work.”

Phelan, when responding to interview question 3 stated that his interest was seeing responders trained to the certification level. The greatest resource other than these trained personnel would be a library of resources from which personnel, current and future, could draw to obtain important information on both the airport and aircraft located there.

Survey question 4 was answered by all 13 respondents. It asked, “Does your department have dedicated staffing for ARFF response?” Only 15.4%, or 2, of departments replied yes, with the remaining 84.6%, or 11, saying no indicating that for the majority of departments responsible for providing fire protection at reliever airports, this was a secondary rather than a primary responsibility.

Survey question 5 asked respondents to identify what specialized equipment their department has for use in airport and aircraft firefighting. Only 3 departments, or 23.1%, have an ARFF vehicle, and only one department responded that its firefighters have proximity gear. However, 84.6% provided that they had foam and foam delivery devices and 61.5% have dry chemical agents available for aircraft firefighting. Exactly 76.9%, or 10 departments reported they have powered rescue equipment available as well. 15.4% reported that they had no ARFF equipment and again, no respondents chose “Other” and therefore no additional equipment was listed in the free text field for survey question 6.

Discussion

What are the measured performance levels during response to an aircraft emergency at the Chesterfield County Airport?

In Phelan’s interview, when discussing what performance levels should be measured, he talked extensively about the importance of documenting responses, all responses from public safety agencies, to the airport to better understand and prepare for

the challenges of providing protection there (T. Phelan, personal communication, July 20, 2011).

CFEMS collects a standard data set for purposes of fire reporting, but falls short in collecting data specific to aircraft emergencies that would help improve such a response. It was determined that CFEMS was not well prepared to manage mutual aid availability with the current performance levels that are measured. Undoubtedly, in an aircraft emergency any larger than a small, private plane mutual aid ARFF resources could be required and the department should be prepared to call upon and manage these resources to its greatest advantage.

In addition, there is no reliable method for measuring the effectiveness and efficiency of aircraft emergency response given current performance measures. Incident times are recorded as are property values and any casualty reports, but these should be combined into a single report giving an overview of the incident's outcome. How long were resources out of service for the incident? Were all resources that were called utilized? How long was the airport/runway closed? How many flights were diverted as a result of the closure? What was the overall cost of mitigating the incident? These are questions that must have data to be answered and currently this data is not captured, or not captured in a format that is useful in the analysis of airport emergency operations.

What performance measures and response standards are used by other departments required to provide protection at reliever airports?

Cobb (2010) stated that firefighters who service airports “will need all the specialized training their departments can provide, and then some.” Trudeau’s focus in answering interview question 1 in terms of what performance levels should be measured

was the number of trained personnel on duty. Cobb validates Trudeau's thinking. In addition, while FCI is not a Part 139 airport due to the aircraft it services, that document specifies that there be trained on duty personnel during operations as part of a fire protection program.

Survey responses to question 2 indicated that the majority of other departments are measuring times and staffing levels. Some of them also measure mutual aid requirements and limitations. CFEMS currently measures these performance levels as well, though as discussed, improvement is needed in tracking mutual aid resources. Only 30% had successfully found a way to measure the effectiveness and efficiency of operations, another area where CFEMS needs to improve. Overall, CFEMS appears in line with other similar agencies with regard to measuring performance levels at aircraft and airport incidents.

How do other fire departments required to provide fire protection at reliever airports train and prepare their personnel for this responsibility?

The FAA, in *Programs for Training of Aircraft Rescue and Firefighting Personnel*, states that, "a worthwhile goal of a training program would be to enable personnel to meet proficiency criteria as detailed in NFPA 1003" (2009b, p. 8). Also, in *Eyewitness Report: United 232*, Captain Haynes speaks of the training and preparation through the use of drills and exercises that allowed the responders in Sioux City, Iowa to be well prepared for an incident of that magnitude (2009b, p. 9).

