



NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

**ENHANCING PUBLIC HELICOPTER SAFETY
AS A COMPONENT OF HOMELAND SECURITY**

by

William Denis Fitzgerald, Jr.

December 2016

Thesis Co-Advisors:

Lauren Wollman
Robert Simeral

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REPORT DOCUMENTATION PAGE			<i>Form Approved OMB No. 0704-0188</i>	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington, DC 20503.				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE December 2016		3. REPORT TYPE AND DATES COVERED Master's thesis
4. TITLE AND SUBTITLE ENHANCING PUBLIC HELICOPTER SAFETY AS A COMPONENT OF HOMELAND SECURITY			5. FUNDING NUMBERS	
6. AUTHOR(S) William Denis Fitzgerald, Jr.				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			10. SPONSORING / MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government. IRB protocol number <u>n/a</u> .				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release. Distribution is unlimited.			12b. DISTRIBUTION CODE	
13. ABSTRACT (maximum 200 words) The wide range of missions performed by public safety helicopters makes them a valuable asset for the public and to the homeland security environment. The high-risk missions, lack of regulatory oversight, and minimal standards of safety put public-safety helicopter aviation in the crosshairs of the National Transportation Safety Board. This study addresses how public safety aviation units' exemption from the Federal Aviation Administration regulations is a contributing factor to helicopter accidents. The study uses a qualitative analysis called coding to identify the common traits among accidents and then makes recommendations to prevent future accidents. There is currently no industry research identifying the commonalities among accidents like this research does. This thesis also identified the safety culture in the public safety units as a contributing factor to the accidents. The nature of public safety personnel is to accept high levels of risk to help those in need. When this attitude is applied to aviation, it leads to unnecessary accidents. The recommendations provided in the last chapter of the thesis provide techniques and solutions to help reduce the risk in public safety aviation. The recommendations, if adequately implemented, may help save lives by preventing future accidents.				
14. SUBJECT TERMS public helicopter safety, law enforcement helicopter safety, public helicopter risk management, public safety aviation, National Transportation Safety Board (NTSB), Federal Aviation Administration (FAA), safety culture, New Mexico State Police, Alaska State Trooper, Maryland State Police			15. NUMBER OF PAGES 89	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UU	

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**ENHANCING PUBLIC HELICOPTER SAFETY
AS A COMPONENT OF HOMELAND SECURITY**

William Denis Fitzgerald, Jr.
Sergeant, Orange County (California) Sheriff's Department
BA, California State University at Fullerton, 1993
MBA, Chapman University, 1999

Submitted in partial fulfillment of the
requirements for the degree of

**MASTER OF ARTS IN SECURITY STUDIES
(HOMELAND SECURITY AND DEFENSE)**

from the

NAVAL POSTGRADUATE SCHOOL

December 2016

Approved by: Lauren Wollman
Thesis Co-Advisor

Robert Simeral
Thesis Co-Advisor

Erik Dahl
Associate Chair of Instruction
Department of National Security Affairs

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ABSTRACT

The wide range of missions performed by public safety helicopters makes them a valuable asset for the public and to the homeland security environment. The high-risk missions, lack of regulatory oversight, and minimal standards of safety put public-safety helicopter aviation in the crosshairs of the National Transportation Safety Board. This study addresses how public safety aviation units' exemption from the Federal Aviation Administration regulations is a contributing factor to helicopter accidents. The study uses a qualitative analysis called coding to identify the common traits among accidents and then makes recommendations to prevent future accidents. There is currently no industry research identifying the commonalities among accidents like this research does. This thesis also identified the safety culture in the public safety units as a contributing factor to the accidents. The nature of public safety personnel is to accept high levels of risk to help those in need. When this attitude is applied to aviation, it leads to unnecessary accidents. The recommendations provided in the last chapter of the thesis provide techniques and solutions to help reduce the risk in public safety aviation. The recommendations, if adequately implemented, may help save lives by preventing future accidents.

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LIST OF ACRONYMS AND ABBREVIATIONS

AC	Advisory Circular
AIRMET	Airman's Meteorological Information
ALEA	Airborne Law Enforcement Association
CFR	Code of Federal Regulations
DPS	Department of Public Safety
FAA	Federal Aviation Administration
FRAT	Flight Risk Assessment Tool
GPS	Global Positioning System
IFR	instrument flight rules
ILS	instrument landing system
IMC	instrument meteorological condition
MEDEVAC	medical evacuation
MSAW	minimum safety altitude warning
MSP	Maryland State Police
NMSP	New Mexico State Police
NTSB	National Transportation Safety Board
PAO	public aircraft operation
PAR	precision approach radar
PCT	Potomac Consolidated Terminal Radar Approach Control
PIC	pilot in command
PIO	public information officer
PSAAC	Public Safety Aviation Accreditation Commission
SMS	Safety Management System
SWAT	special weapons and tactics
TFO	tactical flight officer
TKA	Talkeetna Airport
VFR	visual flight rules
VMC	visual meteorological condition
USC	United States Code

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EXECUTIVE SUMMARY

Public safety helicopters play an integral role in preventing crime and keeping people safe. The wide range of missions performed by helicopters makes them a valuable asset for the public and to the homeland security environment. These types of public safety missions involve high levels of risk and for that reason must be planned and managed with an eye on risk from inception to completion. Consideration should be given as to whether or not to accept a mission. When these missions are accepted and because they are often emergency missions, there is often little time available for detailed planning. Minimal planning time means that safety factors, which may have been considered if there was more time for planning, may be overlooked.

Three catastrophic public safety helicopter accidents involving the New Mexico State Police, Alaska State Troopers, and the Maryland State Police demonstrate the inherent high risk of public safety missions. In spite of the risks and accidents, public safety aviation is unregulated, since the Federal Aviation Administration (FAA) rules do not apply to public safety agencies while performing missions related to public safety. This thesis research is based on the premise that the failure to regulate and oversee public safety aviation has contributed to disasters like the three mentioned above. Furthermore, it argues that public safety aviation needs regulatory requirements to ensure all aviation units are operating using industry best practices.

This thesis research addresses the need for public safety aviation standards. Currently, there are no enforceable standards for public safety helicopter units. The Public Safety Aviation Accreditation Commission (PSAAC) provides guidelines for the establishment of standards, but they are not enforceable. The standards can serve as a basis for regulation if there is more research on public safety aviation.

The study does have one limitation; it only analyzes three accidents. The data available for public safety helicopter incidents and accidents are minimal due to the lack of formal investigations. The New Mexico State Police, Alaska State Trooper, and the Maryland State Police accidents all had fatalities, which prompted the National Transportation Safety Board (NTSB) to conduct a thorough and formal investigation. Without the investigative findings of the NTSB, the data would be impossible to obtain with the resources available for this study. While the NTSB treats these aircraft mishaps as three separate accidents, this study compares the data between accidents and determines the causal factors and trends present in all three. The factors and trends identified help answer the research question relating to how to address the risk in public safety helicopter operations. Additional data may affect the outcome of this study.

The analysis of data was based on the questions scoped for this thesis. The use of a qualitative technique of analyzing documents called coding was used to effectively answer the research questions in this thesis. In the first phase, codes were developed from the safety risk factors noted in the literature review. For example, the literature review recommends a minimum crew rest, which suggests an upper limit of flight time for each crewmember. "Crew rest" was one code used to analyze the NTSB's accident reports. Additional codes were created from terms in the literature review. Furthermore, specific attention was given to the development of codes that related to risk factors that might contribute to public safety helicopter safety.

In the second phase, the codes were used to analyze the three NTSB accident reports. However, in the process of analyzing the accident reports, new codes emerged that are not mentioned in the NTSB reports. These new codes were recorded and also used. The creation of codes was an ongoing process throughout the analysis process.

The third phase of data analysis was to arrange the codes collected from the accident reports into a hierarchy. The codes were categorized according to types of risk factors and also arranged according to the frequency and

significance in the accident reports. Once the data were collected and sorted, they were displayed in a table format to develop a conclusion. Additionally, the data were displayed with reference to several risk factors identified in the literature.

The analysis of research question two was addressed in the fourth phase of data analysis. In this last phase, all the codes collected were cross-referenced with standards and regulations of the PSAAC and FAA. According to Seidel, the purpose of the final phase, thinking about things, is “(1) to make some type of sense out of each collection, (2) to look for patterns and relationship both within a collection, and also across collection, and (3) to make general discoveries about the phenomena you are researching.”¹ To complete these tasks, the literature was reviewed for evidence to rule whether the risk factors identified are congruent with the standards set forth the Public Safety Aviation Accreditation Commission (PSAAC) and Federal Aviation Administration (FAA). This informed the researcher whether the standards and regulations of these agencies might help reduce the risk in operations for public safety aviation.

The analysis of the data showed that there are two factors strongly correlated to the cause of fatal public safety helicopter accidents: the inadequate proficiency use of instrumental flight rules (IFR) flying and the lack of a pre-flight risk assessment. Pilot fatigue is a factor that appeared in two of the accident reports (New Mexico and Alaska) but not evident as a cause in the third (Maryland). However, in coding the data for pilot fatigue, another code that emerged as a common trend of accident causation was the culture of a

¹ John V. Seidel, *Appendix E: Qualitative Data Analysis* (Colorado Springs, CO: Qualis Research, 1998), <http://www.qualisresearch.com/Downloads/qda.pdf>. Originally published as “Appendix E: Qualitative Data Analysis,” in *The Ethnograph: A Users Guide* v 5.0 (Colorado Springs, CO: Qualis Research, 1998).

department, which encourages mission completion over safety. The coding for safety culture of public safety departments is presented and explained in the section below. Overall there are three common factors that emerged from the qualitative analysis of coding: inadequate proficiency of IFR flying, lack of a pre-flight risk assessment, and the safety culture of the public safety department.

However, the research process revealed that pilot fatigue was a part of a more general problem in public safety agencies. The data show that there is a culture within departments that encourages mission completion over safety; the culture of a department is not limited to the motivations of a single person. This additional factor encompasses pilot fatigue because the desire to complete the mission overrode the crucial fact that the pilot was not rested enough to make proper decisions.

During the qualitative analysis phase of the research, the codes “culture” and “desire to complete a mission” emerged. The accident analysis reports suggest that there is a strong culture in all the three departments (New Mexico, Alaska, and Maryland) that encourages pilots to accept missions even though there are warning signs suggesting high levels of risk associated with the flight.

Though it is a governmental agency, the NTSB does not have regulatory authority over the individual public safety aviation units. Rather, its role is to investigate an accident and conclude causations based upon its findings. However, the NTSB does not produce any trend analysis across public safety helicopter aviation accident reports. Therefore, the purpose of this study was to find those factors common to the fatal accident reports.

The three fatal public safety helicopter accidents studied in this thesis all took place with weather considered to be IFR. This chapter recommends public safety units adopt visual flight rules (VFR) as the weather minimums unless the pilot has a current instrument rating and there is a second pilot with access to flight controls. PSAAC should add these specific weather minimums to their

standards to give specific guidance to the public safety units who are trying to make their units safer by adopting the standards.

The governmental oversight of public safety aviation is necessary, but extremely complex. The current FAA regulations do not apply and are not suited for public safety aviation units. The PSAAC standards are the closest to being applicable to the multifaceted missions of public safety aviation. An upcoming challenge as recommended in this thesis will be to convince the FAA to adopt these standards as a part of 14 Code of Federal Regulations (CFR). The research of this thesis clearly shows the lack of standards by each of the public safety units involved with the fatal helicopter accidents. Once the FAA adopts the standards as part of 14 CFR, the standards become regulatory and the FAA can take punitive action for agencies who do not comply. This would help reduce the risk of another fatal helicopter accident.

The missions of public safety aviation are always going to be complex, but the effective management of risk will help keep public safety personnel informed to make the best decisions possible. This can be accomplished by having the FAA adopt the standards set by PSAAC to have the regulations necessary to bring public safety aviation to industry standards. The methodology used for the research in this thesis found the common trends in public safety aviation accidents. The accident agencies may have prevented the fatal accidents by the implementation of the PSAAC standards and specific guidance on the weather needed to accomplish a mission.

