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

Accident Report

NTSB/AAR-11/04
PB2011-910404

National Transportation Safety Board

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Notation 8306
Adopted May 24, 2011

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490 L'Enfant Plaza, S.W.
Washington, D.C. 20594

National Transportation Safety Board. 2011. ***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.*** **Aircraft Accident Report NTSB/AAR-11/04. Washington, DC.**

Abstract: This accident report discusses the June 9, 2009, accident involving an Agusta S.p.A. A-109E helicopter, N606SP, which impacted terrain following visual flight rules flight into instrument meteorological conditions near Santa Fe, New Mexico. The commercial pilot and one passenger were fatally injured; a highway patrol officer who was acting as a spotter during the accident flight was seriously injured. The entire aircraft was substantially damaged. The helicopter was registered to the New Mexico Department of Public Safety and operated by the New Mexico State Police (NMSP) on a public search and rescue mission under the provisions of 14 *Code of Federal Regulations* Part 91 without a flight plan. The safety issues discussed in this report include the pilot's decision-making, flight and duty times and rest periods, NMSP staffing, safety management system programs and risk assessments, communications between the NMSP pilots and volunteer search and rescue organization personnel, instrument flying, and flight-following equipment.

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Abbreviations and Acronyms

AC	advisory circular
AFRCC	U.S. Air Force Rescue Coordination Center
agl	above ground level
ALEA	Airborne Law Enforcement Association
ATC	air traffic control
ATP	airline transport pilot
AXX	Angel Fire Airport
CFR	*Code of Federal Regulations*
DPS	Department of Public Safety
ELT	emergency locator transmitter
EMS	emergency medical services
FAA	Federal Aviation Administration
FLIR	forward-looking infrared
FSDO	flight standards district office
G	One G is equivalent to the acceleration caused by the Earth's gravity (32.174 feet per second squared)
GPS	global positioning system
HEMS	helicopter emergency medical services
IACP	International Association of Chiefs of Police
IB	incident base
IFR	instrument flight rules
IMC	instrument meteorological conditions
METAR	meteorological aerodrome report

MHz	megahertz
msl	mean sea level
MSP	Maryland State Police
NASAO	National Association of State Aviation Officials
nm	nautical miles
NMSP	New Mexico State Police
NOAA	National Oceanic and Atmospheric Administration
NPRM	notice of proposed rulemaking
NTSB	National Transportation Safety Board
NWS	National Weather Service
OCC	operations control center
PIC	pilot-in-command
PIO	public information officer
PLB	personal emergency locator beacon
SAF	Santa Fe Municipal Airport
SAR	search and rescue
SARSAT	Search and Rescue Satellite-Aided Tracking
SIGMET	significant meteorological information
SMS	safety management system
SOP	standard operating procedure
TAF	terminal aerodrome forecast
USFS	U.S. Forest Service
VFR	visual flight rules
VMC	visual meteorological conditions

Executive Summary

On June 9, 2009, about 2135 mountain daylight time, an Agusta S.p.A. A-109E helicopter, N606SP, impacted terrain following visual flight rules flight into instrument meteorological conditions near Santa Fe, New Mexico. The commercial pilot and one passenger were fatally injured; a highway patrol officer who was acting as a spotter during the accident flight was seriously injured. The entire aircraft was substantially damaged. The helicopter was registered to the New Mexico Department of Public Safety and operated by the New Mexico State Police (NMSP) on a public search and rescue mission under the provisions of 14 *Code of Federal Regulations* Part 91 without a flight plan. The helicopter departed its home base at Santa Fe Municipal Airport, Santa Fe, New Mexico, about 1850 in visual meteorological conditions; instrument meteorological conditions prevailed when the helicopter departed the remote landing site about 2132.

The National Transportation Safety Board determines that the probable cause of this accident was the pilot's decision to take off from a remote, mountainous landing site in dark (moonless) night, windy, instrument meteorological conditions. Contributing to the accident were an organizational culture that prioritized mission execution over aviation safety and the pilot's fatigue, self-induced pressure to conduct the flight, and situational stress. Also contributing to the accident were deficiencies in the NMSP aviation section's safety-related policies, including lack of a requirement for a risk assessment at any point during the mission; inadequate pilot staffing; lack of an effective fatigue management program for pilots; and inadequate procedures and equipment to ensure effective communication between airborne and ground personnel during search and rescue missions.

The safety issues discussed in this report include the pilot's decision-making, flight and duty times and rest periods, NMSP staffing, safety management system programs and risk assessments, communications between the NMSP pilots and volunteer search and rescue organization personnel, instrument flying, and flight-following equipment.

1. Factual Information

1.1 History of Flight

On June 9, 2009, about 2135 mountain daylight time,[1] an Agusta[2] S.p.A. A-109E helicopter, N606SP, impacted terrain following visual flight rules (VFR) flight into instrument meteorological conditions (IMC) near Santa Fe, New Mexico. The commercial pilot and one passenger were fatally injured; a highway patrol officer who was acting as a spotter during the accident flight was seriously injured. The entire aircraft was substantially damaged. The helicopter was registered to the New Mexico Department of Public Safety (DPS) and operated by the New Mexico State Police (NMSP) on a public search and rescue (SAR) mission under the provisions of 14 *Code of Federal Regulations* (CFR) Part 91 without a flight plan. The helicopter departed its home base at Santa Fe Municipal Airport (SAF), Santa Fe, New Mexico, about 1850 in visual meteorological conditions (VMC); IMC prevailed when the helicopter departed the remote landing site about 2132.

The mission was initiated after a lost hiker used her cellular telephone to call 911, and the 911 operator transferred the call to an NMSP dispatcher about 1646.[3] The hiker, who was a citizen of Japan, had difficulty communicating in English. However, during her initial and subsequent telephone calls, she told the dispatcher that she had become separated from her hiking companion (her boyfriend) and was lost in the Pecos Wilderness Area about 20 miles northeast of Santa Fe and was feeling very cold.[4] The local district shift supervisor, who was present in the dispatch office, asked an NMSP patrol officer to initiate a SAR effort, and the patrol officer asked the dispatcher to notify the volunteer New Mexico SAR command, which the dispatcher did about 1715.[5]

While the SAR command was organizing the SAR effort, a district sergeant (the outgoing police shift supervisor) made the decision to have the dispatcher contact the accident pilot and ask him to initiate an aerial search for the lost hiker. Because there were no roads into the search area, ground SAR teams would have to hike in, which would delay the rescue. The outgoing shift supervisor stated that he believed that a more immediate helicopter SAR effort was needed.[6] In the meantime, ground SAR personnel began to set up the incident base (IB) at a local ski resort; it was later determined that the IB was about 4 nautical miles (nm) from the hiker's location. Per the sergeant's instructions, the dispatcher called the accident pilot and, about 1756, put him on

[1] All times in this report are mountain daylight time based on a 24-hour clock.

[2] Agusta and Westland signed a joint venture agreement in 2001. In 2004, Finmeccania acquired a 50 percent stake in the combined company. Agusta is now known as AgustaWestland.

[3] Times are based on NMSP dispatch recordings, unless otherwise noted. The NMSP dispatch times are corrected for an error of about 24 minutes.

[4] The lost hiker had only a light jacket and no cold-weather survival gear.

[5] For additional information regarding New Mexico SAR operations, see section 1.18.1.

[6] Postaccident interviews indicated that, during the decision to launch the helicopter on the SAR mission, several state police personnel expressed their concern that the hiker would not have been able to survive on the mountain overnight because she lacked warm clothing and other survival equipment.

the line with the incoming police shift supervisor to discuss the proposed mission. According to NMSP dispatch recordings, the shift supervisor asked the pilot if he "[felt] like going up again" to support the SAR effort and described the general location of the search. Initially, the pilot responded that it was too windy to fly in the described area at that time of day, but he offered to fly the mission at first light or during the night (using night vision goggles) if the winds were calmer. The shift supervisor accepted the pilot's decision, and they ended the telephone call. About 1800, the accident pilot called the dispatcher to further discuss the proposed mission. He indicated to the dispatcher that he had just checked the winds, and he thought that he probably could fly the helicopter to look for the hiker.

The accident pilot (who was the dispatcher's husband) was the chief pilot for the NMSP's aviation section and had already worked a full 8-hour shift (including three previous flights) that day. Postaccident interviews indicated that he contacted the other full-time NMSP aviation section helicopter pilot about flying the mission; when the other pilot was unavailable, the accident pilot accepted the mission himself.

The dispatcher stated that she connected the accident pilot with the patrol officer who had been designated as the mission initiator. The patrol officer requested and received the accident pilot's permission to ride in the helicopter and act as spotter during the search. The patrol officer/spotter then photocopied a topographical map of the search area, gathered SAR-related paperwork (including contact numbers for SAR personnel), and drove to SAF to meet the accident pilot.

The spotter stated that he arrived at SAF and found the accident pilot already in the hangar office. According to the spotter, the pilot told him to "take all [his] gear off" because it was too bulky for him to wear in the cockpit. As a result, the spotter removed his uniform shirt, bulletproof vest, and other police equipment and stowed them in the hangar. The spotter stated that the pilot performed a preflight inspection of the helicopter, gave the spotter a safety briefing, and helped him fasten his safety harness. The spotter said the pilot warned him that it could be windy and/or bumpy in the mountains; he did not recall the pilot saying anything else about the weather or mentioning any other safety-related concerns about the flight. The spotter stated that it was warm[7] and sunny and not very windy when they took off from SAF about 1850. There were few clouds, and there was little turbulence on the way to the search area (which was at a much higher elevation; the lake near which the hiker and her companion were hiking was located at 11,700 feet mean sea level [msl])[8].

About 1851, the pilot radioed the dispatcher to indicate that he and the spotter had departed SAF and that they were en route to the search area. According to dispatch records, the pilot and spotter searched for the lost hiker for more than 1 hour and coordinated with the dispatcher (who was speaking with the hiker on her cellular telephone) to help identify the

[7] The National Weather Service daily summary indicated that the high temperature at SAF at 1853 (about 3 minutes after the helicopter departed SAF) was 68° F.

[8] Unless otherwise indicated, all altitudes in this report are msl. SAF, the helicopter's departure point, was located about 20 miles southwest of the landing site at an elevation of 6,348 feet.

hiker's location.[9] Although the hiker told the dispatcher that she was able to hear the helicopter operating nearby relatively early during the search, she was unable to provide much information that could help narrow the search (such as describing her position relative to the sun, nearby landmarks, or terrain features). She told the dispatcher that she was in a small clearing surrounded by trees and could not identify any landmarks.

About 1927, the pilot advised the dispatcher, "We're dealing with a lot of wind up here…not to worry because we're going to hang out until we get eyes on [the hiker] and go from there." About 15 minutes later, the hiker told the dispatcher that the helicopter was directly above her; the dispatcher relayed this information to the pilot, who then relayed the helicopter's latitude and longitude coordinates back to the dispatcher. The pilot descended, flew in the vicinity of those coordinates, and continued searching until he and the spotter made visual contact with the hiker, which occurred about 2010.[10] After locating the hiker, the pilot stated, "all we need to do now is find a place to land… ." About 2 minutes later, the pilot asked the dispatcher if the hiker was ambulatory, stating that the closest place he would be able to land was about 0.5 mile uphill from her. Initially, because the hiker was not physically injured, the dispatcher responded that the hiker was ambulatory. However, according to dispatch recordings, the hiker subsequently told the dispatcher that she could not walk uphill or very far because she was very cold. In addition, the hiker stated that she could not see very well and did not know which way to hike. As a result, about 2015 (about 4 minutes before sunset), the dispatcher asked the pilot if he could land on top of the hill and send the spotter down to retrieve the hiker. The pilot said, "That's about the only thing we're going to be able to do."

The spotter stated that the pilot made several passes over a large clearing on top of the ridge above the hiker before he landed the helicopter and shut off its engines. According to the spotter, the ride was very bumpy near the ground. After the helicopter landed on the ridge (at an elevation of about 11,600 feet msl), the spotter opened his door, felt very strong, cold westerly winds, and observed that it was starting to sleet. About 2030, the spotter contacted the dispatcher by cellular telephone to say that they had landed and to ask if the hiker was walking toward them. The dispatcher then advised the spotter that she thought that the hiker "did not want to move." The spotter hung up to confer with the pilot, and, about 2 minutes later, the pilot called the dispatcher to clarify the hiker's intentions. The dispatcher told the pilot that she believed the hiker expected them to help her to the helicopter.

About 2033, the pilot (who was wearing an unlined summer-weight flight suit) told the dispatcher that he knew the hiker's general location, and he was going to walk down the hill to look for her while the spotter stayed with the helicopter. He added, "It's going to start snowing up here and if it does that, I've got to get the [expletive] out of here." The pilot told the dispatcher to tell the hiker to listen for him and blow her whistle to help him find her. He commented, "I'm not going to spend a lot of time or we're going to have two search and rescues." This call ended about 2035. According to the spotter, the pilot promptly left the

[9] During the accident SAR mission, the dispatcher also relayed an inquiry from another NMSP pilot about a previously scheduled law enforcement mission for later that evening. The accident pilot responded, "I'll try to accommodate it, but I want to find this gal, at least have a good lock on her [location]."

[10] According to the spotter, they saw the hiker just as it was getting dark. Astronomical data indicated that, on the day of the accident, sunset and the end of civil twilight (beginning of nighttime conditions) in the Santa Fe area occurred about 2019 and 2049, respectively. The moon had not yet risen when the accident occurred.

helicopter (without stopping to retrieve a flashlight from his flight bag) and walked down the heavily forested slope to search for the hiker. Also according to the spotter, it got windier and began “sleeting like crazy” after the pilot left.

About 2045, the dispatcher reached the hiker on her cellular telephone and advised her that the pilot was walking down the hill toward her. The dispatcher remained on the telephone with the hiker and advised her to yell or whistle for the pilot. About 2053, the dispatcher heard the pilot and the hiker yelling to each other, and then the cellular telephone call ended. About 2103, the dispatcher called the spotter to inform him that the pilot had located the hiker, and she asked him to yell to help the pilot find his way back to the helicopter in the dark. The spotter told the dispatcher that the weather conditions were “windy,” and there was a “big cloud bank overhead.”

About 2113, the SAR area commander called the NMSP dispatcher and said he was worried because the weather conditions were deteriorating in the mountains and the SAR team had not heard anything from the pilot.[11] The dispatcher connected the SAR area commander with the spotter’s cellular telephone. According to the SAR area commander, the spotter (who was still waiting for the pilot in the helicopter) reported that the winds were blowing and that the clouds were moving in. The area commander advised the spotter that, if the weather continued to deteriorate and they were unable to take off, they should “hang tight” in the helicopter and use its engines to generate heat until ground SAR personnel could reach them. According to SAR documents, about 2120, two SAR ground teams left the incident base, heading toward the helicopter’s last known position.[12]

The spotter told National Transportation Safety Board (NTSB) investigators that it was completely dark when he heard the pilot and the hiker approaching the helicopter,[13] so the spotter exited the helicopter and used the pilot’s flashlight to help the pilot locate the helicopter in the dark. The spotter saw the pilot, carrying the hiker, about 35 to 40 yards away.[14] About 2124, the spotter called the NMSP shift supervisor to report that the pilot had returned with the hiker. The shift supervisor asked about their intentions, and the spotter responded, “I don’t know, let me talk to [the pilot]. He’s getting some heat on right now. He’s a little out of breath. He was [carrying] her up [the hill].” The spotter told the shift supervisor that they would call back and ended the call. While the pilot prepared the helicopter for takeoff, the spotter helped the hiker get buckled into the right-side, forward-facing, aft passenger seat and then he buckled himself into the left-side, forward-facing, aft passenger seat. About 2127, the spotter called the NMSP dispatcher and advised her that they were going to fly back to Santa Fe. The helicopter’s engines could be heard starting during this recorded call.

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[11] According to SAR protocol, NMSP pilots involved in SAR efforts should be in communication with SAR personnel; however, communication issues often arise in mountainous terrain.

[12] The SAR IB was more than 4 nm over rugged terrain from the lost hiker’s approximate position (based on the coordinates the pilot reported). The IB was established at a local ski area, which was the nearest site to the lost hiker that could be reached by motor vehicle.

[13] The night of the accident was particularly dark, with no moonlight. In addition, the sky was overcast, minimizing starlight, and there were no ground lights in the remote area where the helicopter had landed.

[14] The spotter stated that it was still snowing or sleeting lightly when the pilot and hiker arrived at the helicopter but that the snow was not sticking to the ground.

The spotter stated that he estimated that the helicopter was pointing south and that he recalled that no city lights were visible to him as they prepared for takeoff. The spotter said that, before they lifted off, the pilot pointed out his right window; the spotter thought this gesture meant that they would be flying in that direction. During a postaccident interview conducted in the hospital 2 days after he was rescued, the spotter said that he thought the pilot was pointing toward a "break in the clouds" or a "little cloud free tunnel." During a subsequent interview, the spotter clarified this remark, stating that there was "nothing but gray" outside, and, although there may have been some sort of "separation" in the clouds, he was not certain whether the pilot was pointing at something in particular.

The spotter stated that the pilot took off and began to maneuver the helicopter in the direction that he had pointed; however, the spotter stated that, almost immediately after takeoff, the helicopter was in the clouds with "zero visibility" and that the flight was very turbulent. The helicopter appeared on radar[15] at 2132:48, and numerous radar targets for the helicopter were recorded before the last radar target was recorded at 2135:25.[16] The radar data indicated that the helicopter initially headed northwest from the remote landing site. Subsequently (beginning a little more than 1 minute after the helicopter first appeared on radar), the data indicated that the helicopter began to fly erratically in a northeasterly direction and to climb, crossing terrain as high as 12,500 feet before descending rapidly near the crash site. See figure 1 for a map with the pertinent radar data shown.[17]

The spotter recalled hearing the pilot curse and then felt the helicopter pitch up abruptly, after which it began to make a grinding noise and the ride "got wild." He said he assumed that the helicopter's tail had hit something, and he stated that it seemed as if the pilot was struggling to control the helicopter. The spotter recalled that, after the abrupt pull-up, the helicopter moved in a "jerky" fashion, like there was "obviously something wrong"; however, he could not tell exactly how the helicopter maneuvered because he could not see anything outside.

Dispatch recordings show that, at 2134:10, the pilot radioed the dispatcher, asking if she could hear him. After the dispatcher responded in the affirmative, the pilot stated, "I struck a mountainside. [I'm] going down." The dispatcher asked, "Are you [okay]?" and the pilot replied, "negative." The pilot continued to key his microphone, and, on the dispatch recording, he could be heard breathing rapidly for about the next 39 seconds. The dispatcher inquired, "Santa Fe 606?" The pilot then said, "hang on [unintelligible]," and the radio transmission cut off immediately thereafter. The last radar return for the helicopter was recorded at 2135:25.[18]

[15] The applicable radar data were provided by the U.S. Air Force from its radar sites at Mesa Rica and West Mesa, New Mexico.