This literature serves to complement the opinions of both Phelan and Trudeau. Phelan stressed the importance of providing certification training whether it was ARFF certification, or in its place the General Aviation Firefighting for Structural Firefighters program. Trudeau, as previously mentioned, believes strongly in the value of trained

personnel on duty, to the extent that FCI covered the cost of the six firefighters who attended ARFF certification training earlier this year. Also, in his interview he discussed the importance of drills, scenarios and exercises to have a practical application of the Airport Emergency Plan.

The survey results showed that other agencies providing protection to similar airports have a great disparity in their levels of training. CFEMS is in the 91.7% of departments who do some form of airport familiarization training and is in line with the 100% of other agencies who do both hazardous materials and incident command training. While 25% of other agencies require the general aviation course, CFEMS does not, and while CFEMS has six firefighters trained to the ARFF certification level, 16.7% of agencies surveyed require it for their personnel. CFEMS is among the 61.5% of agencies who do not participate routinely in tabletop simulations, drills or exercises.

While CFEMS provides the “ARFF-related” training such as hazardous materials, EMS and incident command to its personnel, it falls short in providing the aircraft familiarization training that 50% of other agencies receive as well as the general aviation or ARFF certification programs that are truly specific to the discipline of airport and aircraft firefighting.

What resources are needed to improve the Chesterfield Fire and EMS response to aircraft emergencies at the Chesterfield County Airport?

The Aviation Safety Advisory Group stated that, “it is desirable for local fire and rescue personnel serving general aviation airports to have at least one aviation specialist on duty at all times” (2011, p. 3). The FAA, in Programs for Training of Aircraft Rescue and Firefighting Personnel, mandates hands on training for ARFF personnel. In addition, the

Aviation Safety Advisory Group state that it is “highly recommended that firefighters receive hands-on training on the aircraft that regularly serve their airport (2011, p. 10).

These references again support both Trudeau and Phelan’s recommendations. Trudeau’s wishes for trained personnel and his statement that, “They need to get their hands on the aircraft” are supported here. Phelan stated that the greatest resource need was for certified personnel at whatever level the department and airport agree upon.

The survey revealed that CFEMS was similar to the 84.6% of agencies that cover reliever airports and do not have dedicated staffing for ARFF response. In addition, CFEMS has, as 84.6% of others do, foam and foam delivery methods and similar to 76.9% of other agencies, powered rescue equipment. CFEMS is among the 23.1% who have an ARFF vehicle.

Due to the incident history, the fact that dedicated staffing does not exist is acceptable. However, making the on duty personnel knowledgeable and certified can perhaps present the greatest benefit. While a new ARFF vehicle is desirable, as Trudeau pointed out, since CFEMS already has one which is safe and functional, this takes a low priority.

Recommendations

The following recommendations are based on data conducted during the research process in answering the research questions and from an extensive literature review of relevant published sources regarding response to aircraft and airport emergencies.

1. A work group should be established to provide oversight and planning of movement toward a more optimal level of fire protection at the airport. Airport personnel, fire department operational personnel (including both command level officers and

firefighters most preferably from Station 15) as well as representatives from the county's economic development office should be recognized as the critical resources in moving this project forward. Regular meeting should be held to establish the objectives for the program, a timeline, and a specific plan for implementation.

2. CFEMS should begin collecting data and measuring performance specific to aircraft and airport emergencies. This should include, but not be limited to, an improved tracking of available mutual aid, a method for ensuring the continuity of air operations during an incident and a method by which to calculate the true losses incurred when an aircraft incident occurs. Further, a method by which to measure environmental impacts should be considered as well.

3. CFEMS, in cooperation with the airport should consider requiring completion of General Aviation Firefighting for the Structural Firefighter for all operational personnel assigned to Station 15. In addition, CFEMS should strive to continue certifying at least six personnel per year in ARFF as well as maintaining the qualifications of those already certified. Once all Station 15 personnel are ARFF certified, the General Aviation course should begin to be offered to those at surrounding stations.