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I. INTRODUCTION

Public safety helicopters play an integral role in preventing crime and keeping people safe. The wide range of missions performed by helicopters makes them a valuable asset for the public and to the homeland security environment. In addition, helicopters armed with technically advanced cameras can apply stealth tactics and surveil potential threats from undetectable altitudes; this gives public safety agencies the ability to gather intelligence or track a possible subject who may be a significant threat. Another role of helicopters is to provide assistance during natural disasters, deliberate attacks, or search and rescue missions. During natural disasters, they can rapidly move people and supplies to areas of isolation or locations not accessible by land vehicle due to damaged infrastructure. A terrorist attack is an situation in which helicopters provide the flexibility for public safety agencies to appropriately respond. Public safety helicopters can quickly insert first responders into the area to assist with neutralizing the threat, and they can also extract injured people for immediate medical care. Search and rescue is another area where public safety helicopters routinely locate people requiring assistance in remote locations. When people need help in remote locations while hiking, camping, or mountain biking and need assistance, helicopters are used to locate and extract them. Many times, these rescues occur in less than ideal weather conditions, which increases the risk of the operation.

All of these sorts of missions involve high levels of risk, and for that reason must be planned and managed with an eye on risk from inception to completion. Consideration should also be given as to whether to accept a mission. When these missions are accepted, because they are often by their very nature emergency missions, there is often little time available for detailed planning. Minimal planning time means that safety factors, which may have been considered if there was more time for planning, may be overlooked.

Three catastrophic public safety helicopter accidents involving the New Mexico State Police, Alaska State Troopers, and the Maryland State Police demonstrate the inherent high risk of public safety missions. In spite of the risks and accidents, public safety aviation is unregulated, since the Federal Aviation Administration (FAA) rules do not apply to public safety agencies while performing missions related to public safety. This thesis research is based on the premise that the failure to regulate and oversee public safety aviation has contributed to disasters like the three mentioned above. Furthermore, it argues that public safety aviation needs regulatory requirements to ensure all aviation units are operating using industry best practices.

A. PROBLEM STATEMENT

The New Mexico State Police, Maryland State Police, and Alaska State Police have all had fatal helicopter accidents within the last 10 years. This has led the National Transportation Safety Board (NTSB) to place public safety helicopter missions its 2015 “Most Wanted List of Transportation Safety Improvements.”¹ The high-risk missions, lack of regulatory oversight, and minimal standards of safety put public safety helicopter aviation in the crosshairs of a safety perfect storm. Public safety helicopter aviation will no doubt be prone to more accidents in the future if these factors are not adequately addressed. It is imperative that research on these recent helicopter accidents is done to minimize risks and keep crewmembers safe for future missions. It is the goal of this study to contribute to the developing literature on public safety helicopter aviation so that better standards and regulations can be developed.

This study discussed how public safety aviation units’ exemption from FAA regulations is a contributing factor to the high accident rate. The FAA does not regulate many of the public safety missions due to the unique mission requirements of public safety. Missions, such as special weapons and tactics

¹ National Transportation Safety Board (NTSB), “Enhance Public Helicopter Safety,” accessed October 25, 2015, http://www.nts.gov/safety/mwl/Pages/mwl3_2015.aspx.

(SWAT) insertion operations, aerial platform shooting, and search and rescue, are highly specialized and therefore are not included under the FAA's oversight. Without proper oversight, public safety aviation units perform missions with a higher degree of risk, which may lead to a higher rate of helicopter accidents.

This thesis research addresses the need for public safety aviation standards. Currently, there are no enforceable standards for public safety helicopter units. PSAAC provides guidelines for the establishment of standards, but they are not enforceable. The standards can serve as a basis for regulation if there is more research on public safety aviation.

While there are organizations that provide guidelines for public safety, these are not enforceable and could be improved. The FAA is the primary regulatory agency for aviation, but it does not regulate public safety helicopters. The NTSB only provides recommendations, but, as with PSAAC guidelines, public safety agencies are not bound by these recommendations.

The NTSB provides recommendations thorough analysis of significant helicopter accidents. The three fatal public safety helicopter crashes recently and separately investigated by the NTSB are the New Mexico State Police crash (in June 2009), Alaska State Trooper crash (in March 2013), and the Maryland State Police crash (in September 2008).

B. RESEARCH QUESTIONS

This study addresses the need to identify the common risk factors that require control and are associated with public safety helicopter accidents, which is lacking in the current literature lacks. Additionally, this study aims to identify those risk factors so that future standards and regulations can be formed reduce risk and to protect the safety of personnel and the general public. To do so, this study seeks to answer these research questions:

1. What are the common risk factors associated with public safety helicopter accidents?
2. How can these risks be addressed by the Public Safety Aviation Accreditation Commission?

C. SIGNIFICANCE TO THE FIELD

Currently, there are few solutions being proposed to the problems in public safety helicopter aviation. However, the problems are in the spotlight due to a few horrific accidents (e.g., New Mexico, Alaska, and Maryland) and the NTSB placing public safety aviation on its 2015 most wanted list. For the last 15 years, the role of public safety helicopter missions has been expanding due to the increasing demands placed on first responder agencies.

Law enforcement helicopters are now conducting missions that once were performed exclusively by fire departments. Law enforcement helicopters are conducting medical search and rescues along with fighting fires on a regular basis. The additional capabilities lead to more calls generated the services of helicopters. In preparation for attacks, the fire helicopters are increasingly working with law enforcement for mass causality events. The level of risk for public safety aviation may be categorized as low, medium or high depending on specific hazards associated with a mission, and a certain level of risk, which could lead to an accident or mishap, is present for any type of public safety mission.

One goal of this study is to help public safety agencies implement control measures to reduce risk in operations. In addition, the study uses a qualitative analysis called coding to identify the common traits between accidents and then and makes recommendations to prevent future accidents.

The findings from this study suggests standards are necessary to help public safety aviation units reduce their risk in operation. PSAAC has published guidelines for standards that may contribute to reducing the risk in aviation operations. This study analyzes the relationship of these standards to the aforementioned three accidents. This study seeks to determine if these

standards could have prevented units from having an accident by mitigating their risk in their daily operations. Additionally, the effectiveness of the standards is evaluated by determining if these standards would have prevented the accidents discussed.

This type of research answers the question of “why” the accident happened. It is not too difficult to figure out how a helicopter crashed, but the *why* led the researcher to ways to reduce the risk in an organization and to prevent future accidents in public safety aviation. The finished thesis provides insight into public safety helicopter aviation and the methods to reduce risk in operations. Moreover, the research shows trends, such as human behavior and lack of standards, that are common in public safety helicopter accidents. Public safety aviation agencies can use this study to understand how human behavior and the lack of standards contribute to helicopter accidents. Finally, it can aid their understanding how the standards help put control measures on human behavior to help prevent accidents.

D. LIMITATIONS

The study does have one limitation; it only analyzes three accidents. The data available for public safety helicopter incidents and accidents are minimal due to the lack of formal investigations. The New Mexico State Police, Alaska State Trooper, and the Maryland State Police accidents all had fatalities, which prompted the NTSB to conduct a thorough and formal investigation. Without the investigative findings of the NTSB, the data would be impossible to obtain with the resources available for this study. While the NTSB treats these aircraft mishaps as three separate accidents, this study compares the data between accidents and determine the causal factors and trends present in all three. The factors and trends identified help answer the research question relating to how to address the risk in public safety helicopter operations. Additional data may affect the outcome of this study.

Chapter II covers the review of the literature and background, and in Chapter III, the research design and findings are discussed. Chapter IV is a summary of the findings and conclusions and the final chapter includes recommendations to reduce the risk in public safety helicopter aviation.

II. REVIEW OF THE LITERATURE AND BACKGROUND

This chapter presents the literature on public safety helicopter aviation, and it provides the explanation as to why there is a regulatory void for most missions of public safety helicopter aviation. Beginning with the reasons why most missions are exempted from the FAA, which normally is the regulatory authority of aviation within the United States, it then explains the role the NTSB plays within public safety helicopter aviation. In addition, it includes a description of how public safety helicopters are used within the homeland security and presents a summary of PSAAC standards. Then, this literature review summarizes three accident reports used as the data source for this study. Lastly, this chapter concludes with a summary of the current challenges that face public safety helicopter aviation and the implications it has on the overall safety of public safety helicopter missions.

A. EXEMPTIONS FROM THE FEDERAL AVIATION ADMINISTRATION

The FAA has regulatory authority over all civil aircraft operations in the United States. The FAA has the authority to discipline a pilot or civil aircraft operators for violations of regulations established in Title 14 of the Code of Federal Regulations (14 CFR). In support of its responsibilities designated by 14 CFR, the FAA publishes advisory circulars (AC). The FAA uses Advisory Circulars to provide clarity to the aviation regulations that are complex and difficult to interpret.² Even though public safety helicopter agencies must comply with the 14 CFR during any civil aviation missions, they are still a unique segment of the aviation community due to the type of operations they carry out. Therefore, it does not always fall under the regulatory jurisdiction of the FAA. If it does not fall under the regulatory authority of the FAA then that mission is

² David B. Walen, "Civil Aircraft System Safety and Electromagnetic Compatibility" (PowerPoint slides), presented to the National Research Council Electronic Vehicle Controls and Unintended Acceleration Study, Washington, DC, November 2010, <http://onlinepubs.trb.org/onlinepubs/UA/111610Walen.pdf>, slide 6.

classified as a public aircraft operation (PAO).³ The main factor that determines whether the mission is designated as a PAO is the type of mission being performed. This section explains why most public safety helicopter missions meet the criteria of exemption as specified by the FAA.

The FAA Advisory Circular (AC) 00–1.1A, published in 2014, defines what types of flight operations are considered PAOs and therefore are exempt from FAA regulations. AC 00–1.1A states:

Whether an operation qualifies as a PAO is determined on a flight-by-flight basis, under the terms of the statute. The considerations when determining PAO are aircraft ownership, the operator, the purpose of the flight, and the persons on board the aircraft.⁴

The majority of public safety helicopter flights are in direct support of a public safety mission, making them PAO flights. The FAA needs to thoroughly reexamine and possibly revise AC 00–1.1A to more accurately determine if a flight is categorized as an unregulated PAO flight or a civil aircraft flight.

To be classified as PAO mission, the type of aircraft must meet certain criteria, and not all helicopters can serve in a PAO. For clarity, public aircraft are defined in 49 U.S.C. § 40102 (a) (41) as any of the following:

- (A) Except with respect to an aircraft described in subparagraph (E), an aircraft used only for the United States government.
- (B) An aircraft owned by the government and operated by any person for purposes related to crew training, equipment development, or demonstration.
- (C) An aircraft owned and operated by the government of a state, the District of Columbia, or a territory or possession of the United States or a political subdivision of one of these governments.

³ Federal Aviation Administration (FAA), *Public Aircraft Operations* (Federal Aviation Administration Advisory Circular 00-1.1A) (Washington, DC: Federal Aviation Administration, 2014), 2–4.

⁴ Ibid.

- (D) An aircraft exclusively leased for at least 90 continuous days by the government of a state, the District of Columbia, or a territory or possession of the United States or a political subdivision of one of these governments.
- (E) An aircraft owned or operated by the armed forces or chartered to provide transportation or other commercial air service to the armed forces.⁵

Although an aircraft may meet the public aircraft definition under 49 U.S.C. § 40102 (a) (41) as listed above, the aircraft will be considered civil aircraft under 49 U.S. Code § 40125 (b) if the aircraft carries a passenger. In addition, if the aircraft conducts any type of commercial operation or carries a non-crewmember it will no longer be considered a public aircraft. Once an aircraft loses its status as a public aircraft, the civil aircraft rules apply under Title 14, Code of Federal Regulations.⁶

The next requirement for a PAO that would exempt the public safety aircraft from FAA regulations is the type of mission to be performed and the personnel on the aircraft. The FAA defines the exemption as “an activity undertaken by a government, such as national defense, intelligence missions, firefighting, search and rescue, law enforcement (including transport of prisoners, detainees, and illegal aliens), aeronautical research, or biological or geological resource management.”⁷ Public safety missions may include pursuits, searches for fleeing suspects, firefighting and search and rescue, all of which are exempted from FAA regulations because they are classified as a PAO.⁸ Moreover, a mission may also be defined by the crewmember. This code states that a person aboard the aircraft must be a crewmember on the aircraft or a qualified non-crewmember. The typical aircrew on a law enforcement helicopter is the pilot and a tactical flight officer (TFO). A crewmember is defined by 14 CFR

⁵ Ibid., Appendix, 1.

⁶ Ibid., 3.

⁷ Ibid., Appendix, 2.

⁸ Ibid., 2–4.