[16] For additional information on the helicopter's radar data, see section 1.16.2.

[17] The radar data provided by the U.S. Air Force were not corrected for barometric pressures that differed from the standard 29.92 inches of mercury, which resulted in altitude offset errors that made it appear as if the helicopter's flightpath continued through terrain in some locations. The altitude of the data shown in this map have been adjusted to show the approximate ground track above terrain.

[18] Time information from the dispatch recordings and radar data were not synchronized; therefore, it is unknown how long the helicopter continued flying after the end of the pilot's last radio transmission.

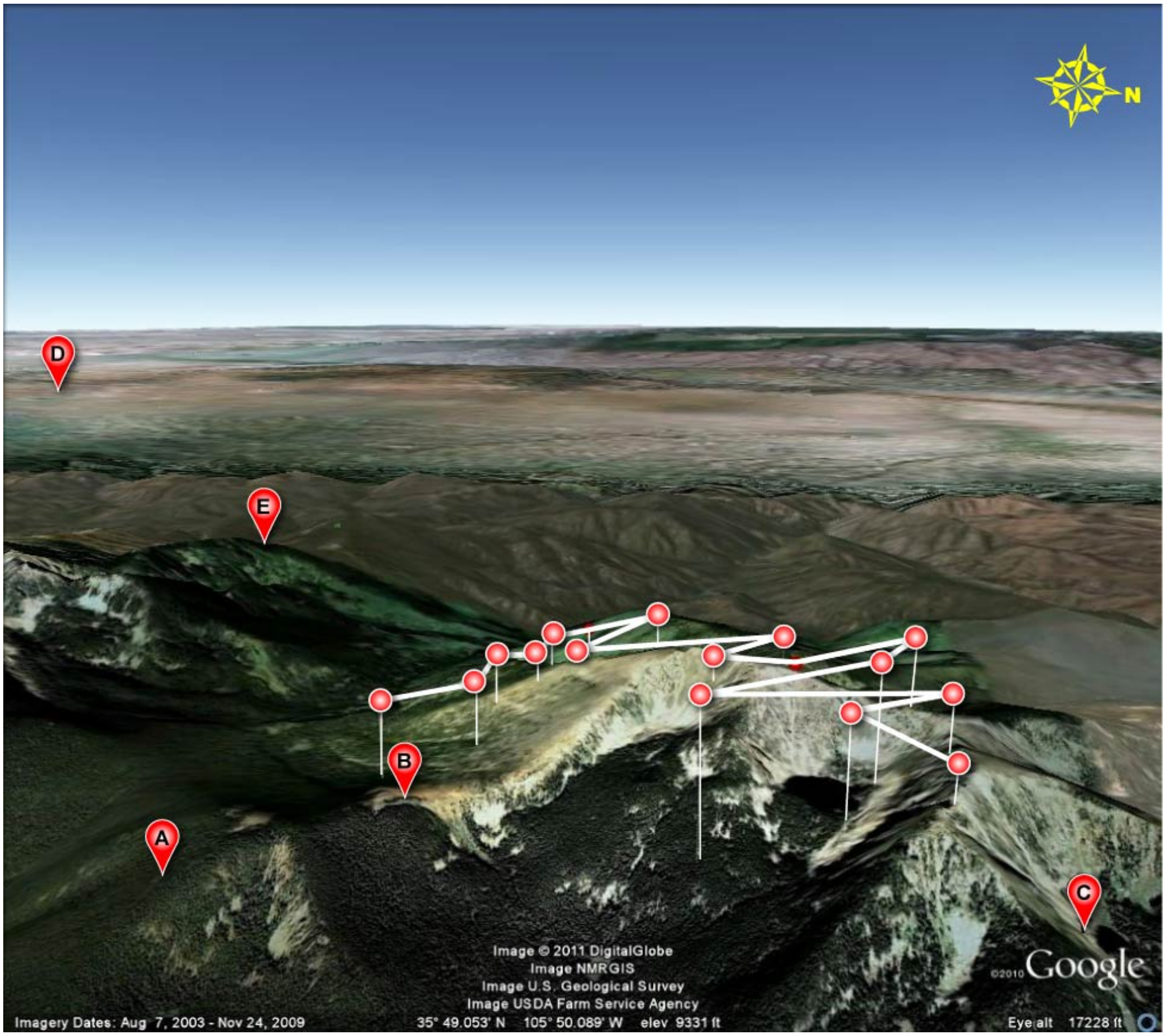

Figure 1. Google Earth map showing pertinent helicopter radar data and other points of interest near the accident site.

Note: Helicopter radar data are indicated by red dots connected by white lines. The map also shows the hiker's approximate location (A); the helicopter's likely landing zone, confirmed by the spotter (B); the main wreckage location (C); SAF (D); and the approximate location of the SAR IB (E). A compass showing north is located in the upper left corner.

Examination of the accident site showed that the helicopter impacted terrain for the second time point at an elevation of 11,970 feet,[19] about 1 nm north-northeast of the hiker's location and about 21 nm northeast of SAF, near the top of a steep ridgeline. Investigators were unable to identify the exact location of the helicopter's first impact with terrain, which the pilot referenced in his radio transmission. After the second impact, the helicopter rolled down a steep, rock-covered slope.[20] During this descent, components of the helicopter separated from the fuselage, and the pilot and hiker were ejected. The separated portion of the tailboom was located at an elevation of about 11,780 feet, and the main fuselage was located at an elevation of about 11,490 feet (see figure 2).

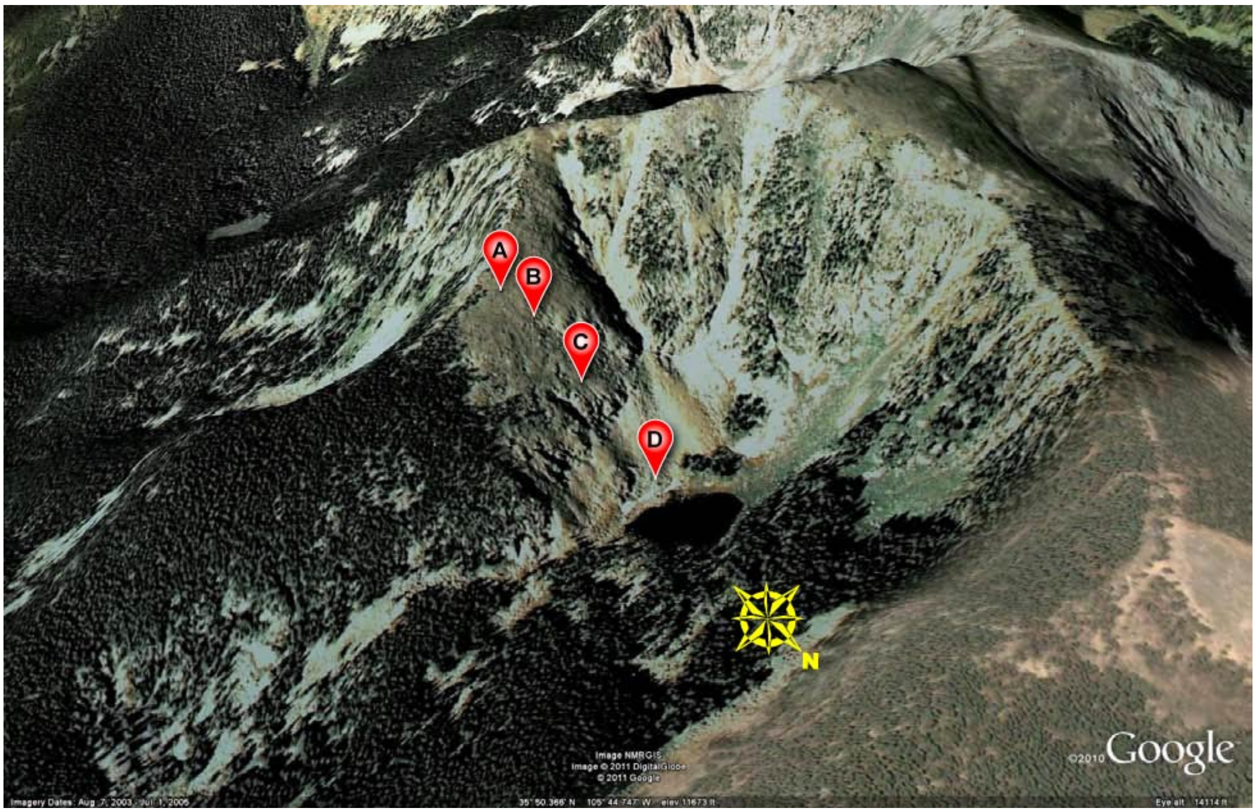

Figure 2. View of the accident location.

Note: The map shows the locations of the highest piece of wreckage debris (A), highest impact marks (B), tailboom (C), main fuselage wreckage (D), and a compass showing north.

According to the spotter, when the helicopter came to a stop, he was alone in the fuselage wreckage. Although he was injured,[21] the spotter crawled out of the helicopter to look for the pilot and hiker. The spotter stated that when he exited the helicopter, it was snowing, dark, and

[19] The elevations described in this section are based on Google Earth elevations with onsite global positioning system readings and topographical map elevations taken into consideration.

[20] The NTSB estimated that the average slope gradient between the highest uphill ground strike and the main wreckage was about 35°, with portions of the hill near vertical.

[21] The postaccident medical diagnosis indicated that the spotter sustained serious injuries during the accident, including a broken ankle, chipped vertebrae, separated ribs, and bumps and bruises to his head. He also suffered from hypothermia.

hazy, with poor visibility. He could still distinguish nearby objects and he could see that there was a lot of snow on the ground. He yelled to the pilot and he heard the pilot yell his name in return, albeit from a distance. The spotter saw the hiker's body lying close to the wreckage. He checked her vital signs and determined that she was deceased. He removed her jacket and put it on to stay warm. He was unable to locate the pilot, who was no longer responding to his calls.[22] The spotter took shelter for the night inside the wrecked fuselage of the helicopter. The next day, the spotter tried to hike down the mountain for help and was subsequently located (about 5.5 miles from the SAR IB) by ground search teams about 1155. About 1311, the spotter was airlifted to a hospital.

SAR ground teams did not locate the helicopter's wreckage until 1816. The SAR ground teams described the accident site as dangerously steep, rocky, and covered with snow and ice (see figures 3, 4, and 5).

Figure 3. Aerial photograph showing the main fuselage wreckage location, circled in red, on the west side of the lake.

Note: A compass showing north is located in the upper left corner.

[22] During one postaccident interview, the spotter stated that he yelled to the pilot repeatedly after the pilot's first response, and he believed that he heard him respond once again, more faintly. However, in a second interview, the spotter stated that the pilot did not respond after the first call. The location of the pilot's body was not precisely documented by rescue teams; therefore, his precise location, relative to the wreckage, is unknown.

Figure 4. Photograph showing the helicopter main fuselage wreckage.

Figure 5. Photograph at ground view looking from the helicopter main fuselage wreckage location in a southerly direction up the ridge that the accident helicopter rolled down.

Note: The location of the separated portion of the tailboom is indicated by the red circle at the base of the tree.

1.2 Injuries to Persons

Table. Injury chart.

Injuries	Flight Crew	Cabin Crew	Passengers	Other	Total
Fatal	1	0	1	0	2
Serious	0	0	0	1	1
Minor	0	0	0	0	0
None	0	0	0	0	0
Total	1	0	1	1	3

Note: Title 49 CFR 830.2, "Definitions," states that a serious injury is any injury that (1) requires hospitalization for more than 48 hours, starting within 7 days from the date that the injury was received; (2) results in a fracture of any bone, except simple fractures of fingers, toes, or the nose; (3) causes severe hemorrhages or nerve, muscle, or tendon damage; (4) involves any internal organ; or (5) involves second- or third-degree burns or any burns affecting more than 5 percent of the body surface.

1.3 Damage to Aircraft

The helicopter was substantially damaged by impact forces as a result of damage to the fuselage, main and tail rotors, and tailboom.

1.4 Other Damage

No other damage occurred as a result of this accident.

1.5 Personnel Information

1.5.1 The Pilot

1.5.1.1 Professional Background

According to NMSP records, the pilot, age 36, completed high school at the New Mexico Military Institute[23] and served in the U.S. Marine Corps and U.S. Marine Corps Reserve from 1991 to 1997. He was hired by NMSP as a patrol officer in 1995. After he completed recruit training, the pilot spent 2 years as a patrol officer and was then transferred to the NMSP academy where he worked as a police instructor. While at the academy, he became a lead instructor and served on the NMSP special weapons assault team.

[23] The New Mexico Military Institute is a college-preparatory military boarding high school located in Roswell, New Mexico.

In November 2002, the pilot was transferred to a pilot position in the NMSP aviation section, began his pilot training, and worked as a pilot until the time of the accident. In May 2003, the pilot obtained a private pilot certificate and airplane single-engine land rating. In October 2003, he obtained an airplane multi-engine land rating, and, in April 2005, he obtained a commercial pilot certificate with airplane single- and multi-engine land and airplane instrument ratings. In August 2005, the pilot completed Cessna 421 initial training at FlightSafety International, Incorporated's facility in Long Beach, California.[24] In early 2006, the pilot began helicopter flight training with Western Helicopters and earned a rotorcraft/helicopter rating for his private pilot certificate on February 16, 2006.

In February 2007, the pilot was promoted from the NMSP rank of patrol officer to that of sergeant and was assigned the additional duties of NMSP public information officer (PIO).[25] In July and August 2007, the pilot received more advanced helicopter training, including a 3-hour mountain flying ground school course, and earned a rotorcraft/helicopter rating for his commercial pilot certificate on August 1, 2007. The pilot did not have a helicopter instrument rating, nor was such a rating specifically required for NMSP aviation section helicopter operations, which were typically conducted in VFR conditions.[26]

Records indicate that, on July 10, 2008, the pilot completed an Agusta A-109E ground and initial flight training course with an independent instructor, which also included mountain flying training. A subsequent memo, dated July 23, 2008, from the DPS cabinet secretary to the then-chief pilot of the NMSP aviation section stated that the pilot was authorized to operate the accident helicopter in VFR conditions with passengers in daylight, for all law enforcement missions, and for SAR missions below 9,000 feet.[27] The memo indicated that the pilot was required to be accompanied by a more experienced pilot when operating the helicopter above 9,000 feet or in mountainous terrain. No NMSP documentation indicated that the 9,000-foot restriction had been removed. However, during postaccident interviews, several individuals in the accident pilot's chain of command stated that they believed that the restriction had been removed after the pilot completed a mountain flying course with an independent instructor.[28] The independent instructor stated that he did provide the pilot with mountain flying training

[24] The pilot subsequently completed recurrent training at the same facility in December 2006 and February 2007.

[25] According to the chief of police and other NMSP managers, the pilot was promoted to sergeant because they saw leadership potential in him and because they wanted a smooth transition when the then-chief pilot retired. They stated that they assigned the pilot PIO duties because they needed someone to perform those functions, and the pilot was articulate and presented himself well in an NMSP uniform.

[26] The NMSP aviation section's "Policies and Procedures" document (which is reproduced in appendix B) required aviation section pilots to have an instrument rating. It did not explicitly require a helicopter instrument rating for helicopter operations. According to NMSP personnel, the aviation section helicopter was not intended to be operated in instrument flight rules (IFR) conditions.

[27] The DPS cabinet secretary stated that he had been a fixed- and rotary-wing pilot with the U.S. Air Force and NMSP and had held the NMSP aviation section chief pilot position until he retired from the NMSP in 1994. He was appointed as DPS cabinet secretary in 2003 and had since received annual training in the Agusta A-109E. According to the adjutant chief of police, the DPS cabinet secretary "kept a pretty close eye on what was going on" in the aviation section.

[28] The accident pilot's logbook indicated that he received some mountain flying instruction from the independent instructor between July 7 and 10, 2008.

during the training completed on July 10; however, the pilot's training folder and logbook did not reflect any mountain flying training after the DPS cabinet secretary's July 23, 2008, memo.[29]

In January 2009, the pilot completed an initial ground and flight training course for the night vision goggle system used by NMSP.[30] Also in January 2009, in addition to his other duties, the pilot was appointed chief pilot of the aviation section.

According to NMSP records, the pilot had accumulated about 1,331 total flight hours, including about 482 hours in helicopters, of which about 411 hours were in the Agusta A-109E helicopter.[31] He had flown about 70, 52, 29, and 2.2 hours (fixed- and rotary-wing) in the 90, 60, and 30 days, and 24 hours, respectively, before the accident flight. A review of the pilot's helicopter logbook indicated that he met the night currency requirements for airplanes and helicopters, as specified in 14 CFR 61.57(b).[32] A review of the pilot's fixed-wing logbook indicated that he met Federal Aviation Administration (FAA) instrument currency requirements for airplanes, as specified in 14 CFR 61.57(c).[33] The pilot's most recent FAA first-class medical certificate, dated November 13, 2008, bore no limitations. During his aviation medical examination, the pilot reported no current health problems and indicated that he was not taking any prescription medication.

A search of FAA records revealed no accident or incident history, enforcement action, pilot certificate or rating failure, or retest history. A search of the National Driver Register found no record of driver's license suspension or revocation.

Pilots who had flown with the accident pilot described his helicopter flying skills favorably to NTSB investigators. In addition to the accident pilot, NMSP employed a full-time helicopter pilot, a part-time helicopter pilot, and a full-time fixed-wing pilot (all of whom had more flight experience than the accident pilot). The full-time helicopter pilot, who flew

[29] The NTSB's review of the insurance policy covering the operations of the aviation section and the accident pilot revealed no restrictions regarding the pilot's flight above 9,000 feet msl.

[30] According to the former chief pilot, all of the NMSP aviation section pilots received night vision goggle training so they could be Federal Aviation Administration-certificated to use the goggles even though NMSP (as a public operator) was not required to certify its pilots. The accident pilot's training folder indicated that he had received training in system description and operation, terrain interpretation, pinnacle/ridgeline and confined area operations, and inadvertent IMC and emergency procedures. However, the pilot's helicopter logbook indicated that he flew numerous helicopter missions using night vision goggles before he completed a formal night vision goggle training course.

[31] A comparison of the pilot's helicopter logbook with the helicopter's maintenance logbooks indicated that, after the accident pilot received his private pilot helicopter rating, almost all of his helicopter flight time was logged as pilot-in-command. Logbook records indicated that, during many of these flights, the pilot was flying with more experienced helicopter pilots, who also logged the flight time.

[32] Title 14 CFR 61.57(b) states that, to maintain night currency, a pilot must perform at least three night takeoffs and landings to a full stop in the same category aircraft within the preceding 90 days. The pilot's records showed that about 0.33 percent of his helicopter flying occurred at night. During the 90 days preceding the accident, the pilot had documented 12 night takeoffs and 20 night landings in the helicopter.