4. While constant manning of an ARFF vehicle is not needed at the current time, CFEMS should consider the creation of the designation of Aviation Specialist in its career development program. Those members who have completed the General Aviation course would be eligible for this designation and could receive additional compensation when funds become available to augment the career development program. In addition, CFEMS should require the at least one Aviation Specialist be on duty at Station 15 at all times.

5. As part of company and battalion level training, simulations, to include a full scale exercise of the Airport Emergency Plan every three years, smaller scale drills on the off years, and routine use of table top simulations should be incorporated into the CFEMS training curriculum.

6. The personnel of CFEMS must be educated as to the importance of these actions in an effort to begin the process of creating successful adaptive change. There must be “buy in” from these critical stakeholders for any changes to be successful, in essence turning them into advocates for the program.

The continued growth and success of the Chesterfield County Airport is of absolute critical importance to the vitality of Chesterfield County. Protecting the airport and those who utilize it is a mission both the airport and CFEMS must take seriously. While considering these changes to traditional fire protection methodology for the airport is a step “outside the box” for CFEMS, the modern fire service executive must be willing to strive to manage not only technical, but adaptive change. This critical analysis and these subsequent recommendations to aid in providing optimal fire protection to the Chesterfield County Airport is an excellent example of this type of leadership.

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Appendix A

Emergency Operations 27 - Aircraft Emergencies

Division: Emergency Operations Procedure: Emergency Operations #27
Subject: Aircraft Emergencies Supersedes:
Authorized by: Deputy Chief James E. Graham Date Issued: March 28, 2005

I. GENERAL

The objective of this procedure is to ensure that all responding agencies adhere to appropriate operational and safety procedures as outlined by County, State, and Federal Regulations as they apply to Aircraft Emergencies at the Chesterfield County Airport or areas throughout the county.

II. UNIT ASSIGNMENTS

- A. The running assignment to aircraft emergencies is two engines, Foam 15, Tanker 7, a technical rescue unit, TSU, two ambulances, Chesterfield County Police, Virginia State Police, and the FAA in certain situations.
- B. To have a safe, effective, and efficient operation, the following guidelines shall be used:
 1. First Arriving Unit and Foam 15 (P-19)
 - a. Size-up the situation
 - b. Approach the aircraft
 - Upwind
 - Uphill

- Rescue side of aircraft
- Closely observe area for personnel thrown from the aircraft
- 45-degree angle – this will keep you away from the blast of the hot brakes if they explode and from the munitions if it is a military aircraft

c. Call for additional resources, if needed.

C. On airport property, other responding units unless otherwise specified:

1. Second Engine.
2. Technical Rescue Unit – Stage at Co. 15.
3. Ambulances – Stage at Co. 15.
4. TSU – Command post between Taxiway C and E (See attachment).
5. Battalion Chief – Command post between Taxiway C and E.
6. County Police
 - a. Supervisor – Command post
 - b. Officers – Set up a perimeter on Whitepine Road and Airfield Drive
 - c. As staffing permits – Set up inside perimeter around the aircraft
7. Virginia State Police – Respond to the scene (State Police is the NTSB designee who will investigate accidents).
8. FAA – Respond to the scene, if necessary.
9. All other fire department units – Stage at Co. 15.