1.1 as a person who has a specific skill to perform a function as an aircrew during the flight. A qualified non-crewmember is defined by 49 U.S. Code § 40125 (a) (3) as a person who provides a service for the mission not related to the operation of the aircraft. An example is a paramedic on a search and rescue mission.⁹ If there is a civilian riding along or a photographer on board the helicopter who does meet the requirements of 49 U.S. Code § 40125 (a) (3), the flight is automatically considered a civil aircraft flight and all of the FAA regulations as published under Title 14 of the Code of Federal Regulations apply.¹⁰

Public safety aviation deviates from civilian aviation in a number of ways, which are defined by the FAA as a PAO.¹¹ A PAO helicopter must be owned by a public safety agency and used for a public safety type mission, such as law enforcement, firefighting, or search and rescue. Based on data from the public safety helicopter agencies in Orange County, California, approximately 95 percent of the public safety flights are classified as PAOs and therefore are unregulated by the FAA.¹² Since the vast majority of the missions of public safety helicopter aviation are unregulated, the need for guidelines and standards of safety are paramount. The void in public safety aviation regulations is partially addressed by guidelines and standards by other governmental agencies (such as NTSB and FAA) but as this literature review presents, these organizations do not have regulatory authority. Without regulatory authority, safety and standards may be compromised.

⁹ Ibid., Appendix, 2.

¹⁰ Ibid., 3.

¹¹ Ibid., 2–3.

¹² Orange County Sheriff's Department, Aviation Support Unit, "Flight Log" (internal document, Orange County Sheriff's Office, Santa Ana, CA, 2010–2016).

B. NATIONAL TRANSPORTATION SAFETY BOARD'S ROLE WITH PUBLIC SAFETY AGENCIES

The NTSB is responsible for investigating all public safety aviation accidents.¹³ In addition, the NTSB investigates all civil aviation accidents as well as other modes of transportation such as the railroads and highways. The NTSB's role in a public safety accident is to determine the cause and issue recommendations. The purpose of the recommendations is to help provide guidance to prevent future accidents.¹⁴ The NTSB is also charged with investigating public safety aviation accidents regardless of whether the flight was a PAO or civil aviation flight. The rules of the board are located in Chapter VIII, Title 49 of the Code of Federal Regulations.¹⁵

The NTSB has identified public safety helicopters on its 2015 most wanted list of transportation improvement because of the high number of accidents they experience. In the last 20 years, "the NTSB has investigated more than 130 accidents involving federal, state, and local public helicopter operations."¹⁶ The risk in public safety helicopter operations is higher based on the average number of accidents each year compared to civilian commercial operators.¹⁷ One potential reason for this is the lack of regulatory oversight of PAOs.

The NTSB gives recommendations, but is not regulatory in nature. The focus of the NTSB is to investigate the accident and determine why the accident occurred. The data obtained and the interviews conducted by the NTSB cannot be used for anything punitive against the individuals or agencies involved in the

¹³ National Transportation Safety Board, "About the National Transportation Safety Board," accessed April 2, 2016, <http://www.nts.gov/about/pages/default.aspx>.

¹⁴ Ibid.

¹⁵ Title 49 CRF, Chapter VIII (2007).

¹⁶ National Transportation Safety Board, "NTSB 2015 Most Wanted List," accessed October 15, 2016, <http://www.nts.gov/safety>.

¹⁷ Lee Roskop, "U.S. Rotorcraft Accident Data and Statistics" (presented to the FAA/Industry Safety Forum, Washington, DC, 2012), http://www.aea.net/events/rotorcraft/files/US_Rotorcraft_Accident_Data_And_Statistics.pdf, slides 12–14.

accident.¹⁸ The FAA is the only regulatory agency to enforce rules relating to aviation,¹⁹ yet its regulations do not apply to a PAO. As explained above, public safety helicopters are exempt from regulation by the FAA when they are performing any type of a public safety mission, therefore the safety rules and policies are based solely on the governmental agency operating the helicopter.²⁰

C. ROLE OF PUBLIC SAFETY HELICOPTERS IN HOMELAND SECURITY

Public safety helicopters play an integral role in protecting the United States from terrorist attacks. Helicopters from law enforcement, fire departments and federal agencies fly various flights each day in support of the homeland security mission.²¹ However, the statistics consider the total number of flight hours but not the complexity of the mission. The mission of public safety helicopters is much more complex and high-risk than civilian helicopters.²²

Public safety helicopters can see real-time imagery to prevent potential terrorist attacks by conducting surveillance on hundreds of potential threats each day as well as providing true metadata embedded in digital video critical for the capture of a terrorist.²³ For example, after the Boston Marathon, Dzhokhar Tsarnaev was captured using heliborne infrared camera that located him bleeding and hiding inside a boat in a resident's backyard.²⁴ After a tip from a

¹⁸ All.Gov, "National Transportation Safety Board (NTSB)," accessed July 9, 2015, <http://www.allgov.com/departments/independent-agencies/national-transportation-safety-board-ntsb?agencyid=7450>.

¹⁹ Federal Aviation Administration, "FAA—What We Do," accessed July 9, 2015, <https://www.faa.gov/about/mission/activities/>.

²⁰ NTSB, "Enhance Public Helicopter Safety."

²¹ Roskop, "U.S. Rotorcraft Accident Data and Statistics."

²² Henry Perritt, *Sharing Public Safety Helicopters* (Chicago: Chicago-Kent College of Law Scholarly Commons, 2014), http://scholarship.kentlaw.iit.edu/cgi/viewcontent.cgi?article=3361&context=fac_schol.

²³ FLIR, "FLIR Law Enforcement Surveillance," accessed October 15, 2016, <http://www.flir.com/surveillance/display/?id=64961>.

²⁴ Damien McElroy, "Police Video Shows Boston Bomb Suspect Dzhokhar Tsarnaev Hiding in Boat," *The Telegraph UK*, April 21, 2013.

resident, the helicopter aircrew noticed a heat source and directed ground units to investigate the source further. Complexity of these types of missions, such as rescuing an injured hiker, also involve a high degree of technicality.

The increased risk of public safety helicopter operations is a critical issue that needs to be addressed as part of the national homeland security strategy. The complexity and high degree of technicality make public safety helicopter missions much riskier than civilian helicopters. The void in regulations makes public safety helicopters a critical flashpoint for accidents if not addressed immediately.

D. PUBLIC SAFETY AVIATION ACCREDITATION COMMISSION STANDARDS

The Airborne Law Enforcement Association (ALEA) was founded by law enforcement personnel in 1968 to address the complex issues with the use of helicopters and airplanes in public safety. ALEA is a non-profit organization composed of approximately 95 percent of the public safety aviation units in the United States.²⁵ To help reduce risks for the public safety helicopter pilots, ALEA created the PSAAC. PSAAC established standards that have been designed as the industry standards intended to foster a universal application of best practices throughout the public safety aviation community.²⁶ Furthermore, PSAAC uses the military model for self-regulation by creating standards specific to public safety aviation.

The standards have been divided into 5 functional areas critical to any public safety aviation unit. The functional areas are: administration, operations, safety, training and maintenance. These areas are the essential components of the aviation unit for both helicopters or airplanes. The critical standards require

²⁵ Airborne Law Enforcement Association, "Membership," accessed July 10, 2015. <http://www.alea.org/membership>.

²⁶ Public Safety Aviation Accreditation Commission (PSAAC), *Standards for Public Safety Aviation Units*, Version 5.1 (Sacramento, CA: Public Safety Aviation Accreditation Commission, 2013).

mandatory compliance and the non-critical standards have recommended compliance.²⁷

PSAAC has assessors who travel throughout the country to evaluate public safety helicopter units for compliance. The units that have met the standards are operating by the best practices for public safety aviation, and this helps maintain industry standards, which helps reduce the risk in operations. Even the units that are still working toward meeting the PSAAC standards are operating closer to the industry best practices compared to units operating without specific guidance or standards. However, there are only nine PSAAC accredited units in the United States. It should be noted that the NTSB has not had to investigate a public safety helicopter accident by any PSAAC accredited unit or a public safety unit working toward meeting the standards.

PSAAC offers several tools to assist units in meeting its standards. An example of the unique tools used by the PSAAC standards is the mission specific Flight Risk Assessment Tool (FRAT). The FRAT is used to determine the level of risk prior to accepting a mission. Factors such as sleep, the length of time on duty, flight experience of the aircrew and complexity of the mission are used to determine if the mission should be accepted. The FRAT is a critical component of public safety helicopter aviation that is required by the PSAAC standards. There are no current regulations for public safety units to implement a FRAT, which is an essential tool in reducing the risk in flight operations.

Another example of a tool used by PSAAC is tracking near misses or significant events. For example, if a helicopter has a maintenance problem with the tail rotor gearbox and has to make a precautionary landing in a field, this information should be captured on an incident form. This allows for trend analysis of maintenance and operational issues. If one aircraft continues to have a problem with a tail rotor gearbox, the gearbox may require replacing. If a certain pilot continues to have problems keeping engine instruments in the normal

²⁷ Ibid.

operating ranges, the pilot may require additional training. Although these answers appear simple, the solutions may not be found unless the data is available and properly evaluated.

The PSAAC standards have a mission specific approach to the safety management systems (SMS) as recommended by the NTSB. SMS is a safety program similar to the U.S. Army that contains the structure for using policies and procedures to reduce risk. One important factor of the SMS is the continual improvement of the safety program. The SMS helps reduce the risk in operations by using four pillars of safety (see Figure 1).



Figure 1. The Four Pillars of the Safety Management System²⁸

The four pillars of an SMS are: safety policies and objectives, safety risk management, safety assurance, and safety promotion.²⁹ The PSAAC standards break down each pillar for public safety helicopter units to implement and use. An

²⁸ Source: Aviation Consulting Group, "Safety Management Systems," accessed October 10, 2016, <https://www.tacgworldwide.com/Safety-Management-Systems>.

²⁹ Aviation Consulting Group, "Safety Management Systems."

important feature of a SMS is to provide a systematic approach using organizational policies to reduce the risk in aviation operations. The managers and supervisors must first understand the mission of the aviation organization to effectively apply the safety policies needed to implement controls for risk. The SMS can be evaluated by the ability to reduce risk in operations. The risk management process of identifying hazards and implementing controls for lower residual risks is the primary goal of all SMS programs.³⁰

The PSAAC standards provide excellent safety strategies that lower the risk of public safety helicopter accidents as indicated by the fact that the NTSB has yet to investigate an accident from an accredited PSAAC unit. Although, the PSAAC standards are not mandated for public safety helicopter missions, they provide a structure to increase safety for public safety helicopter missions if applied to all units across the country. The problem is there is currently no regulatory agency to oversee public safety helicopter operations, which leads to the self-regulation by public safety agencies.

E. ACCIDENT REPORTS

The primary data sources for this study are the official accident reports provided by the NTSB, which conducts a thorough investigation of public safety helicopter accidents. While the NTSB looks at each accident separately, this study looks at the factors that may have increased the risk of each accident. The accidents that this study investigates are delimited by three parameters:

- The accident involved a public safety mission.
- The accident occurred within the last 10 years.
- The accident resulted in death to a crewmember or passenger.

In less significant public safety aviation accidents, the limited data available precludes their use in this study. The three accidents meet the above

³⁰ Skybrary, "Safety Management System," last modified April 1, 2016, http://www.skybrary.aero/index.php/Safety_Management_System.

criteria and are the focus of the study. The three fatal public safety helicopter crashes are:

- New Mexico State Police crash (June 2009)
- Alaska State Trooper crash (March 2013)
- Maryland State Police crash (September 2008).

These accident reports are used in the data analysis phase of this study. A summary of each accident is described in the next section.

1. Overview of the New Mexico State Police Search and Rescue Mission—Factual Information

On June 9, 2009, an Agusta A-109E helicopter, N606SP (Figure 2), crashed into the ground outside of Santa Fe, New Mexico.³¹ According to the NTSB, the pilot lost visual references due to bad weather and crashed. Two people inside the helicopter were killed, one person severely injured and the helicopter was destroyed (Figure 3). The aircraft was registered to the New Mexico Department of Public Safety. The helicopter took off from Santa Fe Municipal Airport in visual meteorological conditions at about 6:50p.m. and was on a public aircraft operation (PAO) search and rescue mission.³²

³¹ National Transportation Safety Board (NTSB), *Crash after Encounter with Instrument Meteorological Conditions during Takeoff from Remote Landing Site New Mexico State Police Agusta S.p.A. A-109E, N606SP near Santa Fe, New Mexico June 9, 2009* (Washington, DC: National Transportation Safety Board, 2011), 12.

³² Ibid.