[33] Title 14 CFR 61.57(c) states, in part, that a pilot must perform and document at least 3 hours of instrument time in an aircraft, including six instrument approaches, a holding procedure, and navigation exercises under actual or simulated instrument conditions, within the preceding 6 calendar months to maintain instrument currency. IFR privileges are allowed only in the aircraft for which the privilege is earned. Records showed that, during the 6 months preceding the accident, the pilot had logged 2.9 hours of actual and 3.7 hours of simulated instrument flight time and accomplished all of the required maneuvers in fixed-wing aircraft.

frequently with the accident pilot, described him as a “very skilled manipulator of the controls…for his experience level” and indicated that the accident pilot was proactive and “very aware.” The part-time helicopter pilot, who flew with the accident pilot once or twice per month, described him as a “competent pilot” who had “very good” stick and rudder skills. The DPS cabinet secretary, who flew infrequently with the accident pilot during training activities and transport flights, said that he had a “good feel for the aircraft” and was a “natural pilot.”

According to the NMSP aviation section’s full-time fixed-wing pilot, who was also the aviation section’s fixed-wing flight instructor, the pilot’s fixed-wing flying skills were comparable to those of other pilots with similar levels of experience. The fixed-wing pilot said that he had some concerns about the accident pilot’s instrument flying skills, in particular his “scan and situational awareness.” The fixed-wing pilot described an occasion when the accident pilot seemed confused about which way to turn to avoid rising terrain ahead during a standard instrument departure at night-time in marginal VMC. When the airplane did not turn as expected, air traffic control (ATC) issued turn instructions, and the accident pilot responded appropriately. The fixed-wing pilot stated that he was concerned about the occurrence and discussed it with the accident pilot the next day. He recalled that the accident pilot was receptive to his feedback.

The accident pilot’s colleagues described him as a motivated, hard-working, disciplined officer who was outgoing and personable. The major in charge of the special operations division, which included the aviation section, described the pilot as a “very aggressive, high speed type” and stated that he was “high-spirited,” “enthusiastic,” and would “go 100 miles an hour all the time” if allowed.

Some of the accident pilot’s colleagues recalled that he had turned down missions in the past, either because of poor weather or because he was fatigued from performing other work-related duties; however, they did not provide examples of missions that the pilot had turned down because of fatigue. The pilot’s wife said that she thought the accident pilot was willing to turn down a mission if the weather was bad, but not if he was tired. When asked about whether he would turn down a mission for fatigue, she stated that he likely would not. She said, “He did not like to be too tired for the missions because that was his job. If he could do the mission and help, that was his focus.”

The accident pilot’s colleagues held varying opinions about his attitudes toward safety. The full-time helicopter pilot told NTSB investigators that the accident pilot, in his role as chief pilot, had told the other aviation section pilots that he would take care of any unsafe situation that they reported. The special operations captain, who had known the accident pilot for about 10 years and was his supervisor at the time of the accident, stated that the accident pilot was capable of being assertive if he felt that a situation was unsafe. The aviation section’s fixed-wing pilot also said that the accident pilot could be assertive. However, he stated that the accident pilot was a “very heroic type person” who disliked turning down missions. The fixed-wing pilot recalled hearing the accident pilot tell his supervisor that the aviation section would no longer be turning down missions without going up to “take a look”; however, he stated that the accident pilot had not pressured him when he subsequently turned down missions. Several of the accident pilot’s colleagues said that the accident pilot was the kind of person who was willing to put himself at risk to save others.[34] The pilot's wife told investigators that her husband probably accepted the accident SAR mission because the wind conditions on the mountain did not preclude it, he was concerned about the hiker's safety, and because a supervisor had asked him to fly the mission.[35]

During postaccident interviews, the pilot's colleagues expressed mixed opinions regarding the pilot's aeronautical decision-making skills. For example, the full-time helicopter pilot said that the accident pilot usually examined all aspects of a mission and selected an intelligent strategy. However, the fixed-wing pilot said that the accident pilot tended to "act right away before thinking things out." This opinion was shared by the part-time helicopter pilot, who said he thought the accident pilot lacked "temperance" because of his youth and inexperience. The former chief pilot said that he believed the accident pilot did not understand the limitations associated with his aeronautical inexperience.

1.5.1.2 Pilot Personal Background and Medical History

According to postaccident interviews with the pilot's family and friends and a review of his personal and FAA medical records, the pilot was in good health at the time of the accident and engaged in some form of physical activity every day. The pilot's wife stated that the pilot did not have a history of any medical conditions and that he did not exhibit any symptoms of illness in the days before the accident. The pilot's wife stated that her husband did not snore and did not have any sleep disorders.[36] The pilot's wife reported that, in the year before the accident, there had been no significant changes in her husband's health, financial situation, or personal life and there had been no significant changes in his daily habits (that is, sleeping, eating, or leisure activities).

A review of the pilot's personal medical records indicated that the pilot had been diagnosed with dysthymia (depression) in June 2002 and was prescribed fluoxetine[37] to treat this condition. These records indicated that the pilot continued to take fluoxetine until the time of the accident and noted that the pilot had not experienced adverse effects from his use of this medication. According to the NMSP aviation section's "Policies and Procedures" document (see appendix B) regarding pilot medical conditions and use of medications, "If medication is required, it must be approved and the pilot certified fit for flight by an FAA-designated medical examiner or flight surgeon." The pilot did not note the use of fluoxetine on any FAA airman

[34] As an example, the colleagues stated that the accident pilot received the 2009 Officer of the Year Award and Medal of Valor (from the New Mexico Sheriffs and Police Association and the International Association of Chiefs of Police, respectively) for his rescue of a man trapped in a flooded arroyo. The supervisor who nominated the accident pilot for these awards wrote that the pilot searched for the man on foot, despite heavy rain and lightning at the time. When he located the man at the bottom of a steep concrete incline under a bridge, there was a high volume of fast-flowing water inside the arroyo. In addition, the trapped man weighed more than 200 pounds, was intoxicated, and had a broken wrist. The commendation letters stated that the conditions of the rescue were "life threatening" for the pilot and that he disregarded his own safety to save the man.

[35] The former chief pilot, who supervised the accident pilot from 2002 to 2008, said that the pilot had difficulty saying "no" to managers. The pilot's wife said that when a supervisor asked the aviation section pilots to fly a mission, they flew it if possible.

[36] The accident pilot's wife stated that he did not have any difficulty falling asleep at night or staying awake during the day, nor did he experience interrupted breathing at night.

[37] Fluoxetine is a prescription antidepressant, also known as Prozac.

medical certificate application in the 7 years during which he took the medication. (For additional information, see section 1.13.)

1.5.1.3 Pilot Schedule and Duties

The accident pilot's wife told investigators that her husband's typical work schedule was 0700 to 1500, Monday through Friday (although this schedule occasionally shifted to accommodate flight or other work commitments), with normal days off of Saturday and Sunday. She stated that, during his work week, her husband's routine was to awaken about 0600, work from 0700 to 1500, take a 30-minute nap in the afternoon, spend time with their children until their children went to bed between 2000 and 2030, and go to bed between 2130 and 2200.[38] The pilot's wife stated that her husband normally slept about 8 to 8.5 hours on a night before a work day. She stated that on his days off, her husband typically awoke between 0700 and 0730 and went to bed about 2100, after their children were in bed.

The pilot's wife further stated that she could not remember the last day her husband had been completely free of work-related duties because he was often expected to be available on call during his "days off" in his capacities as PIO and/or pilot. According to the pilot's wife, her husband typically alternated weekends on call as PIO with his pilot on-call weekends; however, he often served as both PIO and pilot on call when the other full-time NMSP helicopter pilot was unavailable (due to New Mexico National Guard duty or family commitments).[39]

The pilot's wife stated that her husband loved flying and appreciated that the NMSP had given him the opportunity to work as a pilot. However, the pilot's wife stated that her husband "absolutely hated" his duties as the NMSP PIO. She indicated that, although her husband was a private person who disliked being in front of the news media cameras, he was also concerned that fielding calls from the media at all hours as PIO[40] interfered with his ability to get adequate rest for his flying duties. The pilot's wife told investigators that, when her husband advised his supervisors that the PIO assignment conflicted with his chief pilot responsibilities and his ability to get adequate rest, he was told to "get over it" and to do his job.[41] The NMSP special operations captain (the accident pilot's immediate supervisor) also told investigators that he was concerned about the pilot's competing roles. He stated that the former chief pilot had asked NMSP management to relieve the accident pilot of the PIO assignment before the former chief pilot took an early retirement in 2008 (after which the accident pilot was appointed chief pilot), but NMSP management had not acted on his request.

[38] The pilot's wife typically worked a "swing shift" as a police dispatcher on weekday evenings, so that she and the pilot could take turns watching their children during the day. The pilot was usually asleep when she returned home from work about 2315.

[39] According to the other NMSP helicopter pilot, it was rare for the accident pilot to complete an entire weekend without any work-related activity.

[40] When he was assigned PIO duty, the accident pilot was required to serve as the point of contact for the news media regarding any incidents in which the NMSP were involved 24 hours per day, which the pilot's wife indicated often disturbed the pilot's sleep.

[41] The pilot's wife stated that most of the NMSP managers did not understand the training and currency requirements for pilots.

Postaccident interviews with NMSP upper management indicated that, in general, these managers either did not recognize any potential conflict between the accident pilot's PIO and pilot duties or did not believe that there was any reason for concern regarding this conflict. Several interviewees indicated that they were aware that the chief pilot wanted to be relieved of his PIO duties, but they attributed this awareness to his dislike of those duties and his preference for his flying duties. In general, NMSP upper management indicated that they relied on the chief pilot and other aviation section pilots to advise them if they were not rested enough to fly missions. The chief of police told investigators that the aviation section pilots were "not overworked. They don't fly enough hours. They have a lot of idle time." He stated that he had not relieved the accident pilot of his PIO duties after appointing him chief pilot because he "didn't feel it was a conflict. …They're not flying that often and the PIO position…if there's nothing big happening in the state you're not doing anything." The chief of police further stated, "Look at the number of hours they fly and divide that by the number of pilots…he's flying a couple hundred hours a year. …He didn't have too many responsibilities for the number of missions that our department flies."

During postaccident interviews, the DPS cabinet secretary indicated that he had no concerns about the pilot's PIO and pilot duties and that he was unaware that the pilot wanted to be relieved of his PIO responsibilities. The DPS cabinet secretary indicated that he had also performed numerous extra duties, including PIO and special investigation duties, when he served as NMSP aviation section chief pilot.[42] He stated that, if he was unable to take a flying mission because of inadequate rest due to his other responsibilities, "another pilot would have to do it or the mission wouldn't be flown."

1.5.1.4 Pilot Recent and 72-Hour History

The following description of the pilot's activities during the days preceding the accident is based on postaccident interviews with the pilot's wife and his coworkers and a review of other available records (for example, telephone and NMSP dispatch logs). During the weekend before the accident, the accident pilot served as both the NMSP PIO and the aviation section pilot on call. On Saturday, June 6, according to his wife, the pilot got up at a "normal time" for a weekend day (between 0700 and 0730), and he periodically worked with the news media in his PIO role throughout the day. During the day, the pilot also flew the accident helicopter to a public event at which he provided a static aircraft display. The pilot recorded two landings and 0.5 hours of flight time that day. The pilot spent that Saturday evening at home with his family. He made a brief call to a news organization about 2120 and went to bed about 2200, according to his wife.

Telephone records indicate that the pilot received a work-related call about 0035 Sunday, June 7.[43] The pilot's wife stated that her husband then arose about 0730 and went out to breakfast with his family about 0900. Upon their return, the pilot periodically worked with the

[42] In a postaccident interview, the DPS cabinet secretary indicated that he was the chief pilot when he left the aviation section for a different position in the early 1990s.

[43] The pilot's wife did not specifically recall this late-night telephone call, but she said that the pilot's sleep was often interrupted when he was on call as PIO. She stated that she did not know how long it took him to get back to sleep after such calls.

news media in his PIO role throughout the day. The pilot's wife did not recall their activities that afternoon or evening, but she indicated that he might have taken a nap that afternoon and likely engaged in routine activities (for example, activities with the children or watching television) before going to bed about 2200. She said that it was his habit to watch television in bed until 2330 or 2345 on Sunday nights, but she could not recall if he did so that night. Telephone and the pilot's records indicate that the pilot received work-related calls on his cellular telephone between about 2330 and midnight Sunday night and again between about 0245 and 0300 Monday morning, June 8.

On Monday, June 8, the pilot began his duty day about 0300. He flew missions between 0400 and 0500 and between 0630 and 0800, recording two landings and 1.4 hours of flight time. These flights involved an inspection of a canyon using forward-looking infrared (FLIR) technology[44] before sunrise and a second inspection of the canyon during daylight hours. His logbook entry for these flights noted "mountain work up to 11,000 feet" and "slow search flight in mountains." According to his wife, the accident pilot returned home about 1100, ate a meal with his family, visited with his wife before she went to work, took a nap, interacted with the children, and likely went to bed between 2130 and 2200. The pilot was asleep when his wife returned home from work about 2315.

According to the pilot's wife, on Tuesday, June 9, her husband awoke about 0600. He worked his routine shift, from 0700 to 1500. The other full-time helicopter pilot flew three flights with the accident pilot that day[45] and said that the accident pilot seemed to be in good spirits. The other full-time helicopter pilot (who was the pilot flying on their return) stated that, during the second flight (to Las Vegas, New Mexico), the wind had been gusting to almost 40 knots near the ground, and they deviated to the south to avoid the mountainous terrain's wind effects when they returned to SAF. The pilot's wife saw her husband briefly at home at the end of his day before she left for work. She guessed that her husband napped that afternoon and indicated that he was lounging or resting when she called him about the accident flight.

1.5.2 The Spotter

The NMSP patrol officer who accompanied the pilot to act as a spotter during the accident SAR mission was not a pilot and had received no special training for aircraft missions. He had not ridden in the accident helicopter before, but he had previously been transported in helicopters while serving in the New Mexico National Guard.

[44] FLIR technology uses detection of infrared radiation (heat) to create a "picture," which can be used by pilots flying at night or in fog, and to detect warm objects against a cold background when it is completely dark (such as a cloudy, moonless night).

[45] The first of the three flights involved a search for a downed aircraft and was called off about 15 minutes after takeoff. The second flight involved the transport of a criminal investigator to the scene of a homicide in Las Vegas, New Mexico. The third flight occurred between 1200 and 1330 and involved a law enforcement search for a suspect's vehicle.

1.6 Aircraft Information

1.6.1 General Information

The accident helicopter, an Agusta A-109E, serial number 11209, was manufactured by Agusta S.p.A. Aerospace Company in March 2003 and was delivered new to the New Mexico DPS later that year. (Figure 6 is a preaccident photograph of the accident helicopter.) The Agusta A-109E is a twin engine, single main rotor helicopter with retractable tricycle landing gear. The helicopter has a four-blade main rotor system for lift and thrust and a two-blade tail rotor system for directional control and antitorque. Four large doors, two on each side of the helicopter, provide ingress and egress for the pilot(s) and passengers.

Figure 6. Preaccident photograph of the accident helicopter.

The accident helicopter had a dual-engine service ceiling of 19,600 feet, a single-engine service ceiling of 13,100 feet, and a hovering ceiling of 11,800 feet. (According to the former chief pilot of the NMSP aviation section, the DPS chose the Agusta A-109E helicopter because of its high altitude performance.) The accident helicopter was properly certificated, and maintenance records indicated that it was being maintained and inspected at regular intervals (every 50 hours or 30 days) under a manufacturer-developed progressive maintenance inspection schedule. The helicopter’s most recent progressive maintenance inspection was conducted on May 28, 2009, at an aircraft total time of 1,710.7 hours. NMSP maintenance records indicated that the helicopter’s left and right Pratt & Whitney Canada PW206C turboshaft engines had accumulated 1,667.1 and 1,132 total operating hours, respectively, at the time of the accident. NMSP maintenance records further indicated that annual inspections were performed on the left and right engines on October 29, 2008, at 1,414.0 and 1,010.8 total engine hours, respectively. At the time of the accident, the helicopter had accumulated about 1,729 total flight hours and 3,014 landings.

The accident helicopter was equipped with a radio that received and transmitted on police band frequencies and with a very high frequency transceiver radio; the two radios allowed the pilot to monitor two radio frequencies simultaneously while transmitting on one frequency.[46] The NMSP helicopter did not have a multiband transceiver radio like those used by SAR personnel and therefore could not monitor the NMSP dispatch frequency and a SAR frequency at the same time.[47]

The helicopter was equipped with an autopilot that could fly a variety of instrument approaches, leaving the pilot to manage only the pedals and power setting. The autopilot had a go-around feature that would automatically set pitch and roll while the pilot adjusted the collective input to match the collective indicator. According to the NMSP aviation section's other full-time helicopter pilot, the accident helicopter was "very easy" to fly compared to other helicopters he had flown. He thought it had a good autopilot and was stable.

The NMSP had purchased three night vision goggle units for the accident helicopter. According to pilots in the NMSP aviation section, night vision goggles were normally used to facilitate visual flight operations in low-light conditions. Although the presence of precipitation degrades the night vision goggles' usefulness, they can help a pilot see the surrounding terrain if the helicopter remains clear of clouds.[48]

1.6.2 Helicopter Seating and Restraints

The accident helicopter was configured with two pilot seats in the front and six passenger seats (three aft-facing and three forward-facing bench seats) in the rear. The two pilot seats were a composite shell design, with integrated back and seat pans. These seats were equipped with four-point restraint systems with the lap belts anchored in the composite seat material. The passenger seats consisted of cushioned seat backs and seat pans, headrests, and three-point seatbelts anchored directly to the helicopter structure. The passenger seat restraint systems were three-point systems, with right and left side lap belts and a shoulder belt, which were to be attached to a common buckle.

[46] The police band radio frequencies used by NMSP dispatch and SAR personnel fell within the same frequency range; however, the helicopter's radio equipment only allowed the pilot to monitor and transmit on one frequency within that range at a time, whereas SAR personnel were also equipped with a multiband transceiver radio that allowed for communications on three frequencies simultaneously.

[47] The helicopter that was purchased to replace the accident helicopter was equipped with a multiband transceiver radio that allowed for communications on three frequencies simultaneously. The new chief pilot stated that there had not been any formal change of procedures for communications with SAR personnel during SAR missions; however, communication changes are planned.

[48] As previously mentioned, the accident pilot had received training in the NMSP night vision goggle system in January 2009.