D. Areas throughout the county, off airport property:

1. Stage resources early

2. Have the police department establish an outer perimeter as soon as possible

III. EMERGENCY SCENE

- A. The Aviation Law of Virginia, 24 VAC, 5-20-290 states, “The pilot or any member if the crew able to do so, or the owner or lessee of an aircraft involved in an accident, as defined in 49 CFR830, shall immediately report such accidents to the Virginia State Police (See 49 CFR 830.5 attached). The aircraft shall not be moved until the Virginia State Police is on location and takes a report.
- B. If the aircraft is on the runway or if responding units may be in danger of landing aircraft, close the runway. During the daytime (0800-1700), use Foam 15’s (P-19) Airport Radio and contact Chesterfield Unicom. After hours (1700-0800), you will have to use Foam 15’s (P-19) Airport Radio and contact Richmond International Airport. As soon as you can safely operate on the airfield with the runway open, do so. It is very important not to close the runway for extended periods. If Foam 15 (P-19) is not on-scene, go through communications.
- C. Aircraft emergencies off airport property are very difficult to manage. Initially, your resources are very limited. You must quickly assess the entire scene to establish:
 1. How many “workable” patients you have;
 2. How large an area you are dealing with;
 3. How to access the site for incoming units;
 4. Scene security; and
 5. Specialized equipment you will need to request.

**CHESTERFIELD FIRE AND EMS
ADDENDUM A TO AIRCRAFT EMERGENCIES
EMERGENCY OPERATIONS PROCEDURE #27**

**SUBPART B: INITIAL NOTIFICATION OF AIRCRAFT ACCIDENTS,
INCIDENTS, AND OVERDUE AIRCRAFT**

830.5 IMMEDIATE NOTIFICATION

The operator of an aircraft shall immediately, and by the most expeditious means available, notify the nearest National Transportation Safety Board field office when:

1. An aircraft accident or any of the following listed incidents occur:
 - a. Flight control system malfunction or failure;
 - b. Inability of any required flight crewmember to perform his normal light duties as a result of injury or illness;
 - c. Failure of structural components of a turbine engine excluding compressor and turbine blades and vanes;
 - d. In-flight fire; or
 - e. Aircraft collide in flight.
 - f. Damage to property, other than the aircraft, estimated to exceed \$25,000 for repair (including materials and labor) or fair market value in the event of total loss, whichever is less.
 - g. For large multiengine aircraft (more than 12,500 pounds maximum certificated takeoff weight):
 1. In-flight failure of electrical systems which requires the sustained use of an emergency bus powered by a back-up source such as a battery, auxiliary power unit, or air-driven generator to retain flight control or essential instruments;
 2. In-flight failure of hydraulic systems that results in sustained reliance on the sole remaining hydraulic or mechanical system for movement of flight control surfaces;
 3. Sustained loss of the power or thrust produced by two or more engines; and
 4. An evacuation of an aircraft in which an emergency egress system is utilized.
2. An aircraft is overdue and is believed to have been involved in an accident.

Appendix B

List of Agencies Surveyed

1. Anne Arundel County Fire Department
44 Calvert Street
Annapolis, MD 21401
2. Baltimore County Fire Department
700 E. Joppa Road
Towson, MD 21286
3. Blacksburg Fire Department
407 Hubbard Street
Blacksburg, VA 24060
4. Chesapeake Fire Department
304 Albemarle Drive
Chesapeake, VA 23322
5. City of Manassas Fire and Rescue Department
9324 West Street
Manassas, VA 20110
6. Concord Fire Department
100 Warren C. Coleman Boulevard
Concord, NC 28027
7. Deep Run Fire Department
5107 Deep Run Road

- Sanford, NC 27330
8. Fauquier County Department of Fire, Rescue and Emergency Management
62 Culpeper Street
Warrenton, VA 20186
 9. Frederick County Fire and Rescue Department
5370 Public Safety Place
Frederick, MD 21704
 10. Loudoun County Fire and Rescue
803 Sycolin Road, Suite 104
Leesburg, VA 20175
 11. Monroe Fire Department
117 North Church Street
Monroe, NC 28110
 12. Montgomery County Fire and Rescue Service
101 Monroe Street
Rockville, MD 20850
 13. Prince George's County Fire/EMS
9201 Basil Court
Largo, MD 20774
 14. South Boston Fire Department
403 Broad Street
South Boston, VA 24592
 15. Stafford County Fire and Rescue Department