Figure 2. New Mexico State Police Agusta A-109E Helicopter, N606SP³³

According to the NTSB report, the NMSP dispatched the rescue after a hiker called 911 stating she was lost.³⁴ The Japanese hiker was not fluent in English. The lost hiker, feeling very cold, informed NMSP she was lost and separated from her party. The hiker further stated she was located somewhere in the Pecos Wilderness Area. The NMSP Dispatch Office made the decision to initiate the search and rescue call and dedicate the appropriate resources.³⁵

³³ Source: NTSB, *Crash after Encounter* (New Mexico), 18.

³⁴ NTSB, *Crash after Encounter* (New Mexico), 12.

³⁵ Ibid.



Figure 3. Crash Site of the NMSP Agusta A-109E Helicopter³⁶

a. History of Flight

The helicopter departed Santa Fe Airport during daylight hours in visual meteorological conditions (i.e., good weather).³⁷ After about 80 minutes, the supervisor (pilot) located the hiker and found a place to land about a half mile away from the hiker. When the helicopter arrived at the location of the lost hiker, the weather deteriorated, and the sun was starting to set. According to the NTSB, the pilot landed the helicopter and hiked a half mile downhill to the hiker. In addition to being dark, the weather further deteriorated due to the increased winds and sleet. The pilot carried the hiker uphill a half mile to the helicopter. Then pilot started the helicopter and took off from the mountainous area into the poor weather. The pilot, who was not rated as an instrument pilot, lost his visual references with the ground. The helicopter flew erratically until it impacted the mountain and crash landed.

³⁶ Ibid., 12.

³⁷ Ibid., 14.

b. Injuries to the Personnel

The pilot and the hiker were thrown from the helicopter as it rolled down the side of the mountain, while the spotter remained inside of the fuselage. The pilot and the hiker were fatally injured. The spotter, who was a highway patrol officer onboard assisting with the search, was seriously injured.

c. Background on the Pilot

The pilot was 36 years old and served in the military before employment with the New Mexico State Police (NMSP).³⁸ The pilot's duty in the military was not as a pilot. The pilot was transferred to the NMSP Aviation Unit in 2002 and starting the training to become a pilot. In May 2003, he completed his training for an airplane private pilot license. About 18 months later, the pilot completed his training for an airplane commercial pilot license to include the airplane instrument rating. The pilot completed training for his commercial helicopter license in August 2007, which did not include an instrument rating specifically for helicopters. The pilot was in good health and had no reported medical issues or limitations. Other personnel in the unit had indicated the pilot had demonstrated the desire to complete a flight whether or not he was tired. The pilot's wife said he was a motivated pilot that would accept a mission as part of his duties as a public safety officer even when tired.³⁹

d. Weather during the Flight

The weather during the day prior to the flight was visual meteorological conditions with strong winds. Approximately two hours before the helicopter crashed, the weather became worse with reduced visibility, low cloud layers, rain and thunderstorms in the area. The weather at the site of the rescue was low clouds, snow and heavy snow. The ground units on scene reported the weather conditions as "very bad with strong winds, cold temperatures, snow or sleet, and

³⁸ Ibid., 49.

³⁹ Ibid.

occasional whiteout conditions.”⁴⁰ According to the NTSB, the NMSP did not have a Flight Risk Assessment Tool (FRAT) that is designed to alert the pilot of increased risk due to marginal or poor weather conditions.

e. *Pilot’s Decision Making*

The pilot was called at home for the search and rescue mission three hours after working an eight-hour shift when he received.⁴¹ Moreover, the pilot had had minimal sleep the past two nights due to his additional duty as the public information officer (PIO) for the New Mexico State Police. Initially, the pilot had refused to fly the mission due to the high winds near the location of the lost hiker; however, he decided to accept the mission since the winds had dissipated. Most likely, he believed the mission could be accomplished within the remaining two hours of daylight. This was assumed by the NTSB since the pilot did not bring night vision goggles for flight in the darkness.⁴² Though the pilot located the hiker, he could not find a place to land near her. The pilot was able to safely land the helicopter in an open area about half mile upslope from the hiker’s location. The pilot then hiked down the slope on foot and located the hiker and helped her back to the helicopter. This took approximately 50 minutes while the weather continued its deterioration. The pilot decided to depart even with the poor weather and subsequently became spatially disoriented due to the lack of visibility caused by the low cloud layer. The pilot flew the helicopter into the side of the mountain, which was not visible due to the clouds.

2. Overview of the Alaska State Trooper Search and Rescue Mission—Factual Information

On March 30, 2013, at 11:20 p.m., an Alaska State Trooper helicopter (Figure 4) crashed on a mission to rescue a stranded snowmobiler near

⁴⁰ Ibid.

⁴¹ Ibid., 13–14.

⁴² Ibid.

Talkeetna, Alaska.⁴³ The aircrew and the snowmobiler were fatally injured in the crash. The helicopter was shattered upon impact with the terrain and was damaged well beyond repair (see Figure 5). The pilot and flight observer were full-time, sworn Alaska State Troopers. The mission was a Public Aircraft Operation (PAO) flight since the mission was search and rescue. The weather conditions near the site of the rescue were reported to be weather below the requirements for visual flight rules (VFR).⁴⁴



Figure 4. Alaska State Trooper Airbus AS350B3 Helicopter, N911AA⁴⁵

⁴³ National Transportation Safety Board (NTSB), *Crash Following Encounter with Instrument Meteorological Conditions after Departure from Remote Landing Site Alaska Department of Public Safety, Eurocopter AS350 B3, N911AA, Talkeetna, Alaska, March 30, 2013* (Washington, DC: National Transportation Safety Board, 2014), 1.

⁴⁴ Ibid.,

⁴⁵ Source: NTSB, *Crash Following Encounter (Alaska)*, 14.

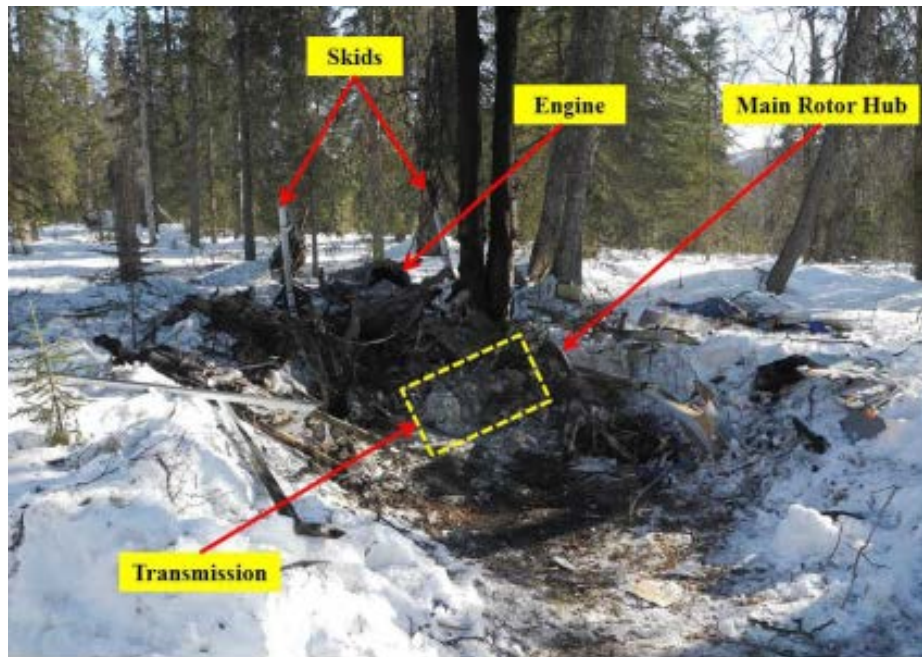


Figure 5. Crash Site of Alaska State Trooper Helicopter N911AA⁴⁶

The pilot and observer successfully located the stranded and hypothermic snowmobiler, and they loaded him in the helicopter. The pilot encountered poor weather about two minutes after taking off from the rescue location. During takeoff from the area of the rescue, the snow was blown up from the ground into the rotor system causing the pilot to lose visibility. The pilot was not certified for instrument flight, and he was unable to control the helicopter due to the limited visibility and became spatially disoriented. In addition to not being certified for instrument flight, the pilot did not have any type of training for flying into limited visibility conditions.

a. History of Flight

At 7:35 p.m., a 911 call was made by a snowmobiler who needed immediate help when his snowmobile was pinned under the snow near Larson

⁴⁶ Source: NTSB, *Crash Following Encounter (Alaska)*, 23.

Lake.⁴⁷ According to the NTSB, the snowmobiler stated he was cold and the weather was deteriorating on him quickly. At 8:19 p.m., the pilot was dispatched for the mission from the Emergency Operations Center. The pilot checked the weather then drove to work. The Alaska State Trooper Aviation Unit was based at Anchorage International Airport.⁴⁸

When the pilot arrived at the airport, he pulled the helicopter out of the hangar and departed at about 9:15 p.m. to the location of the snowmobiler. The pilot located the snowmobiler and landed about a quarter mile away at 9:54 p.m. Then the pilot radioed to his dispatch that he was going to walk over to the snowmobiler. According to the GPS data for the accident flight, the helicopter departed the landing zone at about 11:13 p.m. At 11:17 p.m., the helicopter began to make erratic turns with large deviations in altitude and airspeed. The GPS data for the flight ended at 11:20 p.m. in the location where the crashed helicopter was found.

b. Background of the Pilot

The pilot was in his mid-50s and had a commercial, flight instructor, and instrument license for both airplanes and helicopters. His airplane license included both single engine and multi-engine airplanes.⁴⁹ The pilot had a previous accident on April 21, 2006. According to the NTSB, the pilot said when he applied power during takeoff, the helicopter downwash caused the snow from the ground to be flown up into the rotor blades, which caused him to lose sight of the ground.⁵⁰ The pilot attempted land due to his reduced visibility but was unable to keep the helicopter level. The tailboom contacted the ground due to the nose high attitude when landing causing damage to the helicopter. There were

⁴⁷ NTSB, *Crash Following Encounter (Alaska)*, 2.

⁴⁸ *Ibid.*

⁴⁹ *Ibid.*, 7–8.

⁵⁰ *Ibid.*, 10.

no injuries in the accident. It was later determined the pilot worked over 2 weeks straight with taking a day off for crew endurance.⁵¹

In 2011, based on internal documents from Alaska State Troopers, while flying the helicopter, the pilot had an overtorque. The pilot encountered winds while using a long-line to pull an airplane from a frozen lake. The pilot did not report the overtorque to maintenance personnel or to his supervisor.⁵²

c. *Weather during the Flight*

On March 30, 2013, the weather at the time of departure was marginal visual meteorological conditions with light rain and a low cloud ceiling of 1,000 feet. The forecast did not contain any reports of turbulence, icing, or instrument meteorological conditions (i.e., poor weather). Even so, the weather deteriorated throughout the flight and became instrument meteorological conditions during the time of the rescue mission. According to the NTSB, two witnesses located about 10 miles from the accident site saw the helicopter fly overhead at about 9:30 p.m. The witnesses also stated the light rain turned into heavy snow between 9:30 p.m. and 11:00 p.m.⁵³

d. *Pilot's Decision Making*

The Alaska State Trooper Aviation Unit allows minimum weather standards to be applied based on individual experience. The pilot had documented weather minimums for night vision goggle flights, which allowed him to fly in conditions with a 500-foot cloud ceiling and two miles of visibility.⁵⁴ However, according to colleagues, the pilot stated his actual weather standards were a minimum 200-foot cloud ceiling with a minimum of five miles of visibility. Even when the pilot encountered low ceilings and heavy snow near the accident

⁵¹ Ibid., 11.

⁵² Ibid., 33.

⁵³ Ibid., 17–18.

⁵⁴ Ibid., 8.

site, he continued to fly the mission. The pilot's colleagues stated the pilot was highly motivated to perform missions and accomplish rescues. According to the aircraft section commander, the pilot stated he felt obligated to complete rescues even if high risks were involved. The Alaska State Trooper Aviation Unit did not have any control measures to evaluate risk, which may have prevented the pilot from accepting the unnecessary risk to complete the mission.

3. Overview of the Maryland State Police Crash Search and Rescue Mission—Factual Information

On September 27, 2008, the Maryland State Police was called to evacuate two injured motorists to St. George's Hospital in Cheverly, Maryland.⁵⁵ During the route, the mission, a medical evacuation flight, the pilot lost visual reference with the ground because of low cloud cover and experienced instrument meteorological conditions. As a result, the flight diverted to a different destination. The pilot requested a precision approach radar (PAR) but the controller said the person able to give an adequate PAR was not present. The pilot then tried for an instrument landing system (ILS) approach due to the weather conditions. The pilot became disoriented in the clouds during the ILS approach and the helicopter crashed. The transition from visual flight rules (VFR) (using visual sight to fly) to instrument flight rules (IFR) (relying on instruments for navigation) is a difficult transition in poor weather. As the weather deteriorated further, flying the helicopter became more difficult.⁵⁶ As it was en route, the Airbus AS365N1 Dauphin helicopter collided with trees and terrain and crashed, killing four people and seriously injuring one person (see Figures 6 and 7).