According to the manufacturer's records, the pilot and passenger seats and restraints in the accident helicopter met the limit maneuvering load factor requirements of 14 CFR 27.337 and the emergency landing condition requirements of 14 CFR 27.561 that were in effect at the time of the helicopter's original FAA type certification.[49]

1.7 Meteorological Information

1.7.1 General

The National Weather Service (NWS) weather depiction chart and surface analysis chart in effect at 1900 and 2100, respectively, showed VFR or marginal VFR conditions[50] prevailing over much of New Mexico (including the accident site) and a trough of low pressure extending from a low over Colorado through eastern New Mexico. The NWS radar summary chart for 2119 showed widely scattered rain showers over New Mexico with a few defined thunderstorms over the southern portion of the state.[51] (Weather radar showed light-to-moderate precipitation over the search area at the time of the accident.)

During the day, all local weather observation sites reported a warm and relatively dry environment with strong, gusty winds out of the west to southwest and high-based rain showers developing during the afternoon and early evening; several stations in the area reported clouds obscuring the mountain tops near the time of the accident. The SAF terminal aerodrome forecast (TAF) in effect at the time of the accident expected VFR conditions to prevail throughout the forecast period with rain showers in the area throughout the evening and into the next day. The TAF for SAF indicated light rain showers and mist after 2000, with a ceiling broken at 6,000 feet above ground level (agl) (about 12,000 feet msl) in cumulonimbus clouds and winds at 14 knots gusting to 24 knots through the evening and into the next day.

The NWS area forecast in effect for the region when the helicopter departed SAF predicted the following for the mountainous western portion of New Mexico, which included the accident location: broken clouds at 14,000 feet layered to 22,000 feet; widely scattered light rain showers and isolated thunderstorms and light rain; winds from the southwest gusting to 25 knots until 2100; VFR conditions prevailing; and rain showers and thunderstorms after 0200.

There was no record of the pilot obtaining a formal weather briefing through the FAA flight service station or direct user access terminal service. However, computer internet services providing aeronautical weather information were available in the NMSP SAF hangar and aviation section pilots indicated that they routinely used such services. (A review of the NMSP

[49] The limit maneuvering load factor requirements were 1.0 G up and 3.5 G down, with ultimate load factors of 1.5 G up and 5.25 G down (one G is equivalent to the acceleration caused by the Earth's gravity). The emergency landing load factor requirements were 4.0 G forward, 2.0 G side, 4.0 G up, and 1.5 G down.

[50] VFR conditions are defined as no ceiling or a ceiling greater than 1,000 feet above ground level (agl) and visibility greater than 3 miles. Marginal VFR conditions are defined as a ceiling between 1,000 and 3,000 feet agl inclusive and/or visibility between 3 and 5 miles inclusive.

[51] About 1955 (after the helicopter departed on the accident mission), a convective SIGMET (weather advisory regarding significant convective meteorological conditions) was issued for a diminishing line of thunderstorms moving from east-southeast toward the accident region. The convective SIGMET was valid until 2155 (but it was not updated on the next hourly issuance).

aviation section computer Internet history showed the websites visited by users, but the history did not indicate the times and dates of those visits.) In addition, the pilot had a home computer where he could access Internet weather information.

1.7.2 Local Airport Weather Information

NWS meteorological aerodrome reports (METARs) from six airports around the accident location[52] indicated similar conditions on the day of the accident, with strong, southwesterly to westerly winds gusting to 40 knots and warm, relatively dry, VFR conditions. However, a few hours before the accident, the weather observations varied, showing broken or overcast layers of clouds and scattered rain showers and thunderstorms due to a weak weather disturbance moving across the area. All of the METARs reported rain showers or virga[53] in the area around the time of the accident. For example, during the hour preceding the accident, SAF (the closest airport and weather reporting station to the accident site) reported a broken to overcast layer of clouds between 12,000 and 15,000 feet and rain showers moving across the region. In addition, Angel Fire Airport (AXX), Angel Fire, New Mexico (which was located in mountainous terrain similar to the accident site), reported westerly winds gusting to 33 knots, cloud ceilings at 10,000 feet (less than 2,000 feet agl), and moderate precipitation near the time of the accident. Further, the Albuquerque International Sunport weather observations near the time of the accident reported virga and mountaintop obscuration to the northeast and east of the airport (in the direction of the accident site).

1.7.3 Local Witness Reports

Three hikers who were camping at a lake about 1.5 miles east-southeast of and at a lower elevation than the accident site reported seeing the helicopter flying in the area before landing, and then saw the helicopter's lights as it departed a short time later. They stated that it was dark at the time of the accident and there was a "heavy overcast" with strong, gusty winds. The hikers also reported that heavy rain began at their location shortly after the helicopter crashed.

In addition, members of the New Mexico SAR ground teams described the weather conditions as "very bad," with strong winds, cold temperatures, snow or sleet, and occasional whiteout conditions on the night of the accident.

1.8 Aids to Navigation

No problems with any navigational aids were reported.

[52] Weather observations were obtained from the following airports: SAF (located about 21 nm southwest of the accident site at 6,348 feet); Los Alamos Airport, Los Alamos, New Mexico (located about 26 nm west of the accident site at 7,171 feet); Las Vegas Municipal Airport, Las Vegas, New Mexico (located about 31 nm east-southeast of the accident site at 6,877 feet); Taos Regional Airport, Taos, New Mexico (located about 39 nm north of the accident site at 7,095 feet); AXX (located in mountainous terrain about 43 nm north-northeast of the accident site at 8,380 feet); and Albuquerque International Sunport, Albuquerque, New Mexico (located about 63 nm southwest of the accident site at 5,355 feet).

[53] Virga is precipitation that is falling but is evaporating before it reaches the surface.

1.9 Communications

No technical communications problems that were related to the accident were reported.

1.10 Airport Information

The accident helicopter was based at SAF, which is located about 21 miles southwest of the accident site. No airport problems were identified.

1.11 Flight Recorders

The helicopter was not equipped, and was not required to be equipped, with a cockpit voice recorder or a flight data recorder.

1.12 Wreckage and Impact Information

As previously stated, investigators were not able to identify the point of the helicopter's first impact with terrain. However, evidence of the helicopter's second impact with terrain (light debris from the helicopter and parts of an NMSP decal) was found just below 12,100 feet on the ridge above the main wreckage. Numerous ground strikes (as evidenced by divots in the soil and scars up to 5 inches deep in the loose rock) and helicopter parts and components were observed downhill from that point. According to the spotter and physical evidence, the helicopter tumbled down a rocky, steep slope, shedding parts and components as it descended. A kneeboard with a local area guide, presumed to be from the accident helicopter, was located at an elevation of about 12,083 feet. Debris from the accident helicopter, including the FLIR, the battery, and portions of the main rotor blades, landing gear, tailcone, tailboom, a survival vest,[54] and aircraft manuals and checklists, were scattered between 12,083 feet and 12,000 feet, where the tailcone was located. A large section of the tailboom, with the tail rotor skid tube and the inboard portions of the tail rotor blades[55] attached, was found below the tailcone resting against rocks and a tree (see figure 4). The tail rotor skid tube was bent upward (toward the tailboom) from its original position and exhibited scratches and abrasions in all directions. The outboard portions of the two tail rotor blades were not recovered.

The main wreckage area consisted of most of the fuselage, both engines, the forward portion of the tailboom, and some associated debris, which came to rest in an area of large boulders at an elevation of about 11,500 feet. Most of the fuselage exterior surfaces exhibited extensive crushing, deformation, and torn metal. The cockpit portion of the fuselage was partially inverted and was attached to the cabin section only by some electrical wiring and various other components. The landing gear position selector and all three landing gear actuators were in the down position. The main landing gear struts were separated from the fuselage, and the nose landing gear assembly was in several pieces.

[54] According to NMSP personnel, the survival vest likely contained a mirror, a whistle, a small first-aid kit, flares, and a space blanket.

[55] The outboard 9 to 10 inches of each tail rotor blade was missing.

1.12.1 Seats and Restraints

1.12.1.1 Pilot Seat (Right Front) and Restraint System

The pilot's seat pan and back were found unoccupied, outside the fuselage, and exhibited compression damage in an inboard direction. The seat pan was partially separated from the seat back, and its fabric covering was loose. The pilot's restraint system was a four-point system, with right- and left-side lap belts and shoulder harnesses attached to a common buckle. The left strap of the pilot's lap belt was found still fastened to the buckle, but the right strap of the lap belt was not attached to the buckle. The left and right lap belt mounting flanges were both broken off the seat. The pilot's shoulder harness was found still attached to the floorboard-mounted inertial reel, which was in the locked position. The extended shoulder harness webbing measured about 12 inches from the reel to the beginning of the stitching where the right and left shoulder harness straps split. The right-side shoulder harness strap was not attached to the buckle, but the left-side shoulder harness strap was fastened to the buckle. There was no evidence of preimpact restraint system failure.

1.12.1.2 Aft, Forward-Facing Passenger Seats and Restraint Systems

During postaccident interviews, the spotter stated that he and the hiker were buckled securely into their seats when the helicopter lifted off to return to SAF. The spotter and the hiker occupied the left and right aft, forward-facing passenger seats, respectively, on the three-seat bench, which exhibited impact damage, but remained largely intact.

The spotter was still inside the aft fuselage when the helicopter came to rest; he recalled that he did not need to unbuckle his seatbelt when he crawled out of the fuselage. Postaccident examination of the spotter's lap belt and shoulder harness assembly revealed that the lap belt buckle was not latched and was adjusted about 15.5 inches from the adjustment fitting. The bulkhead-mounted inertial reel operated and locked normally, although its extension and retraction felt "rough." Both the right and left lap belt attachment hooks on the left-side seat were attached to their floorboard mounting brackets with the hook opening upward.

The hiker was ejected during the accident sequence. Postaccident examination of the hiker's lap belt and shoulder harness assembly revealed that the left and right lap belts were connected at the belt buckle and the shoulder harness was disconnected. The right lap belt attachment hook was disconnected from its floorboard mounting bracket, whereas the left lap belt attachment hook remained attached to its floorboard mounting bracket with the hook opening downward. There was no evidence of restraint system failure or separation; however, the left and right floorboard mounting brackets were bent to the right (30, and 45°, respectively) of their normal positions.

1.13 Medical and Pathological Information

The pilot and the hiker were ejected from the helicopter during the accident sequence and did not survive. The University of New Mexico, Health Sciences Center, Office of the Medical Examiner autopsy report listed the pilot's primary cause of death as "environmental cold exposure," adding, "[o]ther significant contributing conditions included multiple blunt force injuries" that "would have been incapacitating, but not necessarily rapidly fatal." The autopsy report listed the hiker's cause of death as multiple blunt force injuries.

The spotter was not ejected during the accident sequence and survived the accident with serious injuries. His injuries included a broken ankle, chipped vertebrae, separated ribs, and bumps and bruises to the head. He also suffered from hypothermia. The spotter was hospitalized for 10 days and then released. (For additional information on the survival aspects of the accident, see section 1.15.)

Toxicological analyses performed on fluid and tissue specimens from the pilot by the New Mexico Department of Health, Scientific Laboratory Division and the FAA's Civil Aeromedical Institute produced largely similar results. The specimens tested negative for carbon monoxide, cyanide, ethanol, and a wide range of illegal drugs.[56] However, toxicological tests did detect fluoxetine and norfluoxetine in the pilot's fluid and tissue samples. (Norfluoxetine is a metabolite of fluoxetine.)

Several studies have shown minimal or no effect of the drug fluoxetine at normal doses on a variety of performance measures,[57] whereas other studies indicate that the performance of depressed patients on various tasks improves when taking fluoxetine.[58] In April 2010, the FAA revised its policy to permit pilots requiring fluoxetine for the treatment of depression to receive a medical certificate through the agency's Special Issuance (waiver) process, provided that a number of diagnostic and evaluative criteria are met. The FAA also permitted pilots who had been using the drug for depression, but not reporting the use or diagnosis, to report the use and diagnosis within 6 months following the policy change without any civil enforcement action for previous falsification.

1.14 Fire

No in-flight or postcrash fire occurred.

[56] Toxicological analyses screened for the following drugs: amphetamine, opiates, marijuana, cocaine, phencyclidine, benzodiazepines, barbiturates, antidepressants, antihistamines, meprobamate, methaqualone, and nicotine.

[57] See, for instance: (a) J.G. Ramaekers, N.D. Muntjewerff, and J.F. O'Hanlon, "A Comparative Study of Acute and Subchronic Effects of Dothiepin, Fluoxetine and Placebo on Psychomotor and Actual Driving Performance." *British Journal of Clinical Pharmacology*, vol. 39, no. 4 (1995), pp. 397–404 and (b) H. Moskowitz and M. Burns, "The Effects on Performance of Two Antidepressants, Alone and in Combination With Diazepam." *Progress in Neuro-Psychopharmacology & Biological Psychiatry*, vol. 12, no. 5 (1988), pp. 783–792.

[58] See, for instance: (a) Y. Levkovitz and others. "The SSRIs Drug Fluoxetine, but not the Noradrenergic Tricyclic Drug Desipramine, Improves Memory Performance During Acute Major Depression." *Brain Research Bulletin*, vol. 58, no. 4 (2002) pp. 345–350 and (b) G.B. Cassano and others, "Paroxetine and Fluoxetine Effects on Mood and Cognitive Functions in Depressed Nondemented Elderly Patients." *Journal of Clinical Psychiatry*, vol. 63, no. 5 (2002), pp. 396–402.

1.15 Survival Aspects

1.15.1 Postaccident Search and Rescue Efforts

The NMSP dispatcher contacted the initial SAR incident commander about the helicopter accident within minutes of the accident. The SAR incident commander instructed the SAR ground teams,[59] who had departed the SAR IB area about 2120 to search for the lost hiker, to proceed toward the helicopter's last known position (near the landing site where the accident pilot picked up the lost hiker) and provided them with the coordinates for that location. SAR logs also indicated that about 2156, SAR personnel requested the assistance of New Mexico National Guard helicopters in their efforts to locate the accident helicopter.[60] (National Guard helicopters did launch the night of the accident; however, these efforts to find the accident helicopter were hampered by the adverse weather conditions.)[61]

By 2240 (about 65 minutes after the accident occurred), satellites had detected the accident helicopter's emergency locator transmitter (ELT)-generated distress signal[62] and relayed location information to the U.S. Air Force Rescue Coordination Center (AFRCC). AFRCC then provided SAR personnel with the ELT's coordinates.[63] During the SAR effort (about 2315 the night of the accident and then about 0725 on June 10), the AFRCC received two additional ELT satellite detection messages, both indicating slightly different locations than the first; however, all three ELT detections were located within 2 nm of the accident site.[64]

According to SAR logs, about 0900 on the morning of June 10, two New Mexico National Guard helicopters were dispatched again to search for the accident helicopter near the third ELT location; however, those helicopters returned to SAF 45 minutes later because of poor weather conditions.[65] The weather conditions eventually permitted the New Mexico National Guard helicopters to resume their search about 1045 that morning.

The spotter, after taking shelter in the fuselage wreckage overnight, began to hike down the mountain for help in the morning. About 1100, SAR commanders were advised that an analysis of pertinent radar data resulted in search coordinates that corresponded to a location on a ridge line 0.25 mile southwest of where the helicopter wreckage was ultimately located.

[59] Although all SAR incidents in New Mexico are coordinated by the NMSP, the primary resources (SAR personnel) for these incidents are volunteers. SAR ground teams were also searching for the hiker's companion.

[60] The New Mexico National Guard operated Sikorsky UH-60 "Blackhawk" helicopters with crews consisting of two helicopter instrument-rated pilots.

[61] Adverse conditions (bad weather with fog, sleet, and "pouring rain," and rugged, slippery terrain) were also reported by SAR teams who participated in the search for the accident helicopter through the night of the accident and into the next day.

[62] The accident helicopter was equipped with an Artex C406-1HM ELT that transmitted on both 406- and 121.5-megahertz (MHz) frequencies.

[63] This location was eventually determined to be about 0.3 mile northwest of the accident site.

[64] The ELT locations generated by the type of ELT unit installed in the accident helicopter are generally considered accurate to within 1 to 3 nm.

[65] In addition, the SAR efforts of the Civil Air Patrol, which had planned to send airplanes to search at first light on the morning of June 10, were also delayed because of adverse weather conditions.

Although SAR ground teams did not yet have the radar data coordinates, they were already searching in the area, and, about 1155, one of the ground teams found the spotter. A New Mexico National Guard helicopter was immediately dispatched to the coordinates provided by the ground search team, and, by 1230 (about 15 hours after the accident occurred), the spotter was being airlifted to a hospital for treatment.

As previously mentioned, SAR ground teams did not locate the helicopter's wreckage until 1816 on June 10. The accident site was described as dangerously steep and covered with snow and ice. Figure 7 shows the approximate route that the SAR ground team took to locate the spotter.

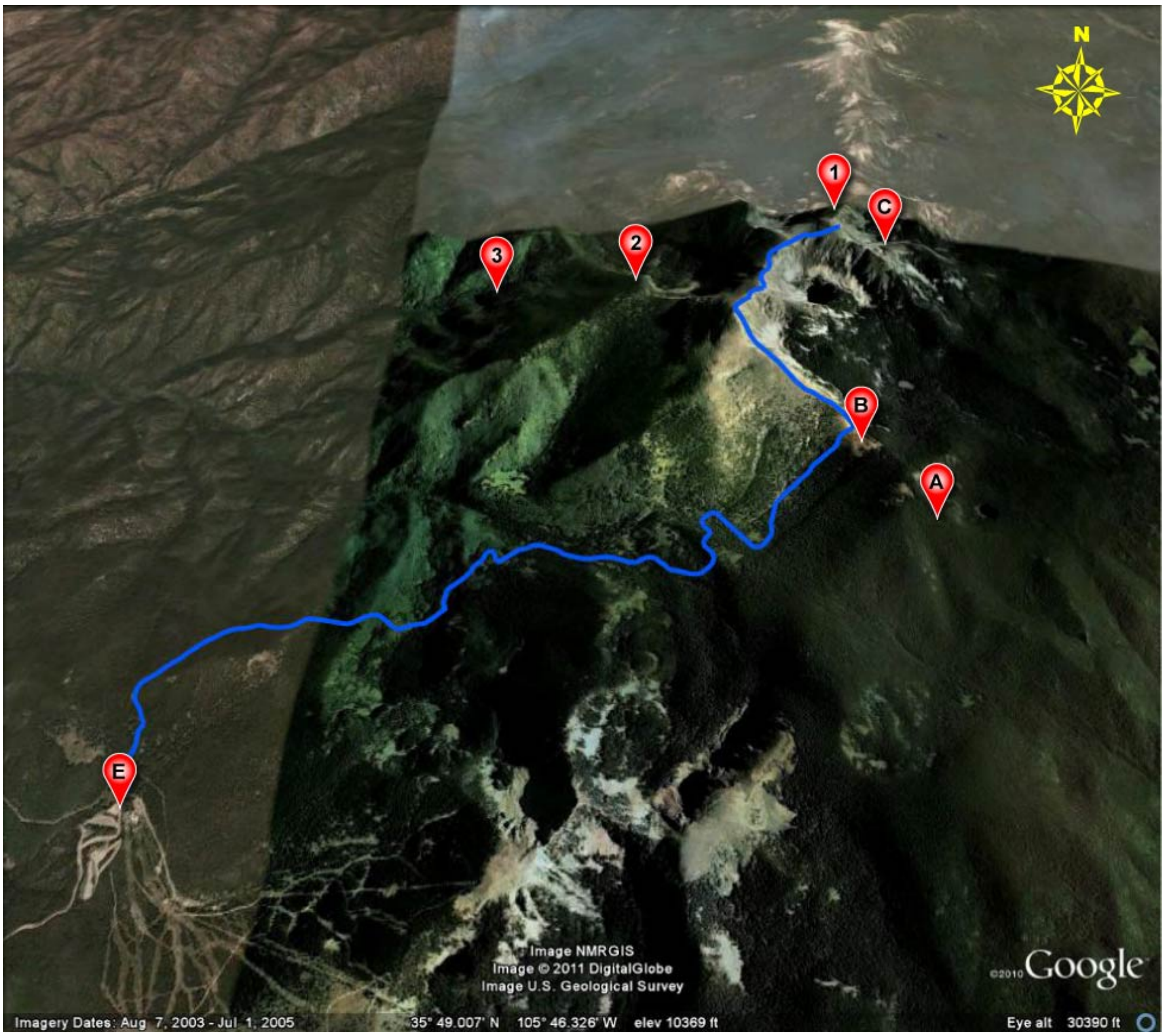

Figure 7. Google Earth image with a blue line showing the likely route that the SAR ground team took from the SAR IB (E) to the helicopter main wreckage location (C).