1225 Courthouse Road

Stafford, VA 22554

16. Suffolk Department of Fire and Rescue

300 Kings Fork Road

Suffolk, VA 23434

17. Westminster Fire Engine and Hose Co. 1

P. O. Box 357

Westminster, MD 21158

Appendix C

Cover Letter to Agencies Surveyed

Dear Fire Officer,

As a third year student in the National Fire Academy's Executive Fire Officer Program, I am conducting research and completing an applied research project regarding fire protection at those general aviation airports with the Federal Aviation Administration (FAA) designation of "reliever". Your jurisdiction has been identified as having such a facility located in its response area.

The results of this survey will be used in helping to determine the optimal level of fire protection at the reliever airport in our jurisdiction.

The results of this research project will be available to other members of the fire service by way of its placement in the Learning Resource Center at the National Fire Academy after completion and review.

The survey should take no longer than 15 minutes to complete and your responses will be confidential. Simply click on the link below to take the survey. Thank you in advance for your response and for your time in assisting with this project.

Do not hesitate to contact me with any questions.

<https://www.surveymonkey.com/s/FFN9PHQ>

Timothy M. McKay
Lieutenant
Training and Education Unit
Chesterfield Fire and EMS
Chesterfield, VA

(804) 706-7641

mckayt@chesterfield.gov

Appendix D

Survey

Part One

1. Does your department collect data specific to airport and aircraft incident response for your jurisdiction?

Yes

No

2. What performance levels does your department measure with regard to airport and aircraft incident response?

Time from incident to notification

Alarm processing time

Turnout and response times

Staffing levels

Mutual aid requirements and limitations

Efficiency and effectiveness of mitigation actions

Demobilization activities

Continuity of air operations during the incident

Other

3. If you marked "Other" in question 2, what additional performance levels does your department measure with regard to aircraft and airport emergencies?

Part Two

4. Does your department have dedicated staffing for ARFF response?

Yes

No

5. What specialized equipment does your department have for use in handling airport and aircraft emergencies? (Choose all that apply.)

ARFF vehicle

Foam and foam delivery methods

Dry chemical agent(s)

ARFF personal protective equipment (proximity suits)

Aircraft specific forcible entry equipment

Powered rescue equipment

None

Other

6. If you answered "Other" to question 5, what other specialized equipment do you carry?

7. Does your department receive training in aircraft and airport incident response?

Yes

No

8. If you answered yes to question 7, what type of training does your department receive? (Check all that apply.)

- Airport familiarization
- Aircraft familiarization
- General aviation firefighting for structural firefighters
- ARFF certification courses
- Hazardous materials response
- Mass casualty incident response
- Emergency medical services (any level)
- Incident command system
- Department mandated "in house" training

9. Does your department participate in tabletop simulations, drills, or exercises to prepare itself for aircraft incident response?

- Yes No

Appendix E

Interview Questions for Subject Matter Experts

1. What performance levels should Chesterfield Fire and EMS measure to improve the effectiveness and efficiency of its aircraft incident response?
2. What preparation and training should Chesterfield Fire and EMS provide for its personnel to handle airport and aircraft emergencies?
3. Describe the optimal level of fire protection for a reliever airport, and specifically for the Chesterfield County Airport.
4. If you could improve, change or impact one facet of the Chesterfield Fire and EMS response to aircraft and airport emergencies, what would it be?

Appendix F

Subject Matter Experts' Curriculum Vitae

Thomas Phalen

- Public Safety Officer, Richmond International Airport Department of Public Safety (1979-1987)
- Firefighter/Crew Chief, Virginia Air National Guard Fire Department (1989-2004)
- ARFF Program Chief, Virginia Department of Fire Programs (2004-present)

Thomas Trudeau

- Airport Manager, Chesterfield County Airport (2008-present)
- Manager, Rutland Southern Vermont Regional Airport System (2000-2008)