⁵⁵ National Transportation Safety Board (NTSB), *Crash during Approach to Landing of Maryland State Police Aerospatiale SA365N1, N92MD District Heights, Maryland September 27, 2008* (Washington, DC: National Transportation Safety Board, 2009), 1–2.

⁵⁶ Ibid.



Figure 6. Maryland State Police Airbus AS365N1 Dauphin Helicopter⁵⁷



Figure 7. Crash Site of the Maryland State Trooper Airbus AS365N1⁵⁸

⁵⁷ Source: NTSB, *Crash during Approach*, 10.

⁵⁸ Source: NTSB, *Crash during Approach*, 10.

a. History of Flight

The Maryland Communications Center received a 911 call at 11:01 p.m. requesting a medevac flight for two motorists with serious injuries from a vehicle traffic collision. The Maryland State Police pilot initially stated the weather in the area was poor due to an 800-foot cloud ceiling, and he would not be able to make it to the hospital.⁵⁹ According to the NTSB, the pilot changed his mind and stated, “yeah we ought to be able to do it... we’re going to try it.”⁶⁰ The pilot then took off for the vehicle accident site at 11:10 p.m. and arrived at 11:19 p.m. With the injured on board, the pilot departed the accident site at 11:37 p.m. At 11:44 p.m., the pilot reported to the air traffic controller at Ronald Reagan Washington National Airport that he encountered instrument meteorological conditions and said he might not be able to make it to the hospital. At 11:47 p.m., the pilot turned around due to the poor weather and requested to climb up to a high altitude (into the clouds) to execute an instrument approach into Andrews Air Force Base, and at 11:55 p.m., he received a landing clearance. At 11:57 p.m. the pilot asked for a PAR and the air traffic controller stated her qualifications were not current and she could not provide that service. A minute later, at 11:58 p.m., the helicopter crashed into the ground.⁶¹

b. Injuries to the Personnel

The pilot of the helicopter and the two medical crewmembers on board the helicopter were fatally injured. One of the passengers was also fatally injured, and the other was seriously injured.

⁵⁹ NTSB, *Crash during Approach*, 1.

⁶⁰ *Ibid.*, 2.

⁶¹ *Ibid.*, 7.

c. Background on the Pilot

The pilot was in his late 50s and was a commercial helicopter pilot with a helicopter instrument license.⁶² He also was a private airplane pilot and a flight instructor for helicopters. The pilot was current with his flight physical and annual flight evaluations. The pilot's flight physical indicated the he was well overweight for his height.

According to the pilot's wife, the pilot snored every night and coworkers also said the pilot snored very loudly.⁶³ It is possible but underdetermined if the pilot also suffered from sleep apnea. If he did, it would have caused him to be fatigued due to the lack of oxygen during his sleep cycle.

The FAA lists sleep apnea as a medical condition that requires further evaluation by a doctor on the flight physical exam.⁶⁴ Sleep apnea is defined by WebMD as:

A serious sleep disorder that occurs when a person's breathing is interrupted during sleep. People who have untreated sleep apnea stop breathing regularly during their sleep, sometimes hundreds of times. This means the brain—and the rest of the body—may not get enough oxygen.⁶⁵

d. Weather during the Flight

At approximately 10:45 p.m. (25 minutes before takeoff) there was an Airman's Meteorological Information (AIRMET) for instrument meteorological conditions in the area.⁶⁶ The weather is below the standards set by VFR, which require a cloud ceiling of at least 1,000 feet and three miles of visibility. At the

⁶² Ibid., 8.

⁶³ Ibid.

⁶⁴ Federal Aviation Administration, *Obstructive Sleep Apnea* [brochure] (Oklahoma City: FAA Civil Aerospace Medical Institute), accessed October 15, 2016, https://www.faa.gov/about/office_org/headquarters_offices/avs/offices/aam/ame/guide/media/Pilot%20Brochure%20-%20OSA.pdf/.

⁶⁵ Ibid.

⁶⁶ NTSB, *Crash during Approach*, 11.

time of the accident (11:58 p.m.), the weather at Andrews Air Force Base was an extremely low cloud base at 200 feet above the ground with poor visibility due to mist. An additional problem with the weather was the temperature and dew point were the same, which creates condition conducive to fog. Fog is a problem for pilots because it obstructs the view of the ground. An instrument approach can only get the aircraft down to about 200 feet above the ground (not below the fog). According to a homeowner who saw the helicopter fly over his house just prior to the crash, the clouds were only 100 feet above the trees.⁶⁷

e. *Pilot's Decision Making*

The pilot should have obtained updated weather prior to taking off for the mission; he did not. This would have alerted the pilot of the deteriorating weather near the vehicle accident and would have helped him understand the weather was deteriorating quickly. According to the NTSB, the pilot heard on the radio of another medical evacuation (MEDEVAC) helicopter in the area completing a mission and stated, "If they can do it, we can do it. Yeah we ought to be able to do it... we're going to try."⁶⁸ According to a pilot with the Maryland State Police Aviation Unit, the unit was not using risk management in their operations. If risk management was used by implementation of a flight risk assessment tool (FRAT), it may have alerted the pilot to the increased risk of the flight due to the weather conditions as well as provided the justification for not accepting the mission and canceling the flight.⁶⁹

F. SUMMARY AND IMPLICATIONS

As these cases illustrate, public safety helicopter aviation is in a safety predicament. The complexity of its missions and the role it plays in homeland security makes most of its missions exempt from FAA oversight. The high level of

⁶⁷ Ibid., 12.

⁶⁸ Ibid., 49.

⁶⁹ Ibid., 50.

risk combined with unregulated oversight is the reason why the NTSB claimed that public safety helicopter aviation is in dire need for safety improvement. Although the PSAAC provides standards that may lessen the risk for accidents, these standards are not mandated and therefore public safety helicopter accidents may increase when standards are not enforced or adopted. This safety void that public safety aviation possesses must be addressed to prevent future accidents. This chapter covered the case studies and the next chapter will discuss the research design and the findings of the research.

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III. RESEARCH DESIGN AND FINDINGS

This chapter presents the methodology used in this study followed by the findings from the research design. This chapter begins with the method of how the data is analyzed. In addition, this chapter includes a thorough explanation of the qualitative research method called coding, which was used to analyze the lengthy NTSB reports. This qualitative method occurred in four phases. Then, this chapter explains how each research question is answered. Afterwards, a visual result of the coding process is presented in the chapter. Finally, the chapter concludes with a summary of the findings.

A. RESEARCH DESIGN

The primary data source used in this study was the official accident reports provided by NTSB to answer the research questions:

1. What are the common risk factors associated with public safety helicopter accidents?
2. How can these risks be addressed by the PSAAC?

Although the NTSB provides analysis of many types of aviation accidents, this study delimited the scope to three major public safety helicopter accidents to make the research more manageable. A major accident is defined by whether there was a fatal injury that occurred during the accident. This study looked at the factors in three specific cases that may have increased the risk of the accident. The three fatal public safety helicopter crashes are:

- New Mexico State Police crash (June 2009)
- Alaska State Trooper crash (March 2013)
- Maryland State Police crash (September 2008)

B. DATA ANALYSIS METHOD: CODING

The analysis of data was based on the questions scoped for this thesis. The use of a qualitative technique of analyzing documents called coding was used to effectively answer the research questions in this thesis. According to

Richards and Richards, coding is a technique used to analyze large data sets so that each document is a “fair, balanced and equally thorough analysis.”⁷⁰

In the first phase, codes were developed from the safety risk factors noted in the literature review. For example, the literature review recommends a minimum crew rest, which suggests an upper limit of flight time for each crewmember. “Crew rest” was one code used to analyze the NTSB’s accident reports. Additional codes were created from terms in the literature review. Furthermore, specific attention was given to the development of codes that related to risk factors that might contribute to public safety helicopter safety.

In the second phase, the codes were used to analyze the three NTSB accident reports. However, in the process of analyzing the accident reports, new codes emerged that are not mentioned in the NTSB reports. These new codes were recorded and also used. The creation of codes was an ongoing process throughout the analysis process.

The third phase of data analysis was arranging the codes collected from the accident reports into a hierarchy. The codes were categorized according to types of risk factors and also arranged according to the frequency and significance in the accident reports. Once the data were collected and sorted, they were displayed in a table format to develop a conclusion. Additionally, the data were displayed regarding several risk factors identified in the literature.

The analysis of research question two was addressed in the fourth phase of data analysis. In this last phase, all the codes collected were cross-referenced with standards and regulations of the PSAAC and FAA. According to Seidel, the purpose of the final phase, thinking about things, is “(1) to make some type of sense out of each collection, (2) to look for patterns and relationship both within a collection, and also across collection, and (3) to make general discoveries about

⁷⁰ Tom Richards and Lynn Richards, “Using Computers in Qualitative Research,” in *Handbook of Qualitative Research*, ed. Norman K. Denzin and Yvonna S. Lincoln, 445–462 (Thousand Oaks, CA: Sage Publications, 1994).

the phenomena you are researching.”⁷¹ To complete these tasks, the literature was reviewed for evidence to rule whether the risk factors identified are congruent with the standards set forth by PSAAC and the FAA. This informed the researcher whether the standards and regulations of these agencies might help reduce the risk in operations for public safety aviation.

C. FINDINGS

To simplify the findings from the research a chart was used to display the data in an easy to read format.

1. Research Question 1

What are the common risk factors associated with public safety helicopter accidents? This question will be answered by first developing codes from the literature, which suggests that there are three areas that may contribute to the increased risk of public safety helicopter missions:

1. Visual and instrumental flight rules
2. Crew endurance (pilot rest)
3. Pre-flight risk assessments

Each of these risk categories are codes used to analyze the three accident reports (New Mexico, Alaska, and Maryland) as provided by the NTSB. As stated in Chapter I, there is no research identifying the commonalities among all the accident reports as this thesis research does.

Each of the accident reports serves as raw data for the coding procedure. Table 1 displays the codes from the accident reports, which the researcher read and coded.

⁷¹ John V. Seidel, *Appendix E: Qualitative Data Analysis* (Colorado Springs, CO: Qualis Research, 1998), <http://www.qualisresearch.com/Downloads/qda.pdf>. Originally published as “Appendix E: Qualitative Data Analysis,” in *The Ethnograph: A Users Guide v 5.0* (Colorado Springs, CO: Qualis Research, 1998).

Table 1. Codes from NTSB Accident Reports⁷²

Code Signals from the Literature	New Mexico (2009)	Alaska (2013)	Maryland (2008)
Instrument Flight Rules, IFR, Instrument Meteorological Conditions, IMC	“According to NMSP personnel, the aviation section helicopter was not intended to be operated in instrument flight rules (IFR) conditions” (p. 11). “DPS cabinet secretary told investigators that aviation section helicopter pilots had to “stay VFR all the time” and avoid getting into a situation where they could encounter IMC” (p. 32). “the pilot likely could not see the surrounding terrain in the dark night 100 IMC conditions” (p. 46). “the pilot’s lack of a helicopter instrument rating and lack of helicopter instrument flying	“Instrument meteorological conditions (IMC) prevailed in the area at the time of the accident” (p. vii). “the pilot was flying a helicopter that was not equipped or certified for flight under instrument flight rules (IFR). The pilot was not IFR current, had very little helicopter IFR experience and had no recent inadvertent IMC training” (p. vii). “The pilot told the observer he would then continue the flight under IFR until they reached the nearest airport or exited the bad weather” (p. 12). “None of the Alaska DPS	“If the pilot had included weather hazards, the briefing would have contained an Airman’s Meteorological Information (AIRMET) for IFR conditions” (p. 12). “If the pilot had thoroughly obtained and reviewed all of the available weather information, it is likely he would have realized that there was a high probability of encountering weather conditions less than MSP minimums on the flight and this would have prompted him to decline the flight” (p. 50). “The controller did not explicitly issue Trooper 2 an instrument clearance or an IFR transponder code. An IFR transponder code

⁷² Sources: NTSB, *Crash after Encounter* (New Mexico), 11, 32, 46, 51, 57, 58, 63, 64; NTSB, *Crash Following Encounter* (Alaska), vii, 12, 14, 46, 50, 54, 65, 71; NTSB, *Crash during Approach*, 12, 50, 56, 57, 59, 60, 73.