Note: Also shown are the hiker's approximate location (A); the helicopter's likely landing zone, confirmed by the spotter (B); and the three AFRCC ELT-provided coordinates (1, 2, and 3, in the order in which they were provided to SAR personnel) for the accident site. A compass showing north is located in the upper right corner.

After an unsuccessful search of the wreckage and surrounding area for the pilot and hiker, about 2007 (about 12 minutes before sunset), the SAR ground team was airlifted from the site by a New Mexico National Guard helicopter. The bodies of the pilot and the hiker were not located until the next day.

1.16 Tests and Research

1.16.1 Emergency Locator Transmitter's Distress Signal Information

The accident helicopter's ELT activated as designed during the accident sequence. It was found intact and still mounted in a portion of the helicopter's tailboom with its cable connected to the fractured external antenna.

The investigation revealed that the ELT's transmissions were received by low-Earth polar orbiting satellites but were not received by the two geostationary operational environmental satellites. National Oceanic and Atmospheric Administration (NOAA) Search and Rescue Satellite-Aided Tracking (SARSAT)[66] personnel examined the discrepancy between the signal's transmission and reception and determined that this discrepancy could be explained by the topography of the crash site and the relative positions of the two geostationary satellites. According to NOAA's report, the accident helicopter's ELT was located on the north face of steeply sloped terrain, while the two geostationary satellites were positioned above the equator in the southern sky (one southwest and the other southeast of the accident site).

1.16.2 Radar Study

The U.S. Air Force provided the NTSB with radar data for the accident flight from its radar sites in Mesa Rica and West Mesa, New Mexico. The data showed that the helicopter flew for about 2 minutes 35 seconds after it lifted off after picking up the hiker. Radar data indicated that the helicopter initially headed northwest from the remote landing site toward the southern flank of the mountain and the much lower terrain of the valley beyond. The data indicated that the helicopter transitioned the southern flank of the mountain and then began to fly a somewhat erratic path, reversing direction, climbing, and heading northeast over the mountain's peak. The radar data also showed that the helicopter crossed terrain as high as 12,500 feet before descending rapidly near the crash site. When plotted on Google Earth, the radar data show the helicopter apparently passing through terrain and continuing its flight on the other side. The NTSB's review of the U.S. Air Force radar data indicated that the anomalous radar data may have been the result of the inconsistent radar coverage in the mountainous area and/or the different barometric pressures in the area, which would result in an altitude offset error. (The U.S. Air Force radar data were not corrected for barometric pressures that differ from the standard 29.92 inches of mercury, and the barometric pressure measured at airports in the mountainous region northeast of SAF varied between 30.11 and 30.19 inches of mercury at the time of the accident.)

[66] The SARSAT system consists of a constellation of satellites and a network of ground receiving stations that provide distress alert and location information to appropriate rescue authorities around the world. Instruments on board the satellites detect the ELT signals and transmit them to the ground receiving stations.

The onset of the helicopter's erratic flightpath and its turn to the northeast began a little more than 1 minute after the beginning of the radar-recorded portion of the flight and about 1.5 minutes before the flight disappeared from radar. The main helicopter wreckage was located about 0.25 mile east of the last radar target.

1.17 Organizational and Management Information

1.17.1 NMSP Aviation Section—General Information

At the time of the accident, the NMSP aviation section operated three fixed-wing airplanes and the accident helicopter. According to the NMSP aviation section's "Policies and Procedures" document (see appendix B),[67] aviation section aircraft were used for searches; rescues; reconnaissance; surveillance; air traffic operations and highway patrol; miscellaneous law enforcement operations; personnel, equipment, and materials transport; and assistance to other agencies. According to NMSP personnel, about 70 to 80 percent of the accident helicopter's usage consisted of law enforcement and SAR missions.[68] One of the fixed-wing airplanes was used exclusively for training, and the other two airplanes were used for transport, law enforcement, and occasional SAR missions. The NMSP operated its aircraft and conducted its flights as "public" operations for the state of New Mexico; those operations were exempt from many FAA regulations applicable to non-public ("civil") aircraft operations.

At the time of the accident, the NMSP aviation section did not have a safety management system (SMS) program,[69] and it did not have published safety goals and objectives; a designated safety officer; a designated safety committee; structured prelaunch and midlaunch risk assessment protocols; or a formal system for communicating safety-related information, other than oral communication.

1.17.2 NMSP Aviation Section Personnel and Chain of Command

When the accident occurred, the NMSP aviation section employed four pilots to operate its aircraft: the chief pilot (the accident pilot, who flew the fixed-wing airplanes and the helicopter),[70] a full-time helicopter pilot,[71] a full-time fixed-wing pilot,[72] and a part-time

[67] The "State Police Aviation Section and Operations" is contained in the *DPS Policy Manual*, number OPR: 49, issued 23 May 2007 (Santa Fe, New Mexico: State of New Mexico, 2007).

[68] During calendar years 2007 and 2008, the accident helicopter flew 451 flights, about 17 percent of which involved SAR operations. The accident helicopter flew 103 total flights during calendar year 2009 (including the accident mission) before the accident occurred, about 26 percent of which involved SAR operations. (Some of these search operations were conducted independent of a formal SAR operation.) The NTSB's examination of NMSP pilot logbooks indicated that the duration of SAR missions varied widely and that the missions were sometimes interrupted because of darkness and resumed in daylight the next day.

[69] According to the FAA, an SMS is a quality management approach to controlling risk in aviation operations. An SMS program also provides the organizational framework to support a sound safety culture and to provide assurance that risk controls are effective.

[70] For information regarding the chief pilot's experience and qualifications, see section 1.5.1.

[71] The full-time helicopter pilot was an NMSP patrolman who was assigned to the aviation section in 2005, after he learned to fly helicopters in the New Mexico National Guard. He had a commercial pilot certificate with

helicopter pilot.[73] According to aviation section personnel, the chief pilot served as the aviation section's day-to-day administrator and supervisor of its pilots and the aviation maintenance technician. NMSP aviation section documents indicated that the chief pilot's specific responsibilities included "all daily flight operations, maintenance coordination, purchasing, training, planning, and personnel matters involving aircraft and pilots."

The chief pilot reported to an NMSP special operations captain, who oversaw the aviation section's budget. The special operations captain reported to the major in charge of special operations, who, in turn, reported to a deputy chief of police. The deputy chief of police reported to the chief of police and an adjutant chief of police, both of whom reported to the DPS cabinet secretary. Of the personnel in this chain of command (aside from the pilots in the aviation section), only the DPS cabinet secretary had any specialized aviation knowledge or experience.

1.17.3 Aviation Section Policies, Procedures, and Practices

The NMSP aviation section had a 9-page general standard operating procedure (SOP) document, titled "Policies and Procedures," in effect at the time of the accident (see appendix B). The aviation section also frequently followed other unofficial practices. This section will describe some of the aviation section's official and unofficial practices.

1.17.3.1 Flight Operations and Training

The SOP stated that the aviation section's helicopters may operate "clear of clouds if operated at a speed that allows the pilot adequate opportunity to see any air traffic or obstruction in time to avoid collision." The NMSP aviation section SOP did not contain official guidance regarding inadvertent IMC encounters or night takeoffs from remote landing sites. However, during a postaccident interview, the full-time helicopter pilot said that he and the accident pilot had discussed inadvertent IMC procedures when clouds, rain, and fog caused the weather conditions to deteriorate during an approach to SAF. During that discussion, the accident pilot told the full-time helicopter pilot that, in the event of an inadvertent IMC encounter, he would climb, set up the horizontal situation indicator, turn, fly directly to the SAF very high frequency omnidirectional radio range navigational aid, and contact ATC.

According to NMSP personnel, aviation section helicopter pilots were not required to have a helicopter instrument rating because of cost constraints and mission requirements. NMSP personnel indicated that the helicopter was primarily used for SAR missions, which are not

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rotorcraft-helicopter and instrument ratings, and he reported about 1,540 hours of total flight experience, about 1,440 hours of which were flown in helicopters.

[72] The full-time fixed-wing pilot was an NMSP patrolman who was assigned to the aviation section in 2003. He was the section's fixed-wing instructor pilot, held an airline transport pilot (ATP) certificate with numerous fixed-wing certificates and ratings, and reported about 11,000 hours total flight experience, all in fixed-wing aircraft.

[73] Before joining the NMSP aviation section, the part-time helicopter pilot spent 7 years as a helicopter pilot in the U.S. Air Force and 16 years as a helicopter pilot for the U.S. Customs and Border Protection. He described himself as an "auxiliary pilot" for the NMSP aviation section, flying the helicopter on a part-time basis (with occasional full-time service) between 2004 and the time of the accident. He held an ATP certificate with a fixed-wing rating, a commercial pilot certificate with helicopter and instrument ratings, and reported about 4,200 total flight hours, about 3,000 hours of which were in helicopters.

typically conducted in IMC because, according to the former chief pilot, "…if you can't see the ground you can't see the person." The former chief pilot further observed that, at higher elevations (where the accident helicopter typically operated), any visible moisture was associated with potential icing conditions, and the Agusta A-109E was not designed to be operated in icing conditions. As a result, a helicopter instrument rating was not a priority for NMSP helicopter pilots.

1.17.3.2 Pilot Flight and Duty Time

The NMSP aviation section's SOP document limited its pilots' pilot-in-command (PIC) flight time and duty time to 6 and 12 hours, respectively, during any 24-hour period.[74] The document did permit increased duty times of up to 15 hours in a 24-hour period under emergency or extraordinary circumstances;[75] however, it did not allow for increased flight time as PIC under any circumstances. The "Policies and Procedures" document specified that "a minimum of eight hours rest is required following any duty day that exceeds twelve hours prior to subsequent duty time."

The NMSP aviation section "Policies and Procedures" document did not define the term "rest," nor did it establish a minimum rest period between duty periods that were less than 12 hours in duration. The former chief pilot noted that NMSP management thought rest meant being at home; however, he indicated that he did not consider the accident pilot to be resting when he was at home and received frequent telephone calls in his role as PIO. The former chief pilot stated that, when he was chief pilot, he tried to ensure that the accident pilot was not the pilot on call on a weekend when he was on call as PIO. The part-time helicopter pilot told investigators that the pilots' rest periods[76] were not protected and that they were not reset if they received a work-related telephone call or had to perform some other work-related duty after working their normal shift. He attributed this issue to the limited number of pilots and the often "life or death" nature of their mission.

According to the former chief pilot, the chief pilot was responsible for screening potential missions and ensuring that the aviation section pilots adhered to flight and duty time limitations. However, the aviation section had no formal system to track flight and duty time. As a result, when a potential mission arose, the chief pilot typically relied on the pilots to advise him if they were going to exceed flight and duty time limitations. The former chief pilot stated that if he had to call a pilot to fly a mission after the pilot had already worked a full day, he relied on the pilot to tell him if he was too tired to fly the mission. The full- and part-time helicopter pilots stated

[74] The document also limited NMSP pilots' flight and duty time to 25 and 65 hours, respectively, during any 7-day period.

[75] The NMSP SOP stated that deviations from limitations would only be permitted "in situations of extreme emergency or extraordinary circumstances." The terms "emergency" or "extraordinary circumstances" were not defined in the SOP document. According to the former chief pilot, circumstances justifying an extension of duty time beyond 15 hours in a 24-hour period had not occurred in his 18 years with the NMSP; however, the part-time helicopter pilot said that he had exceeded 15 hours of duty on "at least a couple of occasions."

[76] 14 CFR 91.1057 defines a rest period as follows: "…a period of time required pursuant to this subpart that is free of all responsibility for work or duty prior to the commencement of, or following completion of, a duty period, and during which the flight crewmember…cannot be required to receive contact from the program manager. A rest period does not include any time during which the program manager imposes on a flight crewmember…any duty or restraint, including any actual work or present responsibility for work should the occasion arise."

that they did not recall ever turning down a mission because of fatigue. The fixed-wing pilot reported that he turned down a mission once because of fatigue, when he was called for an evening flight after flying and working during the day.

The major in charge of special operations stated that the individual(s) who authorized aircraft missions considered the expected length of the mission to determine which pilots might be available to fly it, and then asked the available pilot(s) if he or they were "good to go." NMSP management personnel stated that they expected aviation section pilots to comply with NMSP policies and that the pilots were responsible for tracking their own flight, duty, and rest times to meet that goal.

The chief of police stated that it was the pilots' responsibility to ensure that their supervisor was informed if they were not adequately rested for a flight. He further stated that the "vast majority" of the aviation section's missions were flown during normal work hours. However, the NTSB's review of the accident pilot's logbook entries for the 12 months preceding the accident showed that 24 percent of his helicopter flying and 3 percent of his fixed-wing flying occurred on weekends. About 33 percent of the pilot's helicopter flying and less than 10 percent of his fixed-wing flying occurred at night. Most of the pilot's helicopter night flying (about 85 percent) and all of his fixed-wing night flying occurred during the week. Information provided by the full-time pilot indicated that about 15 percent of the helicopter flights he flew in the 7 months before the accident[77] occurred at night and about 11 percent occurred during a weekend. A review of the part-time pilot's logbook indicated that about 35 percent of his helicopter flights in the 12 months before the accident occurred at night and about 1 percent occurred during a weekend.

1.17.3.3 SAR Helicopter Support Information

1.17.3.3.1 Prelaunch Decision-Making

The NMSP aviation section SOPs stated that the PIC was responsible for "determining whether a flight [was] safe, and for canceling or terminating flights determined to be hazardous." However, the NMSP did not have an official risk assessment policy. The former chief pilot and current pilots in the aviation section said that the NMSP did not have written NMSP guidance to assist pilots in making launch decisions. The former chief pilot indicated that he used a mental risk management checklist when making safety of flight determinations.[78] He indicated that, when he was chief pilot, he was typically notified first about potential missions and that he was responsible for making go/no-go decisions.[79] The former chief pilot stated that if he thought a SAR mission was feasible, he would ask a pilot to check the weather and contact the incident commander for more information about the search area. The former chief pilot said that he would use the weather and search information to determine whether it was safe for aircraft operations. The former chief pilot said that he considered the "gravity" of the situation, the experience level

[77] The full-time pilot did not fly with the NMSP until December 2008 because of his duties with the New Mexico National Guard.

[78] The former chief pilot stated that aviation section pilots determined whether they could comply with the minimum weather requirements specified in 14 CFR Part 91 when deciding whether to depart on a mission.

[79] He said that he made conservative decisions when dealing with the inexperienced, junior pilots.

of the pilot, how much flying the pilot had already done that day, and visibility and lighting conditions in his decision-making.

The former chief pilot stated that, during his tenure as aviation section chief pilot, he often received complaints from the DPS cabinet secretary when the former chief pilot turned down missions that he considered too dangerous. He told investigators that, in March 2006, he was relieved of his chief pilot duties because he declined a SAR mission for safety-related reasons.[80] (After being relieved of his chief pilot duties, the former chief pilot functioned as an NMSP aviation section pilot until he retired in 2008.) After the former chief pilot was no longer authorized to approve aircraft missions, aviation section pilots were contacted directly by a mission initiator. After the initial contact, the pilot would decide whether to accept the mission and was then responsible for obtaining authorization from upper management. The former chief pilot and the part-time helicopter pilot said that they were concerned about the new approval process because the managers who were authorized to approve aircraft missions (other than the DPS cabinet secretary,[81] who was not typically involved in mission-related decisions) had no aviation expertise and were not qualified to evaluate the potential risks associated with accepting a particular mission.

1.17.3.3.2 Risk Management During SAR Missions

Postaccident interviews with former and current aviation section pilots and management revealed varying opinions about who was responsible for managing risk during a mission. The former chief pilot said that the PIC and the SAR incident commander were responsible for managing risk during a mission. The full-time helicopter pilot stated that the PIC bore most of the responsibility for risk management but added that SAR commanders should advise pilots about localized deteriorating weather conditions so that the pilots could make better-informed decisions during a mission. The part-time helicopter pilot said that he thought that the PIC and the chief pilot were responsible for managing risk during a mission; the special operations major said that the mission initiator and the SAR incident commander held that responsibility.

NMSP documents did not address procedures for preflight weather evaluation and/or in-flight weather-related decision-making. However, the full-time helicopter pilot said that NMSP aviation section pilots typically contacted the FAA flight service station for a weather briefing before cross-country flights, whereas they used the NOAA Aviation Weather Center website to obtain routine weather observations and TAFs for local flights. The pilots typically

[80] The former chief pilot submitted a letter to NMSP management indicating that he had been relieved of his position because he refused to send the aviation section's two most junior pilots on a mission that he considered extremely high-risk. The mission would have involved high-altitude flying, strong wind conditions, intermittent snow, and zero illumination. The only available NMSP pilots were the accident pilot and the full-time helicopter pilot, who, at the time of that mission, had about 50 and 200 hours of helicopter time, respectively. The former chief pilot postponed the mission until the next morning; he received a call that morning from the NMSP deputy chief, during which he was advised that he was being relieved of his chief pilot responsibilities (on orders from the DPS cabinet secretary) because of his decision to delay the SAR mission.