Code Signals from the Literature	New Mexico (2009)	Alaska (2013)	Maryland (2008)
Instrument Flight Rules, IFR, Instrument Meteorological Conditions, IMC	proficiency, maneuvering in dark night conditions, and turbulence) were present during the accident flight” (p. 46). “Because the accident pilot did not have training specific to inadvertent helicopter instrument meteorological condition encounters, he was not prepared to react appropriately to the loss of visual references” (p. 64).	helicopters were IFR-certified” (p. 14). “TKA reported light rain and ceilings varying between VFR and IFR conditions” (p.46). “Forecasts indicated that conditions in the search area would be IFR and that forecast cloud ceilings and visibility would likely be below the pilot’s Alaska DPS weather minimums and possibly below his last known personal weather minimums” (p. 50). “The accident helicopter was a single-engine, nonIFR-certified platform and was crewed by a single pilot who was not instrument-current” (p. 54).	is necessary for aircraft to receive MSAW service” (p. 56). “Between the time Trooper 2 contacted PCT and issuance of the IFR approach clearance, Trooper 2’s status as an IFR or VFR flight was ambiguous” (p. 57). “The NTSB concludes that although the pilot met the recent-experience requirements to act as PIC under IFR, he was not proficient in instrument flight. This lack of proficiency likely contributed to the pilot’s failure to properly conduct what effectively became a nonprecision approach at night in instrument conditions” (p. 59).
Crew Endurance, Pilot Fatigue, Pilot Rest	“most critical decision during the accident mission—his decision to take off in adverse weather conditions ... was consistent with the effects of fatigue” (p. 51).	Crew endurance was not a factor in Alaska.	“the increased workload on the pilot” (p. 73). “Based on the late hour, the length of time awake, the risk factors for sleep apnea exhibited by the pilot, and the decision to

Code Signals from the Literature	New Mexico (2009)	Alaska (2013)	Maryland (2008)
	“the accident pilot was likely fatigued as a result of his sleep restriction the preceding day” (p. 57). “Probable cause...pilot’s fatigue” (p. 65). “Fatigue was one of several factors that likely affected the pilot’s decisions and actions on the night of the accident” (p. 58).		deviate from the published procedures, the pilot was likely less than fully alert, and fatigue may have contributed to his deficient decision-making” (p. 60).
Risk Management, Pre-Flight Risk Assessment	“no safety management system” (p. 57). “the aviation section did not require its pilots to perform a structured, systemic risk assessment before accepting a mission or to reassess risks during a mission” (p. 57). “The New Mexico DPS policies placed responsibility for safety exclusively on pilots” (p. 58). “...If operators implemented structure, task-specific risk assessment and management programs, their pilots would be	“The pilot was not required to complete any standardized preflight risk assessment process, either before accepting a mission or while conducting a mission to help evaluate risk as new variables (such as deteriorating weather conditions) were introduced” (p. 54). “Probable cause.... lack of requirement for a risk management system throughout the mission” (p. 65). “causal was the Alaska	“MSP [Maryland State Police] did not have a formal risk management program in place” (p. 50). “Had a formal flight risk evaluation program been in place at Maryland State Police before the accident, it may have resulted in the cancellation of the flight” (p. 72).

Code Signals from the Literature	New Mexico (2009)	Alaska (2013)	Maryland (2008)
	more likely to thoroughly identify and make efforts to mitigate the potential risks associated with a mission” (p. 63).	Department of Public Safety’s punitive culture and inadequate safety management” (p. 71).	

2. Analysis of Trends

The analysis of the data showed that there are two factors strongly correlated to the cause of fatal public safety helicopter accidents. The two factors are the inadequate proficiency use of instrumental flight rules (IFR) flying and the lack of a pre-flight risk assessment. Pilot fatigue is a factor that appeared in two of the accident reports (New Mexico and Alaska) but not evident as a cause in the third (Maryland). However, in coding the data for pilot fatigue, another code that emerged as a common trend of accident causation was the culture of a department, which encourages mission completion over safety. The coding for safety culture of public safety departments is presented and explained in the section below. Overall there are three common factors that emerged from the qualitative analysis of coding: inadequate proficiency of IFR flying, lack of a pre-flight risk assessment, and the safety culture of the public safety department.

a. Instrumental Flight Rules

The first factor is inadequate proficiency for IFR flying. The use of IFR occurs when the weather is limited (visibility and cloud ceiling) and the pilot must rely on his or her instruments to fly. IFR is opposed to VFR in which the pilot uses visual cues to fly. IFR conditions are defined when visibility is less than three miles and the cloud ceiling is less than 1,000 feet.⁷³

All three fatal accidents occurred in deteriorating weather conditions. It can be argued that each mission should have been declined due the increased risk caused by the poor weather. In each case, the pilot had to abandon VFR for flying and had to rely on IFR. In the New Mexico crash, the pilot began the flight in visual meteorological conditions but then because of deteriorating weather conditions, instrument meteorological conditions prevailed. The Alaska crash also began with visual meteorological conditions but suddenly became under instrument meteorological conditions (in which the pilot did not have training).

⁷³ 14 CFR, § 91.155 (2015).

Lastly, the Maryland crash also required instrument flight rules due to inclement weather. (The motivation to accept the missions is explained later in this research as part of a larger problem of safety culture of public safety departments).

To fly with IFR, a pilot must have proper certification and current training. In addition, the helicopter must be equipped with the proper instrumentation to fly under IFR conditions. According to the data, in all three accidents, the pilot, the aircraft, or both were not proficient to fly under IFR conditions.⁷⁴ In each case, the inclement weather combined with lack of proficiency of IFR flying proved to be disastrous. To make matters worse, in two of the cases (New Mexico and Alaska), the helicopter was not properly equipped and certified for IFR conditions.⁷⁵

b. Pre-Flight Risk Assessments

Another common factor that emerged from the data is the lack of a pre-flight risk assessment. These accidents may have been prevented had the pilot conducted a thorough risk assessment prior to the accepting of the mission. Additionally, the assessment should consider weather conditions, pilot rest, and a number of other factors that would have captured the appropriate risk for the flight. A risk assessment typically categorizes the flight into risk levels of low, medium or high.

In the New Mexico crash, the aviation unit did not require its pilots to “perform a structured, systemic risk assessment before accepting a mission or to reassess risks during a mission.”⁷⁶ In this specific case, pilot fatigue was also a factor and a risk assessment may have required better rested pilot to handle the mission. In the Alaska case, there was no requirement to “complete any

⁷⁴ NTSB, *Crash after Encounter* (New Mexico), 46; NTSB, *Crash Following Encounter* (Alaska), vii; NTSB, *Crash during Approach*, 59.

⁷⁵ NTSB, *Crash after Encounter* (New Mexico), 11; NTSB, *Crash Following Encounter* (Alaska), 14.

⁷⁶ NTSB, *Crash after Encounter* (New Mexico), 57.

standardized preflight risk assessment process, either before accepting a mission or while conducting a mission to help evaluate risk as new variables (such as deteriorating weather conditions) were introduced.”⁷⁷ Finally, the Maryland case had the same issue; the Maryland State Police did not have a formal risk management program.⁷⁸ The accident report shows that “had a formal flight risk evaluation program been in place at Maryland State Police before the accident, it may have resulted in the cancellation of the flight.”⁷⁹

In all three cases, a pre-flight risk assessment would have informed the pilot of deteriorating weather conditions in the area and have alerted the pilot to the higher risks associated with the flight. As is clearly evident by these tragedies, a pre-flight risk assessment is a necessary step that should have been taken prior to these public safety helicopter missions. Analysis of the voluntary standards set forth by an optional governing agency to determine that these standards are necessary and recommended as standard protocol for all public safety missions is discussed in the analysis for research question two.

c. Crew Endurance (Pilot Rest)

The last potential factor coded in the data is pilot rest. As the data show, this was a common factor in two of three cases (New Mexico and Maryland), but it was not concluded as a potential cause of the crash in the third (Alaska).

d. Safety Culture of Public Safety Agencies

The third code of “pilot fatigue” was not common to all accident reports. However, it is learned from the research process that pilot fatigue was a part of a more general problem in public safety agencies. The data show that there is a culture within departments that encourages mission completion over safety; the culture of a department is not limited to the motivations of a single person. This

⁷⁷ NTSB, *Crash Following Encounter* (Alaska), 54.

⁷⁸ NTSB, *Crash during Approach*, 50.

⁷⁹ *Ibid.*, 72.

additional factor encompasses pilot fatigue because the desire to complete the mission overrode the crucial fact that the pilot was not rested enough to make proper decisions. The raw data was then coded again with “safety culture.” Table 2 displays the coded data of all three accident reports.

Table 2. Emerged Codes from Data⁸⁰

Code Signals from the Literature	New Mexico (2009)	Alaska (2013)	Maryland (2008)
Safety Culture, Motivation, Decision- Making, Pressure	“Initially, the pilot responded that it was too windy to fly” (p. 2). “the pilot decided to take off from the remote landing site, despite mounting evidence indicating that the deteriorating weather made an immediate return to Santa Fe inadvisable because his fatigue, self-induced pressure to complete the mission” (p. 63). “Although there was no evidence of management pressure on the pilot, there was evidence of management actions that emphasized accepting all missions, without adequate regard for conditions, which was not consistent with a safety-focused organization safety	“Pilot’s exceptionally high motivation for conducting search and rescue missions likely played a part” (p. 69). “Pilot’s exceptionally high motivation... increased risk tolerance” (p. 70). “The Department lacked organizational policies and procedures to ensure that operational risk was appropriately managed....that would have encouraged the pilot to decline the mission” (p. 70). “The Department had a punitive culture that impeded the free flow of safety-related information and impaired the organization’s ability to address underlying safety deficiencies	“The pilot’s decision to accept the flight contributed to the accident” (p. 71). “...fatigue may have contributed to his deficient decision-making” (p. 72). “Fatigue in combination with the high workload the pilot was experiencing could explain this deficient decision” (p. 60). “The pilot’s comments, ‘if they can do it we can do it’ followed by ‘yeah we out to be able to do it...we’re going to try it’ The pilot was referring to a medical transport helicopter that completed a mission earlier in the area” (p. 49).

⁸⁰ Sources: NTSB, *Crash after Encounter* (New Mexico), 2, 63, 65; NTSB, *Crash Following Encounter* (Alaska), 69, 70; NTSB, *Crash during Approach*, 49, 60, 71, 72.

Code Signals from the Literature	New Mexico (2009)	Alaska (2013)	Maryland (2008)
	culture” (p. 63). “contributing to the accident were an organizational culture that prioritized mission execution over aviation safety” (p. 65).	relevant to this accident” (p. 70).	

During the qualitative analysis phase of the research, the codes “culture” and “desire to complete a mission” emerged. The accident analysis reports suggest that there is a strong culture in all the three departments (New Mexico, Alaska, and Maryland) that encourages pilots to accept missions even though there are warning signs suggesting high levels of risk associated with the flight.

The data shows that the culture of the New Mexico aviation unit placed a high priority of mission completion over safety. Although the pilot already worked a full eight-hour shift, the shift supervisor asked the pilot to take the mission.⁸¹ Initially, the pilot rejected the mission because of adverse weather conditions, not fatigue; however, after some time, the pilot called back and told his supervisor he would take the mission.⁸² The data of the New Mexico accident shows that a contributing factor to the accident was the “organizational culture that prioritized mission execution over aviation safety.”⁸³

A similar situation occurred with the pilot in Maryland crash. The data overwhelming suggests that the culture of the Maryland State Police aviation unit prioritizes mission completion over logical thinking about risks associated with a mission. In addition, the data shows that the pilot was fatigued⁸⁴ and his decision-making abilities were compromised.⁸⁵ Lastly, the Alaska NTSB report analysis concludes the same: the culture of the department encourages illogical risk taking to complete a mission. The data shows that the pilot had an “exceptionally high motivation to complete search and rescue missions, which increased his risk tolerance and adversely affected his decision-making.”⁸⁶ An aviation department must be structured to objectively assess mission safety,

⁸¹ NTSB, *Crash after Encounter* (New Mexico), 2.

⁸² Ibid.

⁸³ NTSB, *Crash after Encounter* (New Mexico), 65.

⁸⁴ NTSB, *Crash during Approach*, 72.

⁸⁵ Ibid., 60.

⁸⁶ NTSB, *Crash Following Encounter* (Alaska), 71.

which would lead the pilot to make a decision based on the risk associated with the flight. The desire to take a mission, reinforced by organizational culture, should not be a consideration when deciding whether a mission should be accepted. The institutional culture is not adequate enough to prevent flights from being accepted. The data from the case studies suggest that an objective measure of risk assessment, prior to the flight, is needed to increase the safety of public safety helicopter missions.

Based on the qualitative analysis (coding) employed by this study, there are two strong factors that emerge as having played a role in each accident. The inclement weather and the lack of a pre-flight risk assessment are two factors that could have prevented the fatal accidents in New Mexico, Alaska, and Maryland. In addition, a new causative factor emerged from the coding process suggesting the culture of public safety helicopter departments leads to risk and thus contributes to accidents. All three of these factors have strong implications for the future of safety and risk management in public safety helicopter aviation.

3. Research Question 2

The second research question of this study is, how can these risks be addressed by the PSAAC? This question was answered by cross-referencing the above findings (codes) with the document published by the PSAAC titled *Standards for Law Enforcement Aviation Units*. Table 3 depicts the coding results from the document.

Table 3. Codes from PSAAC Standards⁸⁷

Code	Data from the Public Safety Aviation Accreditation Commission <i>Standards for Law Enforcement Aviation Units</i>
Instrumental Flight Rules	“Inadvertent flight into instrument meteorological conditions is an emergency. It is an unplanned and unexpected condition that must be addressed immediately. Every attempt shall be made to avoid meteorological conditions that may result in inadvertent cloud penetration or loss of ground reference due to low ceiling, fog or “on-top” conditions” (p.16). “It is strongly recommended that for operations in uncontrolled airspace, units establish minimums greater than one-mile visibility and clear of clouds. These minimums should also be used as VFR or Special VFR launch minimums. Pilot and aircrew experience, equipment capabilities and local terrain are additional criteria that should be considered when establishing weather minimums” (p. 16).
Pre-Flight Risk Assessment	“Safety Risk Assessment & Mitigation: The unit shall determine and analyze the risk factors related to the severity and likelihood of potential events associated with known hazards and identify appropriate risk mitigation strategies” (p. 25).

The PSAAC’s *Standards for Law Enforcement Aviation Units* addresses two of the codes found in the data, and it suggests adopting weather minimums to dictate whether a mission should be accepted. If the PSAAC’s standards are adopted in aviation departments, then pilots would be forced to reject a mission based upon objective measures. Weather minimums “shall be specified as a minimum ceiling and visibility in a written policy for both day and night operations.”⁸⁸ These weather minimums avoid IFR conditions, which could increase safety because, as discovered in the case studies, all three accidents involved weather requiring IFR but not all pilots and aircraft are IFR certified. The

⁸⁷ PSAAC, *Standards for Public Safety*, 16, 25.

⁸⁸ Ibid., 16.

standards stipulate inadvertently flying into weather categorized as instrument flight rules as an “emergency” and that “every attempt shall be made to avoid instrument meteorological conditions.”⁸⁹ The PSAAC’s standards also address the need for a pre-flight risk assessment. The standards suggest that the department should “analyze the risk factors related to the severity and likelihood of potential events associated with known hazards and identify appropriate risk mitigation strategies.”⁹⁰ However, the standards do not list objective measures that may provide a structure for adopting a checklist of requirements that should be met prior to flight. The document contains weather minimums and several other factors but not a comprehensive list of requirements, which is needed to develop a fail-safe approach to risk management.

In addition to lacking comprehensive pre-flight requirements, the PSAAC’s standards do not adequately address safety culture of the individual departments. Rather, it proposes standards that aviation departments can adopt that would allow them to objectively decide whether a mission should be accepted. The findings of this thesis suggest that public safety aviation units throughout the country should adopt the PSAAC standards to prevent fatal accidents as those that occurred in the case studies.

⁸⁹ Ibid., 16.

⁹⁰ Ibid., 25.

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IV. CONCLUSION

A. RESEARCH QUESTIONS

This chapter begins with the research questions followed by the conclusion of the analysis by answering each question. The chapter ends with a summary of each of the accident analyzed for this thesis.

1. Research Question 1

What are the common risk factors associated with public safety helicopter accidents? The qualitative data analysis reveals that three factors contributed to the fatal public safety helicopter accidents: 1) inclement weather, 2) lack of pre-flight risk analysis, and 3) a safety culture within aviation departments that prioritizes mission completion over safety considerations.

2. Research Question 2

How can these risks be addressed by the PSAAC? After discovering the above risk factors from the first research question, this thesis investigates if these factors are addressed by the standards published by the PSAAC. This report concludes that two of the aforementioned factors (inclement weather and pre-flight risk analysis) are addressed by the PSAAC standards. However, the third, safety culture within individual aviation departments, is not addressed by the standards.

B. CONCLUSION

The National Transportation Safety Board placed public safety helicopter aviation on its “Most Wanted List of Transportation Safety Improvements” in 2015. The lack of governmental oversight combined with the high-risk nature of the missions puts public safety helicopter aviation in a hazardous position. Although many issues in public safety aviation have yet to be resolved, the NTSB did not place public safety helicopter aviation on the 2016 most wanted list.

The unique nature of public safety helicopter aviation missions makes it difficult to create concrete rules to determine whether missions should be accepted or declined. These aviation missions respond to a variety of emergency situations that are impossible to predict. Though the FAA regulated civilian operators, it does not regulate public safety helicopter aviation to allow the public safety agencies the flexibility to respond to emergency situations demanded daily by the public. A heavily regulated public safety agency may choose not to respond to lifesaving missions for fear of violating regulations by the FAA. The purpose of this thesis is to determine whether there are commonalities in the causation of recent fatalities in helicopter aviation. Through the qualitative process of data analysis, this thesis identifies three factors common to the recent fatal accidents in public safety helicopter aviation: inclement weather, the lack of a pre-flight risk assessment, and a complacent culture within departments that prioritize mission completion over safety concerns are found as causes of the accidents. These factors are not unique to any of the accidents but are found as causes of all three. Therefore, it is vital that these factors are addressed in every public safety aviation unit as a standard protocol prior to mission acceptance.

The NTSB is a governmental agency that does not have regulatory authority over the individual public safety aviation units. Its role is to investigate an accident and conclude causations based upon its findings. However, the NTSB does not produce any trend analysis across public safety helicopter aviation accident reports. Therefore, the purpose of this study was to find those factors common to the fatal accident reports.

The PSAAC has developed standards in public safety helicopter aviation in an attempt to make public safety agencies safer. PSAAC is an organization composed of public safety personnel who understand the specific role of public safety aviation. However, the required pilot licenses are issued solely by the FAA, which makes the FAA the only regulatory agency in aviation with the ability to implement mandatory compliance. The NTSB and PSAAC can only make recommendations to the FAA and the public safety agencies. This study

investigated these standards to determine whether they address the common factors identified in the first research question. It was concluded that two of the factors that caused the fatal public safety helicopter accidents are addressed but not the third (department safety culture).

1. Inclement Weather

Inclement Weather is found to be a cause of all three accidents studied in this thesis. The PSAAC standards recommend adopting a minimum ceiling height and visibility to complete missions with an acceptable level of risk. In addition, it suggests that instrument meteorological conditions (IMC) should be avoided at all times. The FAA has established well-defined weather minimums for visual meteorological conditions (VMC) with a minimum 1,000-foot ceiling and three miles of visibility.⁹¹ Any weather condition below those weather minimums is considered instrument meteorological conditions. The PSAAC standards should do more than recommend a minimum ceiling height and visibility for the public safety agencies. At a minimum, they should suggest the public safety agency follow the FAA weather minimums for visual meteorological conditions.

These unambiguous weather standards would force a pilot who is overly motivated to accept a mission to decline based on not having the required weather for the mission. The weather minimums established by the public safety agency would remove the decision from the pilot and allow the public safety agency to manage pilot decisions with policy. Currently, there are no regulations or universal policies that dictate to a public safety agency which minimum weather standards to be established.

2. Pre-flight Risk Assessment

A Flight Risk Assessment Tool (FRAT) is a tool that can protect the pilots from taking a fatal flight. In addition to assessing the level of risk associated with

⁹¹ 14 CFR, § 91.155 (2015).

the mission, the FRAT can place the responsibility for mission acceptance to the appropriate level of authority. The upper management of New Mexico State Police would be less likely to demand a pilot to fly a high-risk mission if it were responsible for approving the high-risk mission. For example, a low-risk mission could have an approval authority of the chief pilot of the unit. A medium risk mission could require approval from a supervisor. However, a high-risk mission should require upper management approval, which puts the burden of responsibility for accepting the risk to the selected upper management person. When the responsibility is put on an individual for the high risk, it makes the person less likely to approve the risky mission. The FRAT also would give the supervisor an immediate warning about the risk of the mission. When a mission is evaluated as high risk, control measures are needed to reduce the risk to acceptable levels. Factors such as sleep, the length of time on duty, flight experience of the aircrew and complexity of the mission are used to help determine if the mission should be accepted. The FRAT is a critical component of public safety helicopter aviation that is required by the PSAAC standards. There are no current regulations for public safety units to implement a FRAT, but it is an essential tool in reducing the risk in flight operations.

3. Department Safety Culture

The safety culture of a public safety aviation unit is essential to reduce the risk in operations. The culture of a unit is the discipline the unit shows towards policies and procedures. For example, the New Mexico State Police (NMSP) Aviation Unit did not have policies which reflected the way it conducted its day to day operations. This allowed the unit to make policies as it went along, which created complacency and a subtle breakdown of discipline.

The pilot of the NMSP crash tried to designate another pilot to fly the mission. However, since the other full-time pilot was unavailable due to weekend duty with the National Guard, the pilot accepted and flew the fatal mission. The reason the pilot attempted to find someone else to fly the mission was due to

high winds in the area and because he had been awake the previous night working on public information officer (PIO) duties. Policies are needed to protect the pilots from themselves and from possible retribution for not accepting a mission. The previous chief pilot of the unit was relieved of his position as the chief pilot for refusing a search and rescue mission.⁹² The upper management who relieved the chief pilot of his duties reinforced a culture where mission execution was a priority over the risks associated with the mission.

When a culture promotes mission completion over safety, it breeds the type of personnel who become focused on the mission without an appreciation for the risks involved. This type of culture contributes to poor decisions, which lead to aviation accidents. An effective culture should reward the individuals who decline a mission in which the risk may be too great. This culture can only exist if the management of an organization fosters an atmosphere of trust where unit members are influenced to evaluate the risk prior to accepting the mission, and the pilots have no fear of retribution for declining for safety reasons.

C. SUMMARY

The NMSP Aviation Unit did not meet the current industry standards for law enforcement aviation due to its lack of requirements for pilot rest, lack of a pre-flight risk assessment, and ambiguous weather minimum standards. The upper management stated it relied on the line pilots in the unit to make the right decisions.⁹³ However, due to the subtle breakdown of discipline in the unit, the right decisions were not being made and there were no set standards for operations. The upper management could have directed its aviation unit to meet the PSAAC standards and used the resources from the ALEA to help management determine if their unit was doing things right. The management

⁹² NTSB, *Crash after Encounter* (New Mexico), 32.

⁹³ *Ibid.*, 16.

could not rely on the FAA regulations to keep the unit safe since the public safety agency is exempt from the regulations when on any type of PAO.

The pilot who was killed in the Alaska State Trooper crash had a previous accident under similar conditions. According to the NTSB, the pilot previously stated he felt obligated to complete the rescues although high risks were involved.⁹⁴ The leaders of the unit fostered a poor culture in which the pilot felt he needed to complete rescue missions regardless of risk. A pre-flight risk assessment form may have prevented the pilot from accepting the mission even with the pressure he felt from the organization. Moreover, the pre-flight risk assessment form can provide the pilot with supporting documentation for the reason not to accept a flight. The Alaska State Troopers did not have any type of risk assessment form and the unit's weather minimums were unclear. Although the PSAAC standards may not have helped with the unit culture, the requirements of a risk assessment form and specific weather minimums may have prevented the fatal accident.

The Maryland State Police also did not meet the PSAAC standards. The weather minimums along with a required pre-flight risk assessment may have prevented the fatal crash. The pilot in the accident also felt pressure to complete the mission as evidence in his statements, such as "If they can do it, so can we."⁹⁵

⁹⁴ NTSB, *Crash Following Encounter (Alaska)*, 11.

⁹⁵ NTSB, *Crash during Approach*, 2.