[81] During postaccident interviews, the 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. He further stated that aviation section helicopter pilots were to avoid strong wind conditions because they usually meant turbulence in the mountains.

did not have access to official weather forecasts and official observations during SAR missions, unless they were in an area where they could reach Flight Watch.[82]

1.17.3.4 Crew Staffing and Equipment Practices

The NMSP aviation section had no official guidance or policies specifying which aircraft missions should be flown with two pilots and which missions could be flown with one pilot. According to the former chief pilot, he tried to send two pilots on each mission, but it was not always possible because of staffing limitations. He stated that he also tried to require two pilots when the FLIR was used but that informal policy was not always enforced. The part-time helicopter pilot stated that the accident pilot had performed at least two aerial searches at night by himself during which he likely used the night vision goggles and maybe used the FLIR. The part-time helicopter pilot stated that he had urged the accident pilot to take another pilot with him on such missions.

Aviation section policy required the presence of an auxiliary crewmember, an observer or spotter, aboard NMSP aircraft when highway speed-patrol operations were being performed. Observers used in highway speed-patrol operations were required to be “familiar with his/her equipment” and with the section of highway to be patrolled. The policy did not address the need for auxiliary crewmembers on other types of missions and did not specify how such auxiliary crewmembers should be trained.

The aviation section had no official policy regarding the minimum equipment (such as cold-weather gear, night vision goggles, or FLIR) that was required for missions. NMSP managers stated that it was the chief pilot’s responsibility to establish formal requirements regarding the minimum equipment needed for missions and to ensure that aviation section pilots understood what equipment was needed. The chief of police stated that he and the other NMSP managers who were not pilots did not know what equipment should be required for a mission. Regarding cold-weather gear, the DPS cabinet secretary stated that the aviation section used to require at least a minimum supply of cold-weather gear and that he thought the current pilots had been told that they should dress for adverse weather conditions. He stated that, when he was a pilot in the aviation section, he routinely carried a survival kit and extra blankets because he had been stuck in the mountains before.

1.17.4 NMSP Aviation Section Staffing

Each full-time NMSP aviation section pilot was expected to work at least 2,080 hours per year (80 hours per 2-week pay period) for their salary, which was based on their NMSP rank plus a flight pay supplement. Work performed in the office and time spent performing mission-related activities (including the accident pilot’s PIO activities) were credited toward this total number of hours, but pilots were not paid for time spent on call outside of regular office hours, unless they were actually performing work-related tasks.

[82] Flight Watch is an en route flight advisory service that provides en route weather updates and pilot report information to pilots operating between 5,000 and 17,000 feet in the United States. Flight Watch services may be available below 5,000 feet, depending on terrain and the distance from the nearest station.

When asked about the adequacy of NMSP aviation section staffing during postaccident interviews, the aviation section pilots and the managers in their chain of command provided differing opinions. According to the full-time helicopter pilot, when he joined the aviation section in 2005, it was adequately staffed for its mission with five full-time pilots. However, two pilots had subsequently retired (a fixed-wing pilot in 2006 and the former chief pilot in 2008), and no additional pilots had been hired to replace them. The full-time fixed-wing pilot stated that, at the existing staffing level, the aviation section pilots were almost always on call. The special operations captain who supervised the chief pilot at the time of the accident agreed that the aviation section needed more pilots. He noted that it was “challenging to provide coverage 24 hours a day, 7 days a week” with two and a half helicopter pilots and one fixed-wing pilot.

On the other hand, the special operations major, who supervised the special operations captain, told investigators that, before the accident, he believed that staffing in the NMSP aviation section was adequate. However, after the accident, he said he came to understand that the unpredictability of the missions and the amount of time the pilots spent on call made additional staffing necessary. The former adjutant chief of police stated that he believed that the aviation section was adequately staffed. He noted that the aviation section had averaged only 569 flight hours per year during the last 4 years and that, as a result, he saw the pilots’ workload as very light and that he felt that additional staffing was not justified. When he was asked how many hours per week each pilot was expected to be on call, he said that each pilot was required to work 40 hours per week and that they shared the responsibility of being on call. He said most missions were flown during regular business hours. The DPS cabinet secretary also believed that the aviation section was adequately staffed at the time of the accident, explaining, “If we didn't have the resources to [fly a mission], we didn't do it.”

1.17.5 Postaccident NMSP Actions

The NMSP conducted a postaccident investigation into the conduct of the SAR mission for the accident helicopter and personnel and, in March 2010, presented the resultant report to the New Mexico Search and Rescue Review Board.[83] The report recommended that the NMSP aviation section 1) follow proper protocol for SAR missions, specifically to include a mission initiator briefing, and NMSP aircraft use only at the request of the SAR incident commander, and 2) review the communications processes between NMSP pilots, dispatch, and SAR personnel.

NTSB investigators have been in contact with NMSP aviation section personnel and reviewed changes that were made or proposed by the aviation section since the accident. The aviation section had developed a strategic plan and improved its flight authorization procedures to ensure that the shift supervisor on duty receives all relevant information before dispatching section pilots and aircraft on a mission. The section also developed a mission risk assessment worksheet that addressed factors such as the type and complexity of the mission (for example, training, dignitary transport, SAR, mountain or overwater operations), planning time and guidance available, crew selection (pilot experience, currency, and quality of rest), and environmental conditions (for example, day, night, IMC, or icing conditions). The risk

[83] The New Mexico Search and Rescue Review Board is a governor-appointed board that evaluates the operation of the New Mexico Search and Rescue Plan and problems on specific missions and makes recommendations to the appropriate authorities.

assessment worksheet also contained a mission briefer checklist, which included weather briefing, crew current and qualified, weight and balance, equipment, aircraft logbook, crew rest, and three approving signature blocks.

NMSP pilots indicated that the radio equipment on the accident helicopter limited the number of frequencies they could monitor at one time, which hampered their ability to monitor and communicate with NMSP dispatch and SAR personnel at the same time. According to NMSP personnel, the replacement helicopter is equipped with a radio that allows pilots to monitor and communicate on three separate frequencies. As a result, NMSP pilots can now monitor and communicate with NMSP dispatch and SAR personnel at the same time. In addition, the NMSP plans to further review and change as necessary its procedures regarding communications with SAR personnel during SAR missions.

Additionally, since the accident, the NMSP has purchased a global positioning system (GPS)-based flight-following unit to improve flight-following capabilities for its aircraft. The NMSP purchased a service plan that provides position updates every 5 minutes and when the helicopter stops. In addition, the NMSP purchased personal emergency locator beacons (PLB) for its pilots to carry during missions. The PLBs transmit self-contained GPS coordinates to satellites when manually activated and, thus, provide SAR personnel with more precise location coordinates than an aircraft's ELT signals.

After the accident, the aviation section also developed study guides for each of the section aircraft, instituted monthly aviation section safety meetings, increased flight training time, developed and incorporated programs to track and monitor quarterly training and proficiency checks for aviation section pilots (in addition to the annual "factory" checkrides), and designated section safety and training officers for missions. The aviation section also instituted a tactical flight officer training program to provide dedicated and trained observers. In addition, the aviation section created an aviation life support and equipment program to ensure that aircraft occupants have the equipment necessary to assist in their safe escape, survival, and recovery during an accident or other emergency.

1.18 Additional Information

1.18.1 New Mexico Search and Rescue Act and Plan

The New Mexico Search and Rescue Act (SAR Act), which was made law in 1978, governs SAR operations in the state of New Mexico. The New Mexico Search and Rescue Plan, dated January 1, 1996, is a working document that supports the SAR Act.

At the time of the accident, every NMSP district had police officers who were trained to function as mission initiators. When a call came in, the mission initiator investigated the need for SAR and, if needed, contacted a SAR incident commander, after which SAR volunteers would be contacted. SAR incident commanders would normally set up an incident command post near the search area. If an incident commander determined that aircraft SAR support was needed,[84]

[84] Available SAR aircraft support options included the NMSP, the Civil Air Patrol, the New Mexico National Guard, or a private helicopter emergency medical services operator.

they had to request that support through the area commander, who would oversee the incident commander. According to the SAR plan, the incident commander would provide the area commander with a description of the situation, the related weather conditions, the urgency of the mission, and an assessment of the type of aircraft and related equipment he or she thought would be most useful under the circumstances. If the area commander chose to request NMSP aircraft support, he or she should pass the relevant information described in the previous sentence (such as weather information, urgency, and equipment needed, for example) directly to the on-duty pilot so the pilot could make a decision about whether to proceed.

1.18.2 Public Aircraft Operations

Public aircraft, as defined by Public Law 103-411, the Independent Safety Board Act Amendment of 1994, are exempt from many FAA regulations applicable to civil aircraft. The statute, which became effective April 23, 1995, narrowed the definition of public aircraft with the intent that government-owned aircraft, which operate for commercial purposes or engage in the transport of passengers, be subject to the regulations applicable to civil aircraft.[85] However, the law specifically does not apply to SAR, firefighting, or law enforcement operations. During the NTSB's February 3 through 6, 2009, public hearing on the safety of helicopter emergency medical services (HEMS) operations,[86] FAA representatives testified that, with the exception of operations within the National Airspace System, the FAA has no statutory authority to regulate public aircraft operations. FAA Advisory Circular (AC) 00.1-1, "Government Aircraft Operations," dated April 19, 1995, provides "guidance on whether particular government aircraft operations are public aircraft operations or civil aircraft operations under the statutory definition of public aircraft." On the subject of SAR, the AC states the following:

> This term is commonly used to mean operations conducted to locate and rescue persons who are lost, injured, and/or exposed to some degree to danger or harm. Generally, the use of an aircraft is indispensable to the search effort or is the only feasible means of recovering the victim. Persons rescued would be considered "associated with" the activity.

The AC further states the following:

> …persons engaging in [SAR] operations from an aircraft would be considered necessary for the performance of the governmental function. Also included would be persons who are being carried to a remote search area from which they would conduct ground search and rescue operations, provided that the use of the aircraft is necessary for the performance of that mission.

[85] The NTSB performed a safety study of public aircraft safety, adopted October 23, 2001. The study concluded that public aircraft experienced fewer accidents per flight hour than general aviation aircraft but had accidents more frequently than aircraft operating under 14 CFR Part 135 or Part 121. The study also concluded that the use of different accident and activity data collection systems made it difficult, if not impossible, to compare accident rates for public aircraft operators. As a result of this study, the NTSB issued eight safety recommendations to the FAA and two safety recommendations to the General Services Administration. For more information, see *Public Aircraft Safety*, Safety Study NTSB/SS-01-01 (Washington, DC: National Transportation Safety Board, 2001) at <http://www.ntsb.gov/Publictn/A_Stu.htm>.

[86] For details, see the NTSB's website at <http://www.ntsb.gov/events/Hearing-HEMS/default.htm>.

FAA Order 8900.1, volume 3, chapter 14, section 2, "Public Aircraft Operations and Surveillance, Government Aircraft Operations versus Civil Aircraft Operations," part 3-565, "Surveillance," dated September 13, 2007, states that "government-owned aircraft operators holding any type of FAA certification will be included in the normal surveillance activities such as spot inspections of the aircraft and aircraft records." Further, the order provides the following example: "If an operation is considered public and the operator holds an airworthiness certificate, its maintenance records are eligible for review." Additionally, it states that "government-owned aircraft operators that are conducting public aircraft operations should be included in the [flight standards district office] FSDO's annual planned surveillance activities to ensure that the operator's status remains unchanged."

The accident helicopter was maintained under a standard airworthiness certificate, issued March 20, 2003. The aviation section maintenance technician told investigators that FAA inspectors had not visited the NMSP aviation section facility to conduct an inspection of the helicopter since the maintenance technician was hired in September 2005. FAA personnel at the local FSDO told NTSB investigators that they had not conducted any oversight of NMSP operations because NMSP was a public operator.

1.18.3 Airborne Law Enforcement Association Standards

The Airborne Law Enforcement Association (ALEA) was founded in 1968 as a non-profit association comprised of local, state, and other public aircraft operators engaged in law enforcement activities. The association's mission is to "support, promote and advance the safe and effective utilization of aircraft by governmental agencies in support of public safety missions through training, networking, advocacy and educational programs." At the time of the accident, ALEA's records indicated about 3,500 member agencies in the association. Although ALEA's records showed that none of the NMSP aviation section pilots were members of ALEA at the time of the accident[87] (nor was the NMSP a member organization), the current aviation section pilots are all members.

ALEA has established multiple programs to aid in the organization, safety, and efficiency of airborne law enforcement units.[88] The association makes available to its members a comprehensive start-up guide, which contains detailed standards for law enforcement units to use in developing a set of SOPs, and numerous example manuals.[89] In addition, ALEA provides members with an extensive database of safety-related research and resource links and, if opted for by a public operator, an accreditation program. The accreditation program is designed to objectively evaluate and certify a participating aviation unit's overall compliance with ALEA's standards with a goal of "safe, efficient, and accident-free aviation operations in support of law enforcement missions." An audit process (to ensure that safety management efforts are effective) is included as part of the ALEA accreditation program. ALEA also provides and encourages the use of an SMS toolkit for aviation sections to develop an SMS program.

[87] During postaccident discussions, the then part-time pilot indicated that he had been a member of ALEA for more than 20 years except for 1 year when NMSP forgot to renew his membership.

[88] See ALEA's website at <http://www.alea.org>.

[89] According to ALEA's executive director, most small airborne law enforcement units use the association's sample manuals, standards, and guides to create their rules and procedures.

Further, ALEA offers a library that contains explanations of public aircraft, the laws that affect police airborne units, and questions and answers concerning public aircraft. According to the ALEA website, the association continues to update its standards. The website contains a members-only section that allows members immediate access to sample manuals, updates, and other resources. In addition, ALEA conducts regional safety seminars and a weeklong national conference and exposition annually.[90] (According to NMSP aviation section personnel, all NMSP pilots and tactical flight officers attended ALEA training in April 2011.)

1.18.4 Safety Management System Programs

In recent years, the International Civil Aviation Organization, FAA, International Helicopter Safety Team, ALEA, and the NTSB have encouraged aviation service providers to adopt SMS programs.[91] A successful SMS program incorporates proactive safety methods to evaluate a company's flight and maintenance operations to, at a minimum, identify safety hazards, ensure that remedial action necessary to maintain an acceptable level of safety is implemented, provide for continuous monitoring and regular assessment of the safety level achieved, and continuously improve the company's overall level of safety. Further, a successful SMS approach relies on senior management to develop a formal safety policy, establish safety objectives, develop standards of safety performance, and take the lead in fostering an organizational safety culture. Research has shown that this kind of management involvement plays a key role in the success of organizational safety programs.[92]

At the NTSB's February 3 through 6, 2009, public hearing on the safety of HEMS operations, representatives of the FAA and ALEA stated that an SMS program can be scaled to suit the size and characteristics of a specific operator.

[90] For example, issues addressed during the 2010 national conference included tactical flight officer selection and training, helicopter rescue and aerial firefighting, night operations, and aviation physiology and safety equipment.

[91] For additional information, see International Civil Aviation Organization, *Safety Management Manual*, 2nd ed. ICAO Doc 9859 (Montreal, Quebec, Canada: International Civil Aviation Organization, 2009); *Safety Management Systems for Aviation Service Providers*, Advisory Circular 120-92A, (Washington, DC: U.S. Department of Transportation, Federal Aviation Administration, 2010); International Helicopter Safety Team, *Safety Management System Toolkit* (Alexandria, Virginia: U.S. Joint Helicopter Safety Implementation Team, 2009); Airborne Law Enforcement Association, *Safety Management System Toolkit,* (Frederick, Maryland: Airborne Law Enforcement Association, 2009). Also see (a) *Crash of Pinnacle Airlines Flight 3701, Bombardier CL-600-2B19, N8396A, Jefferson City, Missouri, October 14, 2004,* Aircraft Accident Report NTSB/AAR-07/01 (Washington, DC: National Transportation Safety Board, 2007); (b) *In-flight Fire, Emergency Descent, and Crash in a Residential Area, Cessna 310R, N501N, Sanford, Florida, July 10, 2007,* Aircraft Accident Summary Report NTSB/AAR-09/01/SUM (Washington, DC: National Transportation Safety Board, 2009); and (c) NTSB recommendation letter to FAA Administrator J. Randolph Babbitt, dated September 24, 2009 <http://www.ntsb.gov/Recs/letters/2009/A09_87_96.pdf>.

[92] See (a) M.J. Smith and others, "Characteristics of Successful Safety Programs, *Journal of Safety Research*, vol. 10, no. 1 (1978), pp. 5–15 and (b) H.S. Shannon, J. Mayr, and T. Haines, "Overview of the Relationship Between Organizational and Workplace Factors and Injury Rates," *Safety Science,* vol. 26, no. 3 (1997), pp. 201-217.

1.18.5 Previously Issued Safety Recommendations

1.18.5.1 Pilot Flight and Duty Time and Rest Period Limitations

On February 7, 2006, the NTSB issued Safety Recommendation A-06-10 following its investigation of an October 19, 2004, accident in which Corporate Airlines (doing business as American Connection) flight 5966 struck trees on final approach and crashed short of runway 36 at Kirksville Regional Airport, Kirksville, Missouri.[93] Safety Recommendation A-06-10, which has been on the NTSB's Most Wanted List of Transportation Safety Improvements since 2006, asked the FAA to do the following:

> Modify and simplify the flight crew hours-of-service regulations to take into consideration factors such as length of duty day, starting time, workload, and other factors shown by recent research, scientific evidence, and current industry experience to affect crew alertness.

In a September 9, 2009, response, the FAA reported that it held a 3-day fatigue symposium that presented the most current scientific knowledge of fatigue in aviation. The FAA also reported that it had developed a plan that included developing a notice of proposed rulemaking (NPRM) on flight time limitations, duty period limits, and rest requirements for pilots in operations under Part 121 and 135. In a December 29, 2009, letter, the NTSB retained the classification "Open—Unacceptable Response" pending publication of the NPRM.

On September 14, 2010, the FAA published an NPRM, "14 CFR Parts 117 and 121: Flightcrew Member Duty and Rest Requirements," that proposed to amend Part 121 and establish Part 117 to create a single set of flight time limitations, duty period limits, and rest requirements for pilots in Part 121 operations. The NTSB's November 15, 2010, response to the NPRM noted that the proposed rule takes into consideration length of duty day, starting time, workload, and time-zone changes and, if adopted, would likely meet the intent of Safety Recommendation A-06-10.

As a result of its investigation of a February 13, 2008, incident in which the flight crew of a Bombardier CL-600-2B19, operated by Mesa Airlines as *go!* flight 1002, flew past the destination airport because both the captain and first officer fell asleep during the flight, the NTSB issued Safety Recommendation A-09-64, which asked the FAA to do the following:.