V. RECOMMENDATIONS

Public safety helicopter aviation falls through the cracks of governmental oversight in safety regulation. The fatal accidents in New Mexico, Alaska, and Maryland are reasons that drastic intervention is needed to prevent any future crashes in public safety helicopter aviation. In one of the accidents, a supervisor of the unit tried to stop high-risk operations in an attempt to prevent an accident; however, since public safety helicopters are not regulated, the supervisor was unable to implement any change. If the supervisor was armed with the PSAAC standards made regulatory by the FAA, this accident may have been avoided. Many accidents can be avoided by breaking one link in the long chain that typically exists prior to an accident. PSAAC standards provide the doctrine for public safety aviation supervisors throughout the country to reduce the risk in operations.

A. RECOMMENDATION 1: UNIVERSAL STANDARDS

The first recommendation of this thesis is to immediately adopt universal safety standards for all public safety helicopter aviation units. PSAAC has developed comprehensive standards that could greatly help all aviation units across the nation. Furthermore, the FAA will need to adopt these standards as a part of 14 Code of Federal Regulations. Once the FAA adopts the standards as part of 14 CFR, the standards would become regulatory and the FAA could take punitive action for agencies that do not comply. These standards address two of the three risk factors (IFR and Risk Assessment) identified in this thesis.

The PSAAC standards address inclement weather. The adoption of weather minimums (visibility and ceiling height) are objective measures that could prevent accidents such as the three studied in this research. In addition, another policy regarding instrument meteorological conditions (IMC) should also be immediately enforced. This policy regarding IMC is discussed under recommendation 3).

The PSAAC also has a FRAT (Flight Risk Assessment Tool) that serves as a checklist of conditions to evaluate the risk for a mission. The pilot must seek the appropriate level of approval for the mission dependent upon the level or risk determined by the FRAT. The use of such a tool may have prevented the three accidents of this study. The need for objective measures to assess whether the level or risk is acceptable for a mission is necessary for the future of public safety aviation. The data already found that pilot decision-making abilities are influenced by fatigue, ego, or a can-do culture. A FRAT could provide another objective measure that can enhance aviation safety.

B. RECOMMENDATION 2: ESTABLISH EFFECTIVE PUBLIC SAFETY AVIATION SAFETY OFFICERS

Although the standards do not address the safety culture of aviation departments, it is recommended by this study that assignment of public safety aviation safety officers become a priority in all public safety helicopter aviation units. The safety officers could assume the responsibility and authority to become the resident expert in the field of risk management. In addition, the safety officer could advise the supervisor of the unit on all issues related to reducing the risk in aviation operations. In addition, the safety officer would have direct access to the upper levels of management with all issues related to risk management and safety. This would provide a check and balance in case a supervisor's attitude toward safety is not conducive to the best interest of the public safety agency.

The checks and balance a safety officer provides has proven successful in the military for many years. The safety officer in the military reports directly to a commander to advise on all safety related matters. This direct line of communication allows the commander to receive an immediate information on the effectiveness of risk management in the unit and the culture of safety. This direct line of communication also prevents a few poor supervisors in the chain of command from creating a poor safety culture without knowledge of the commander. The public safety agencies have similar command structures as the

military, so the position of safety officer would report to higher levels of command outside of the immediate aviation unit.

The public safety aviation safety officer would also be responsible for teaching the supervisor and pilots in the units risk management and how it applies to public safety aviation. This training should enforce the safety standards (such as weather minimums and pre-flight risk assessment tools) so each person in the unit is well-versed and understands the need to make better aviation decisions. These tools would help a public safety aviation pilot decline a mission when the risk associated with the mission is too high, thus allowing progress toward the ultimate goal of making public safety aviation safer. The missions of public safety aviation are always going to be complex, but the effective management of risk would help keep public safety personnel informed to make the best decisions possible.

C. RECOMMENDATION 3: MAINTAIN VISUAL FLIGHT RULES WEATHER MINIMUMS UNLESS PILOT HAS A CURRENT INSTRUMENT FLIGHT RULES RATING

A factor in all three helicopter crashes studied in this thesis was inclement weather. To prevent future accidents due to poor weather, public safety aviation units should only fly in VFR conditions that require a 1,000-foot ceiling and three miles of visibility. The only exception for a pilot to fly in less than VFR conditions is the pilot must have a current instrument rating and have a second pilot with access to flight controls. The second pilot does not need to be an instrument rated pilot, but she or he should be current in the type of airframe and qualified in the type of mission to be flown. This recommendation would help reduce the risk of an accident significantly due to poor weather by ensuring a properly trained aircrew is at the flight controls.

D. RECOMMENDATION 4: MANDATORY RISK MANAGEMENT TRAINING

The public safety aircrews do not receive mandatory risk management training, and this lack of training contributes to the misunderstanding of how to

manage risk. In contrast, the military spends a considerable amount of time in flight school training each pilot on the purpose of risk management and how to incorporate it into everyday operations. All public safety aviation units should incorporate risk management training into both flight officer and pilot training. When the aircrews understand risk management, it helps them identify the hazards and develop controls to eliminate the hazards or reduce the risk associated with a mission.

A better understanding of risk management would also help balance a unit culture focused on mission accomplishment. Pilots in a unit that is focused on mission accomplishment may feel self-induced pressure to accept a mission for fear of reprisal. A pilot who is able to articulate a why mission was declined due to unacceptable levels of risk would be better accepted by management. The appropriate application of risk management may also allow control measures to be implemented to reduce the risk of a mission down to acceptable levels. A control measure as simple as selecting a better-rested pilot make the difference the outcome of a mission.

The missions of public safety aviation are always going to be complex, but the effective management of risk will help keep public safety personnel informed to make the best decisions possible. This can be accomplished by having the FAA adopt the standards set by PSAAC to have the regulations necessary to bring public safety aviation to industry standards. The methodology used for the research in this thesis found the common trends in public safety aviation accidents. The accident agencies may have prevented the fatal accidents by the implementation of the PSAAC standards.

E. RECOMMENDATION 5: AVIATION UNIT SUCCESSION PLANNING

A consequence of the lack of succession planning is an aviation unit may receive a new supervisor or manager with little or no aviation experience. The culture of an aviation unit was a common trend of the fatal public safety helicopter accidents that emerged from the research, and the supervisor or

manager of the unit is the most important person for fostering the culture of the aviation unit.

The research showed a strong desire for law enforcement personnel to eagerly accept complex missions regardless of the associated risk. Law enforcement personnel have been trained since the academy as the first responders who run toward an active shooting scene while others are running away. This type of training cannot be applied to aviation since there is usually time to manage risk for the aviation missions. A technique to mitigate a supervisor or manager expecting pilots to accept missions at all costs is to promote from within the unit or identify supervisors with aviation experience. Pilots who have demonstrated the ability to be a supervisor should be identified early and be part of succession planning for future promotions. This will help the public safety aviation unit with finding supervisors who have the aviation experience. Experienced supervisors are necessary to foster the culture to allow pilots to decline high-risk missions without fear of retribution. A supervisor with the aviation experience will also be able to help eliminate the self-imposed pressure of many law enforcement pilots. A supervisor or manager does not need aviation experience to be successful, but the supervisor with the experience is better suited to create the appropriate culture by understanding the role of helicopters in public safety missions.

F. FUTURE RESEARCH NEEDED IN THE FIELD

The research for this thesis was scoped to find the common risk factors between the fatal public safety helicopter accidents and to determine if the PSAAC standards address these factors. This narrowly scoped research was necessary to obtain a starting point for preventing future public safety helicopter accidents.

The culture of the unit emerged in all three public safety accidents. Thus, this study addressed culture and proposed several controls to help manage risk regardless of the culture of the unit. Additionally, this study addressed ways to

improve culture of the unit by conducting formal aviation risk management education. However, more research needs to be dedicated specifically to the culture in public safety units and should include interviews with former and current public safety aviation employees and supervisors. Furthermore, the research conducted on culture in public safety aviation will be relevant to many disciplines in the public safety sector.

G. IMPLEMENTATION OF RECOMMENDATIONS

The NTSB placed public safety aviation on its most wanted list in 2015 due to the dire need for the industry to address safety concerns. The recommendations in this thesis can immediately reduce the risk in public safety aviation if implemented. Since the completion of the research for this thesis, many public safety aviation units are trying to align their aviation programs with the PSAAC standards. This chapter previously advocated that the PSAAC standards should have specific weather minimums. The current standards fail to mention what the weather minimums should be creating ambiguity on how to implement weather requirements.

The three fatal public safety helicopter accidents studied in this thesis all took place with weather considered to be instrument flight rules (IFR). This chapter recommends public safety units adopt visual flight rules (VFR) as the weather minimums unless the pilot has a current instrument rating and there is a second pilot with access to flight controls. PSAAC should add these specific weather minimums to its standards to give specific guidance to the public safety units who are trying to make their units safer by adopting the standards.

The governmental oversight of public safety aviation is necessary, but it is extremely complex. The current FAA regulations do not apply and are not suited for public safety aviation units. The PSAAC standards are the closest to being applicable to the multifaceted missions of public safety aviation. An upcoming challenge as recommended in this thesis is to convince the FAA to adopt these standards as a part of 14 Code of Federal Regulations (CFR). The research of

this thesis clearly showed the lack of standards by each of the public safety units involved with the fatal helicopter accidents. Once the FAA adopts the standards as part of 14 CFR, the standards become regulatory and the FAA can take punitive action for agencies who do not comply. This would help reduce the risk of another fatal helicopter accident.

H. SUMMARY

The missions of public safety aviation are always going to be complex, but the effective management of risk will help keep public safety personnel informed to make the best decisions possible. This can be accomplished by having the FAA adopt the standards set by PSAAC to have the regulations necessary to bring public safety aviation to industry standards. The methodology used for the research in this thesis revealed the common trends in public safety aviation accidents. The accident agencies may have prevented the fatal accidents by the implementation of the PSAAC standards and specific guidance on the weather needed to accomplish a mission.

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LIST OF REFERENCES

- Federal Aviation Administration. *Public Aircraft Operations*. Federal Aviation Administration Advisory Circular 00–1.1A. Washington, DC: Federal Aviation Administration, 2014.
- McElroy, Damien. “Police Video Shows Boston Bomb Suspect Dzhokhar Tsarnaev Hiding in Boat.” *The Telegraph UK*, April 21, 2013.
- National Transportation Safety Board (NTSB). *Crash after Encounter with Instrument Meteorological Conditions during Takeoff from Remote Landing Site New Mexico State Police Agusta S.p.A. A-109E, N606SP near Santa Fe, New Mexico June 9, 2009*. Washington, DC: National Transportation Safety Board, 2011.
- . *Crash during Approach to Landing of Maryland State Police Aerospatiale SA365N1, N92MD District Heights, Maryland September 27, 2008*. Washington, DC: National Transportation Safety Board, 2009.
- . *Crash following Encounter with Instrument Meteorological Conditions after Departure from Remote Landing Site Alaska Department of Public Safety, Eurocopter AS350 B3, N911AA, Talkeetna, Alaska, March 30, 2013*. Washington, DC: National Transportation Safety Board, 2014.
- Perritt, Henry. *Sharing Public Safety Helicopters*. Chicago: Chicago-Kent College of Law Scholarly Commons, 2014. http://scholarship.kentlaw.iit.edu/cgi/viewcontent.cgi?article=3361&context=fac_schol.
- Public Safety Aviation Accreditation Commission. *Standards for Public Safety Aviation Units*, Version 5.1. Sacramento, CA: Public Safety Aviation Accreditation Commission, 2013.
- Richards, Tom, and Lynn Richards. “Using Computers in Qualitative Research.” In *Handbook of Qualitative Research*, edited by Norman K. Denzin and Yvonna S. Lincoln, 445–462. Thousand Oaks, CA: Sage Publications, 1994.
- Roskop, Lee. “U.S. Rotorcraft Accident Data and Statistics.” Presented to the FAA/Industry Safety Forum, Washington, DC, January 2012. http://www.aea.net/events/rotorcraft/files/US_Rotorcraft_Accident_Data_And_Statistics.pdf.
- Seidel, John V. *Appendix E: Qualitative Data Analysis*. Colorado Springs, CO: Qualis Research, 1998. <http://www.qualisresearch.com/Downloads/qda.pdf>.

Walen, David B. "Civil Aircraft System Safety and Electromagnetic Compatibility." PowerPoint slides. Presented to the National Research Council Electronic Vehicle Controls and Unintended Acceleration Study, Washington, DC, November 16, 2010. <http://onlinepubs.trb.org/onlinepubs/UA/111610Walen.pdf>.

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