> Conduct research examining how pilot fatigue is affected by the unique characteristics of short-haul operations and identify methods for reducing those effects; include research into the interactive effects of shift timing, consecutive days of work, number of legs flown, and the availability of rest breaks.

The FAA's October 23, 2009, response indicated that the aviation rulemaking committee that was established to assist in developing the flight crew duty and rest requirements NPRM

[93] For more information, see *Collision with Trees and Crash Short of Runway, Corporate Airlines Flight 5966, BAE Systems BAE-J3201, N875JX, Kirksville, Missouri, October 19, 2004,* Aircraft Accident Report NTSB/AAR-06/01 (Washington, DC: National Transportation Safety Board, 2006) at <http://www.ntsb.gov/Publictn/A_Acc1.htm>.

was also tasked with developing a single approach for addressing fatigue in all Part 121 and 135 operations, including short-haul operations. Therefore, the FAA did not believe that additional research into short-haul operations was merited at that time. The NTSB stated in its June 8, 2010, response that it looked forward to reviewing the proposed revisions, including those that will address the unique aspects of short-haul operations, but noted once again that there is little or no scientific research describing the interaction of the unique characteristics of short-haul operations (such as the interaction of time of day, cumulative time on duty, and number of legs flown) on flight crew fatigue. The NTSB asked the FAA to provide a list of the scientific literature on the unique characteristics of short-haul operations and flight crew fatigue that the aviation rulemaking committee used as the basis for its recommendations on this issue. Accordingly, Safety Recommendation A-09-64 was classified "Open—Acceptable Response," pending the FAA's performance of the recommended action or provision of the requested list of research.

The NTSB observed in its November 15, 2010, response to the September 14, 2010 NPRM that, although the proposed rule did shorten flight duty periods and maximum flight time based on the number of flight segments that exceed four in 1 day (which should help to mitigate fatigue in short-haul operations), it did not specifically address Safety Recommendation A-09-64. The NTSB response stated that, as acknowledged in the NPRM, there is little data directly addressing short-haul operations, and, as recommended in Safety Recommendation A-09-64, research into factors affecting the development of fatigue in these operations (especially in the context of the proposed rule) would be beneficial.

1.18.5.2 Safety Management Systems

On September 24, 2009, as a result of testimony given at the NTSB's February 2009 public hearing on HEMS safety and the investigative findings of several 2008 HEMS accidents,[94] the NTSB issued several safety recommendations to the FAA, public HEMS operators, and other federal agencies.[95] Safety Recommendations A-09-89 (to the FAA) and A-09-98 (to 40 public HEMS operators) address the implementation of SMS for these operations. Safety Recommendation A-09-89 asked the FAA to do the following:

> Require helicopter emergency medical services operators to implement a safety management system program that includes sound risk management practices.

In a December 23, 2009, response, the FAA stated that it is considering requirements for HEMS operations in its Part 135 SMS rulemaking project. Pending the NTSB's review of the proposed rule, Safety Recommendation A-09-89 was classified "Open—Acceptable Response" on October 7, 2010.

[94] The associated safety recommendation letter cited the following accidents: NTSB case numbers DFW08FA062, CHI08FA128, DEN08FA101, DEN08MA116A and DEN08MA116B, MIA08MA203, and CEN09MA019. The briefs for these accidents can be accessed online at <http://www.ntsb.gov/ntsb/aviationquery/index.aspx>.

[95] Because the NMSP aviation section does not perform HEMS operations, the section did not receive these safety recommendations.

Safety Recommendation A-09-98 asked 40 public HEMS operators to do the following:

> Implement a safety management system program that includes sound risk management practices.

To date, 2 of the 40 public HEMS recipients have replied, and the recommendation has an overall status of "Open—Acceptable Response." Of particular note is the October 22, 2009, response from EMS STAR Flight in Austin-Travis County, Austin, Texas, which indicated that, in 2008, the organization implemented an SMS program that includes a risk assessment tool for HEMS operations and, in 2009, the program was revised. The response also stated that STAR Flight was developing a risk assessment tool for its other public use responders (including SAR). Noting that these actions exceeded the intent of the recommendation, the NTSB classified it "Closed—Exceeds Recommended Action" for STAR Flight on June 2, 2010.

1.18.5.3 Risk Management and Assessment

On February 7, 2006, the NTSB issued Safety Recommendation A-06-13 (which was added to the NTSB's Most Wanted List of Transportation Safety Improvements in October 2008) as a result of its special investigation of a number of accidents between January 2002 and January 2005 involving aircraft performing emergency medical services (EMS) operations.[96] Safety Recommendation A-06-13 was reiterated in November 2009 following the NTSB's investigation of the accident involving an Aerospatiale (Eurocopter) SA365N1 that was registered to and operated by the Maryland State Police (MSP) as a public medical evacuation flight and impacted terrain during an instrument landing system approach.[97] Safety Recommendation A-06-13 asked the FAA to do the following:

> Require all emergency medical services (EMS) operators to develop and implement flight risk evaluation programs that include training all employees involved in the operation, procedures that support the systematic evaluation of flight risks, and consultation with others trained in EMS flight operations if the risks reach a predefined level.

In a March 12, 2010, letter, the NTSB noted that this recommendation remained classified "Open—Unacceptable Response," based on the FAA's stated intent to pursue rulemaking—rather than revise the operations specifications covering HEMS operators, as previously reported—to ensure all operators develop and implement flight risk evaluation programs. The NTSB stated its concern that often FAA regulatory projects require considerable time to issue the NPRM and to enact the final rule. The NTSB also noted that such a requirement should have minimal implementation costs and, given the 94 percent voluntary compliance the FAA reported in its August 17, 2009, response, should encounter little opposition. On October 12, 2010, the FAA published an NPRM titled "14 CFR Parts 1, 91, 120, and 135 Air

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[96] For more information, see *Special Investigation Report on Emergency Medical Services Operations*, Special Investigation Report NTSB/SIR-06-01 (Washington, DC: National Transportation Safety Board, 2006) at <http://www.ntsb.gov/Publictn/A_Stu.htm>.

[97] For more information, see *Crash During Approach to Landing of Maryland State Police Aerospatiale SA365N1, N92MD, District Heights, Maryland, September 27, 2008*, Aircraft Accident Report NTSB/AAR-09/07 (Washington, DC: National Transportation Safety Board, 2009) at <http://www.ntsb.gov/Publictn/A_Acc1.htm>.

Ambulance and Commercial Helicopter Operations, Part 91 Helicopter Operations, and Part 135 Aircraft Operations; Safety Initiatives and Miscellaneous Amendments; Proposed Rule." The NPRM proposed to require all HEMS operators to implement preflight risk assessment programs to include the conduct of formal risk assessments before each mission and consideration of the risks associated with each leg of a mission. The NTSB noted in its January 10, 2011, response to the NPRM that, if adopted, the proposed change would be responsive to Safety Recommendation A-06-13.

Following its investigation of the September 27, 2008, MSP accident, the NTSB issued several recommendations to 40 public HEMS operators on November 13, 2009. The final report noted that the accident demonstrated the need for all EMS operators—both public and civil—to develop and implement flight risk evaluation programs and that, because the FAA does not have the authority to regulate public operators, they would not be required to comply even if flight risk evaluation programs were required for HEMS operators. Safety Recommendation A-09-131 asked 40 public HEMS operators to do the following:

> Develop and implement flight risk evaluation programs that include training for all employees involved in the operation, procedures that support the systematic evaluation of flight risks, and consultation with others trained in helicopter emergency medical services flight operations if the risks reach a predefined level.

This recommendation is currently classified "Open—Await Response."

1.18.5.4 Flight Following and Dispatch Procedures

As a result of the 2006 special investigation of EMS operations, the NTSB also issued Safety Recommendation A-06-14, which asked the FAA to do the following:

> Require emergency medical services operators to use formalized dispatch and flight-following procedures that include up-to-date weather information and assistance in flight risk assessment decisions.

In May 2008, the FAA published AC 120-96, "Integration of Operations Control Centers into Helicopter Emergency Medical Services Operations," which provides detailed guidance about the creation and operation of operations control centers (OCC) for HEMS operations, as well as guidance for establishing the recommended formalized dispatch and flight-following procedures. The FAA also conducted a survey in January 2009 to determine how many operators had voluntarily adopted these recommended best practices and found that 89 percent had integrated an OCC into their operations. On January 23, 2009, the NTSB indicated that, although the AC was responsive to the recommendation, it was only guidance and that the FAA needed to require that all EMS operators incorporate the guidance contained in the AC into their operations. Pending that action, Safety Recommendation A-06-14 was classified "Open—Acceptable Response."

The FAA's October 12, 2010, NPRM contained proposed requirements to address this recommendation, proposing that commercial HEMS operators with 10 or more helicopters that are engaged in HEMS activities establish OCCs. In its January 10, 2011, response to the NPRM, the NTSB stated that it did not agree with this limitation and that the requirement for an OCC should be applied to all HEMS operators. The NTSB noted that AC 120-96 provides guidance on how to scale an OCC to fit the size of an organization. The NTSB also disagreed with the FAA's contention that preflight risk assessments may suffice for smaller operators in lieu of an OCC, stating that preflight risk assessments cannot substitute for the services and support provided by an OCC. The NTSB stated that the proposed requirement was only partially responsive to Safety Recommendation A-06-14.

Safety Recommendation A-09-132 also resulted from the NTSB's investigation of the September 27, 2008, fatal accident involving an Aerospatiale (Eurocopter) SA365N1, registered to and operated by MSP as a public medical evacuation flight. Although MSP does have formalized dispatch and flight-following procedures and access to up-to-date weather information, the final report expressed concern that other public HEMS operators may not have dispatch and flight-following procedures or include weather information and assistance in flight risk assessment decisions. Safety Recommendation A-09-132 asked 40 public use HEMS operators to "Use formalized dispatch and flight-following procedures that include up-to-date weather information and assistance in flight risk assessment decisions." This recommendation is currently classified "Open—Await Response."

1.18.5.5 Helicopter Pilot Training for Inadvertent Encounters with IMC

As a result of its February 2009 public hearing on HEMS safety and the investigative findings of several 2008 HEMS accidents, the NTSB also issued Safety Recommendation A-09-97 to 40 public HEMS operators, asking them to do the following:

> Conduct scenario-based training, including the use of simulators and flight training devices, for helicopter emergency medical services (HEMS) pilots, to include inadvertent flight into instrument meteorological conditions and hazards unique to HEMS operations, and conduct this training frequently enough to ensure proficiency.

Safety Recommendation A-09-97 is currently classified "Open—Await Response" for 39 of the 40 recipients. One recipient, EMS STAR Flight of Austin-Travis County, Austin, Texas, reported that its director of aviation and chief pilot conduct quarterly flight training that includes emergency IMC recovery. All crewmembers, flight paramedics, and flight nurses are included in this training and have roles and responsibilities in IMC encounters. The organization also reported that the director of aviation and chief pilot had evaluated a flight simulator at American Eurocopter Corporation for inclusion in advancing their instrument and emergency procedures training and planned to add this training to the annual pilot training program immediately.

In a June 2, 2010, letter, the NTSB commended STAR Flight for incorporating simulator training into its program and noted that the use of simulators permits pilots to practice procedures and maneuvers that they would never perform in a helicopter except in an emergency. The NTSB asked to be advised of which topics are covered in simulators and flight training devices and which are covered in actual helicopter flight training after the training program has been revised. Safety Recommendation A-09-97 is currently classified "Open—Acceptable Response" for EMS STAR Flight.

1.18.5.6 FAA Oversight of Public Operations

On December 27, 2010, the NTSB issued Safety Recommendation A-10-150 to the FAA following the investigation of an August 5, 2008, fatal accident in which a Sikorsky S-61N helicopter impacted trees and terrain during the initial climb after takeoff from a helispot in mountainous terrain near Weaverville, California.[98] The helicopter was being operated by the U.S. Forest Service (USFS) as a public flight to transport firefighters from one helispot to another. The USFS had contracted with Carson Helicopters, Inc., of Grants Pass, Oregon, for the services of the helicopter, which was registered to Carson Helicopters, Inc., and leased to Carson Helicopter Services, Inc., of Grants Pass. The NTSB determined that the accident occurred, in part, due to insufficient oversight by the USFS and the FAA.[99] Safety Recommendation A-10-150 asked the FAA to do the following:

> Take appropriate actions to clarify Federal Aviation Administration (FAA) authority over public aircraft, as well as identify and document where such oversight responsibilities reside in the absence of FAA authority.

The FAA's March 28, 2011, response to the NTSB indicated that in partial response to this safety recommendation, on January 20, 2011, it held a public forum to propose initial policy changes related to public aircraft operations. The FAA indicated that it also plans to publish a notice in the *Federal Register* to advise of proposed public aircraft operational policy changes. Based on the comments received from this notice and the public forum, the FAA will revise policy documents as necessary to clarify FAA authority over public aircraft. While the NTSB is evaluating this response, Safety Recommendation A-10-150 is classified "Open—Initial Response Received."

[98] For more information, see *Crash During Takeoff of Carson Helicopters, Inc., Firefighting Helicopter Under Contract to the U.S. Forest Service, Sikorsky S-61N, N612AZ, Near Weaverville, California, August 5, 2008,* Aircraft Accident Report NTSB/AAR-10/06 (Washington, DC: National Transportation Safety Board, 2010) at <http://www.ntsb.gov/Publictn/A_Acc1.htm>.

[99] The full probable cause statement for this accident is as follows: "The National Transportation Safety Board determines that the probable causes of this accident were the following actions by Carson Helicopters: 1) the intentional understatement of the helicopter's empty weight, 2) the alteration of the power available chart to exaggerate the helicopter's lift capability, and 3) the practice of using unapproved above-minimum specification torque in performance calculations that, collectively, resulted in the pilots relying on performance calculations that significantly overestimated the helicopter's load-carrying capacity and did not provide an adequate performance margin for a successful takeoff; and insufficient oversight by the USFS and the Federal Aviation Administration (FAA)."

"Contributing to the accident was the failure of the flight crewmembers to address the fact that the helicopter had approached its maximum performance capability on their two prior departures from the accident site because they were accustomed to operating at the limit of the helicopter's performance. Contributing to the fatalities were the immediate, intense fire that resulted from the spillage of fuel upon impact from the fuel tanks that were not crash resistant, the separation from the floor of the cabin seats that were not crash resistant, and the use of an inappropriate release mechanism on the cabin seat restraints."

2. Analysis

2.1 General

The FAA has the authority to oversee the airworthiness of certificated aircraft used in public operations; however, it had not provided airworthiness surveillance for the accident helicopter. The investigation determined that the accident helicopter was properly certificated and maintained in accordance with NMSP policies and the manufacturer's recommended maintenance program. There was no evidence of any preimpact structural, engine, or system failures.

The pilot had been taking fluoxetine to treat depression for 7 years before the accident; however, studies have shown that normal doses of fluoxetine have had minimal or no adverse effect on patient performance and might actually improve the performance of depressed patients on various tasks. The pilot's personal medical records noted that the pilot had not experienced adverse effects from his use of this medication. Therefore, it is unlikely that the pilot's use of fluoxetine to treat depression played any role in this accident. The investigation found no evidence that the pilot had any preexisting medical or toxicological condition that adversely affected his performance during the accident flight. Although the pilot had not reported his use of fluoxetine on his FAA medical certificate applications, the FAA has recently (since April 2010) permitted pilots taking fluoxetine for depression to receive a medical certificate through the agency's waiver process and has offered amnesty to pilots who had not previously disclosed use of this medication.

The NTSB concludes that postaccident examination of the helicopter's seats and restraint systems revealed no evidence of preimpact inadequacies. The pilot and the hiker were ejected from the helicopter when their seats and restraint systems were subjected to forces beyond those for which they were certificated during the helicopter's roll down the steep, rocky mountainside.

According to the spotter's postaccident statements, the pilot survived the accident and responded to the spotter's initial calls; however, at some time during the night, the pilot stopped responding to the spotter's calls. Throughout the night, the SAR ground teams were traversing more than 5 miles of rugged terrain in darkness and adverse weather conditions, toward the accident location (based primarily on AFRCC-provided ELT coordinates). New Mexico National Guard helicopters that were launched to find the accident site during the night were hampered and eventually delayed until the next day by the adverse weather conditions. The SAR ground teams reached the general accident area the next morning and found the spotter about 1155; they did not locate the main helicopter wreckage until just before sunset that day. The NTSB concludes that neither the airborne nor ground SAR personnel could have reached the pilot before he died of exposure given the adverse weather conditions, which precluded a prompt airborne SAR response and also hindered the ground SAR teams' progress; the darkness and the rugged terrain in which the ground SAR teams were responding; the distance they had to travel; and the seriousness of the pilot's injuries.

The radar data indicated that, beginning a little more than 1 minute after the helicopter first appeared on radar after the accident takeoff, the helicopter reversed direction, climbed, and flew erratically, crossing terrain as high as 12,500 feet before descending rapidly near the crash site. Dispatch records showed that, shortly after the erratic flying began, the pilot radioed the dispatcher and asked if she could hear him. After the dispatcher responded in the affirmative, the pilot stated, "…I struck a mountainside." Postaccident wreckage examination indicated that the accident helicopter's tail rotor skid tube was bent upward (toward the tailboom) from its original position and exhibited scratches and abrasions in all directions. In addition, the outboard 9 to 10 inches of the two tail rotor blades were missing and were not recovered along the main wreckage path, indicating that the helicopter did strike something prior to the identified wreckage field. The pilot continued to key his microphone, and on the dispatch recording he could be heard breathing rapidly for about the next 39 seconds.

Because there was no evidence of any preimpact structural, engine, or system failures with the helicopter, it is likely that the helicopter's initial collision with terrain resulted from either 1) pilot geographic disorientation (lack of awareness of position) and a controlled collision with terrain, because the pilot likely could not see the surrounding terrain in the dark night[100] IMC conditions or 2) pilot spatial disorientation and an uncontrolled collision with terrain, because multiple risk factors for spatial disorientation (the pilot's lack of a helicopter instrument rating and lack of helicopter instrument flying proficiency, maneuvering in dark night conditions, and turbulence) were present during the accident flight.[101]

The first of these scenarios, geographic disorientation, would likely result in a relatively stable flightpath leading up to the initial collision with terrain followed by an erratic flightpath. Spatial disorientation and loss of control, on the other hand, would likely result in a more erratic flightpath before the initial collision. Using the radar data to distinguish between these two possibilities would require clear identification of the timing and location of the initial collision with terrain. While it appears that the pilot reported to the dispatcher that he hit the mountainside shortly after the erratic flying began, without knowing the exact point of impact, it is unclear whether the erratic flying led to the impact or if the erratic flying occurred because of the impact. As a result, it was not possible to evaluate the relative likelihood of these two possible causal explanations.

The remainder of this analysis discusses safety issues related to the following: the pilot's decision-making, flight and duty times and rest periods, NMSP staffing, SMS programs and risk assessments, communications between the NMSP pilots and volunteer SAR organization personnel, instrument flying, and flight-following equipment.

2.2 Pilot Decision-Making

2.2.1 Decision to Launch on the Mission

An NMSP dispatcher contacted the accident pilot about 1756 (almost 3 hours after he had completed his normal 8-hour work shift) regarding use of the NMSP helicopter to aid in SAR efforts to find a lost hiker in the mountains northeast of Santa Fe. According to NMSP dispatch

[100] As previously noted, there was no moonlight at the time of the accident.

[101] Spatial disorientation is the mistaken perception of an aircraft's attitude relative to the earth.

recordings, the pilot was initially reluctant to launch on the accident mission because he believed it was too windy; the pilot stated that he would prefer to go up to look for the hiker in the morning. The pilot's concern about the windy conditions likely stemmed from a flight he operated with the full-time helicopter pilot a few hours earlier when the two pilots encountered winds gusting to near 40 knots on the ground in Las Vegas, New Mexico,[102] and adjusted their return flight to SAF. However, minutes after the request to fly the accident mission, the pilot called the dispatcher back and told her that he had "checked the wind"[103] and could "probably go up and take a look" for the missing hiker.

The full-time helicopter pilot said that the aviation section pilots normally obtained the TAF and METARs for SAF using the NOAA Aviation Weather Center website rather than checking the area forecast for a local flight. TAFs and METARs are only valid within a 5-mile radius of the airport, but they provide detailed local weather information. It is possible, therefore, that the accident pilot reviewed the TAF and/or METAR for SAF before the accident mission. The TAF in effect for SAF at that time indicated that, between 1800 and 2200, temporary conditions would exist for the next 4 hours that included a cumulonimbus cloud ceiling at 6,000 feet agl (about 12,000 feet msl). (If such conditions extended an additional 15 miles to the northeast, there was a potential for thunderstorms and mountain obscuration in the search area during the mission.) The area forecast in effect for the higher elevations in which the SAR efforts took place predicted broken clouds at 14,000 feet, layered clouds to 22,000 feet, with widely scattered light rain showers and isolated thunderstorms and gusting wind until 2100.

A little more than 2 hours of daylight remained when the accident pilot was notified about the mission, and he might have thought it would be a short mission. The pilot knew that the hiker was in communication with the NMSP dispatcher via cellular telephone, and he might have believed that the hiker could quickly guide him to her location. This belief and the fact that the weather at SAF was warm and clear and the wind was calmer than earlier in the day likely contributed to the pilot's decision to accept the flight. Further, the mountains in the search area were visible from SAF, and the pilot would have seen that they were clear of clouds at the time of departure. The pilot likely believed that he could fly to the search area (which was only 20 nm from SAF) and return to SAF quickly and safely before dark. (Several preflight comments indicated that the pilot predicted that the mission would be a quick "in and out" flight.) However, the hiker was unable to provide the pilot with much of the useful guidance that lost hikers can typically provide (such as describing her position relative to the sun, nearby landmarks, or terrain features), likely in part because of her limited proficiency with the English language and the remote, wooded, and unfamiliar area in which she was lost. The SAR mission extended into nighttime. According to the DPS cabinet secretary, when he was a pilot in the NMSP aviation section, a supply of cold-weather gear was carried on board, and he routinely carried a survival kit and extra blankets on such missions.

Additionally, based on the elevation of the targeted search area (estimated to be 11,700 feet), the pilot should have anticipated that the helicopter would be operating near the

[102] Las Vegas, New Mexico, is located about 40 miles east of SAF and 34 miles southeast of the accident location.

[103] The NTSB was unable to determine which specific weather reports the pilot reviewed before accepting the accident mission.

upper limit of its hovering and/or landing performance capabilities. (The helicopter's dual-engine hover ceiling was 11,800 feet.)[104]

The NTSB concludes that, when the pilot made the decision to launch, the weather and lighting conditions, even at higher elevations, did not preclude the mission; however, after accepting a SAR mission involving flight at high altitudes over mountainous terrain, with darkness approaching and with a deteriorating weather forecast, the pilot should have taken steps to mitigate the potential risks involved, for example, by bringing cold-weather survival gear and ensuring that night vision goggles were on board and readily available for the mission.

Although the pilot may have considered some personal restrictions regarding maximum altitudes, terrain characteristics, and winds that would permit a safe landing in the search area, no official NMSP risk assessment policy existed and, therefore, there was no evidence that the pilot considered such restrictions. For additional information regarding risk assessments, see section 2.4.1.

2.2.2 Decision-Making During the Mission

About 2010, when the pilot finally located the lost hiker, she was in a small clearing in a wooded area, with no suitable landing site nearby. The pilot maneuvered above the hiker and told the dispatcher to instruct the hiker to walk in the direction he was flying to reach the landing site. It is possible that the pilot initially expected the hiker to walk up to the helicopter landing site, and, as a result, the pilot likely believed that they would be able to depart the remote landing site relatively quickly after landing. However, although the hiker was ambulatory, she indicated to the dispatcher that she was cold and could not see well enough to move toward the helicopter's landing site. NMSP dispatch records show that, about 2015 (about 4 minutes before sunset), the dispatcher asked if the pilot could land on top of the hill and send the spotter down to retrieve the hiker. The pilot, sounding exasperated, said, "That's about the only thing we're going to be able to do."

According to the spotter, during the pilot's efforts to evaluate the nearest suitable landing site, the helicopter encountered strong winds and turbulence below 200 feet agl, it was getting dark, and low clouds were approaching from the west, all of which would have made the landing more hazardous. Although the incoming weather and the increasing darkness meant that the operation was growing increasingly risky, the pilot made several passes over the landing site and, after determining that a safe landing could be accomplished, proceeded with the landing. About 2030 (11 minutes after sunset), the pilot landed the helicopter on a ridge about 0.5 mile uphill from the hiker and at an elevation of about 11,600 feet. The spotter reported that they encountered moderate turbulence when they arrived at the landing site and that, when they exited the helicopter after landing to pick up the hiker, they encountered strong wind and sleet.

When the spotter contacted the dispatcher by cellular telephone after the helicopter had landed, the dispatcher again reported that the hiker "did not want to move." The pilot subsequently called the dispatcher to clarify the hiker's intentions, and the dispatcher told him that she believed that the hiker expected them to help her to the helicopter. As a result, about

[104] The accident helicopter's dual- and single-engine service ceilings were 19,600 and 13,100 feet, respectively.

2033, the pilot (who was wearing an unlined summer-weight flight suit) told the dispatcher he was going to "walk down the hill a little bit."[105] He indicated that he expected the weather conditions to deteriorate and stated, "…if it does that, I've got to get the [expletive] out of here." The pilot added, "I'm not going to spend a lot of time or we're going to have two search and rescues." There is no evidence that the pilot took the time to consider his options; rather, he promptly left the helicopter and walked down the heavily forested slope to find the hiker without stopping to get his flashlight out of his flight bag. These communications and actions suggest that the pilot was feeling increasing stress as a result of the deteriorating conditions and that he was fixated on the goal of retrieving the hiker and taking off again as quickly as possible.

The spotter stated that the strong wind continued to blow while the pilot was recovering the hiker. By the time the pilot and hiker returned to the helicopter (about 50 minutes after the pilot left the helicopter to retrieve the hiker and more than 1 hour after sunset), the sleet had turned to snow, and the clouds had lowered. Other witnesses who were camping at a lower elevation nearby reported "a heavy overcast" with heavy rain within 30 minutes of the accident. These conditions indicated a strong likelihood of reduced visibility and the potential for structural icing. In addition, the remote landing site was surrounded by high, rugged terrain that was no longer visible. Yet the pilot quickly prepared the helicopter for departure and, about 9 minutes after the pilot returned to the helicopter with the hiker, the helicopter was airborne again. According to the spotter, the pilot seemed to indicate that he intended to depart through a narrow path, a "tunnel in the clouds."

An interim risk assessment performed at this point may have indicated to the pilot that a different course of action would be more prudent. Even rudimentary consideration of the adverse weather conditions should have indicated to the pilot that it was no longer safe to take off and attempt to return to SAF at that time. At that point, the only safe option was to wait inside the helicopter at the remote landing site, contact SAR personnel for information and assistance, and wait for the weather conditions to improve. Although the temperature was near freezing, the helicopter provided good shelter, and the pilot could have periodically used its engines to generate heat as needed throughout the night. However, because the remote landing site was less than 15 minutes flying time from SAF, the pilot was likely very tempted to attempt to fly back to SAF rather than wait inside the helicopter for an indefinite period of time. The fact that the helicopter was airborne within about 9 minutes of the pilot's return indicates that the pilot was still fixated on departing as soon as possible, and he did not spend much time considering alternative courses of action.[106]

Taking off in a helicopter in dark (moonless) lighting conditions, with marginal visibility, strong wind, turbulence, low clouds, the potential for structural and/or engine icing conditions, and surrounded by high terrain poses an unacceptably high risk of spatial and/or geographic

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[105] Although the dispatcher suggested that the spotter retrieve the lost hiker, the pilot, who was slightly more appropriately clothed for the conditions, hiked to retrieve her.

[106] In this regard, the pilot's decision-making performance during the accident mission is reminiscent of a category of decision-making error that researchers have labeled "plan continuation error." Plan continuation error has been defined as "failure to revise a flight plan despite emerging evidence that suggests it is no longer safe." [J. Orasanu, L. Martin, and J. Davison, "Cognitive and Contextual Factors in Aviation Accidents," in E. Salas and G.A. Klein, eds., *Linking Expertise and Naturalistic Decision Making* (Mahwah, New Jersey: Lawrence Erlbaum Associates, 2001), pp. 209-225.]

disorientation, which could lead to loss of control and/or a controlled flight into terrain accident. Had the pilot performed an interim risk assessment and considered the external circumstances or discussed them with the spotter,[107] the NMSP dispatcher, or SAR ground personnel, he would have been more likely to recognize the potential hazards associated with an immediate takeoff and might have delayed his departure from the remote landing site until more favorable conditions prevailed. The NTSB concludes that the pilot exhibited poor decision-making when he chose to take off from a relatively secure landing site at night and attempt VFR flight in adverse weather conditions.

2.3 Factors Affecting the Pilot's Decision-Making

This section addresses factors that could have influenced the pilot's decision-making both before accepting the mission and when he took off from the mountain to return to SAF, including fatigue, self-induced pressure, and situational stress.

The NTSB considered whether environmental and/or physiological factors related to the cold temperature or the high altitude might have degraded the pilot's decision-making in this case. The pilot spent about 50 minutes searching for the hiker and carrying her up a steep slope in very cold, windy conditions, in freezing precipitation, while dressed only in an unlined summer-weight flight suit and undergarments. Although cold stress can degrade cognitive performance, especially for tasks that are complex or perceptually demanding,[108] experts on cold exposure at the U.S. Army Research Institute for Environmental Medicine indicated that, based on the pilot's level of exertion and the terrain, the pilot's metabolic rate would likely have been fairly high, offsetting the cold weather's effects and minimizing the risk of hypothermia. After reviewing the circumstances of this accident for evidence of any physiological effects from the high altitude (the pilot was operating in the unpressurized helicopter for more than 2 hours before the accident), U.S. Army Research Institute for Environmental Medicine personnel indicated that the altitude would have affected the pilot very little as well. Because the pilot lived at an altitude of about 6,000 feet, he would likely have been sufficiently acclimatized to operate at higher altitudes.[109] Since the time at altitude was relatively short (about 3 hours), there was likely little hypoxic effect on the pilot's cognitive function.

[107] The SAR commander spoke with the spotter while the pilot was retrieving the hiker and urged the spotter to remain in place and wait for ground teams to arrive if it was not safe to take off. However, it is not clear that the spotter shared this information with the pilot when he returned to the helicopter; the spotter did not recall the pilot raising the possibility of remaining on the mountain overnight.

[108] R.G. Hoffman, "Chapter 12: Human Psychological Performance in Cold Environments," in D.E. Lounsbury, R.F. Bellamy, and R. Zajtchuck, eds., *Medical Aspects of Harsh Environments, Volume 1* (Fort Detrick, Maryland: Department of the U.S. Army, Office of The Surgeon General, Walter Reed Army Medical Center Borden Institute, 2002), pp. 399–400.

[109] For additional information, see S.R. Muza and others, "Residence at Moderate Altitude Improves Ventilator Response to High Altitude," *Aviation, Space, and Environmental Medicine*, vol. 75, no. 10 (2004), pp. 1042–1048.

2.3.1 Fatigue

Scientific research and accident investigations have demonstrated the negative effects of fatigue on human performance,[110] including a breakdown in vigilance, degraded response times, and poor decision-making and risk assessment. As discussed in the NTSB's report on a 1993 accident involving American International Airways flight 808 at Guantanamo Bay, Cuba, fixation on a course of action (for example, the NMSP accident pilot's decision to take off again and fly to SAF) while disregarding critical evidence that the course of action is no longer safe is also consistent with the effects of fatigue.[111] Thus, the pilot's most critical decision during the accident mission—his decision to take off in adverse weather conditions rather than wait on the ground for conditions to improve—was consistent with the effects of fatigue.

Cellular telephone records, notes in the accident pilot's planner, and information provided by the pilot's wife indicate that the pilot's available sleep time between Sunday evening, June 7, and Monday morning, June 8, totaled 4 hours 6 minutes[112] and was split into two separate possible sleep periods (2200 to 2326 on June 7 and 0003 to 0243 on June 8) due to work-related phone calls that occurred between 2326 Sunday night and 0003 Monday morning and between 0243 and 0256 Monday morning. Further, the pilot had to get up earlier than usual because of two missions that he flew between 0300 and 1100 Monday morning.

According to the pilot's wife, her husband normally slept about 8 hours (beginning between 2130 and 2200) in a single consolidated sleep period on a night before a work day. However, the pilot's wife said that he frequently watched television later than usual on Sunday nights; although she did not specifically recall her husband's actions on the Sunday before the accident, he might have still been awake when he began to receive work-related telephone calls about 2326 Sunday night.[113] If the pilot watched television rather than slept during this earlier available sleep period, his maximum available sleep time would have been only 2 hours 35 minutes (again, assuming he used every minute of available sleep). Because of his work-related sleep disruptions and the fragmented nature of the pilot's sleep during the preceding 24 hours, it is highly likely the pilot experienced acute fatigue on Monday, June 8.

Between Monday evening and Tuesday morning (the day of the accident), the pilot was in bed for 8 to 8.5 hours. Additionally, according to his wife, the pilot likely took a 30-minute

[110] For the scientific research, see (a) J.A. Caldwell, "Fatigue in the Aviation Environment: An Overview of the Causes and Effects as Well as Recommended Countermeasures," *Aviation, Space, and Environmental Medicine*, vol. 68, no. 10 (1997), pp. 932–938; (b) D.R. Haslam, "The Military Performance of Soldiers in Sustained Operations," *Aviation, Space, and Environmental Medicine*, vol. 55, no. 2 (1984), pp. 216–221; and (c) G.P. Kruger, "Sustained Work, Fatigue, Sleep Loss, and Performance: A Review of the Issues," *Work and Stress*, vol. 3, no. 1 (1989), pp. 129–141. For accident investigation research, see *A Review of Flightcrew-Involved, Major Accidents of U.S. Air Carriers, 1978 through 1990*, Safety Study NTSB/SS-94/01 (Washington, DC: National Transportation Safety Board, 1994) at <http://www.ntsb.gov/Publictn/A_Stu.htm>.

[111] See *Uncontrolled Collision with Terrain, American International Airways Flight 808, Douglas DC-8-61, N814CK, U.S. Naval Air Station, Guantanamo Bay, Cuba, August 18, 1993*, Aircraft Accident Report NTSB/AAR-94/04 (Washington, DC: National Transportation Safety Board, 1994) at <http://www.ntsb.gov/Publictn/A_Acc2.htm>.

[112] Because people do not normally fall asleep instantaneously, it is likely that the pilot actually slept less than the 4 hours 6 minutes of available sleep time.

[113] The pilot's wife was working at the time, so she could not be certain about the pilot's actions at home.

nap on Tuesday afternoon. Therefore, the pilot could have received as much as 8.5 to 9 hours of sleep in the 24 hours before the accident. Research shows that fatigue-related effects linger after one night of near-normal recovery sleep (8 hours) that is preceded by a night of acute sleep restriction.[114] Therefore, the sleep the pilot got Monday night and Tuesday morning probably alleviated some, but not all, of the fatigue resulting from his sleep restriction the day before. It is likely, therefore, that the pilot was still experiencing some residual fatigue on the day of the accident as a result of work-related activities, both PIO duty and flying, that he performed on the preceding day.

At the time of the accident, the pilot had accumulated 11 hours 41 minutes of duty time and 4 hours 30 minutes of flight time in the previous 24 hours. During his normal 8-hour work day (from 0700 to 1500), he spent 2.8 hours flying in the helicopter. Three hours after his normal work day ended, the pilot went back on duty for the accident mission, during which he accumulated an additional 3 hours 41 minutes of duty time and 1 hour 41 minutes of flight time. The accident mission, in addition to the pilot's normal work day, resulted in a long day that approached (and may have eventually exceeded) the aviation section's 12-hour duty time limits. An NTSB study of flight crew-involved major accidents found that pilots with more than 12 hours (averaging 13.8 hours) of time since waking made significantly more procedural and tactical decision errors (mostly errors of omission) than pilots with less than 12 hours of time since waking.[115] A 2000 FAA-sponsored study found accidents to be more prevalent among pilots who had been on duty for more than 10 hours.[116] Additionally, a study performed by the U.S. Naval Safety Center found that helicopter pilots who were on duty for more than 10 of the last 24 hours were more likely to be involved in pilot-at-fault accidents than pilots who had not accumulated as much duty time.[117] The U.S. Naval Safety Center study also found that helicopter flights that began between 2100 and 2400 (as the accident flight did) experienced a higher rate of pilot-at-fault accidents than flights originating at other times of day. Therefore, the pilot's time since waking and his substantial cumulative duty time on the day of the accident also increased the likelihood that he was experiencing some fatigue. NMSP flight and duty time policies will be discussed in section 2.4.2.

[114] For more information, see (a) M. Sallinen and others, "Recovery of Cognitive Performance From Sleep Debt: Do a Short Rest Pause and a Single Recovery Night Help?", *Chronobiology International*, vol. 25, nos. 2 and 3 (2008), pp. 279–296; (b) G. Belenky and others, "Patterns of Performance Degradation and Restoration During Sleep Restriction and Subsequent Recovery: A Sleep Dose-Response Study," *Journal of Sleep Research*, vol. 12, no. 1 (2003), pp. 1–12; and (c) H.P.A. Van Dongen and others, "The Cumulative Cost of Additional Wakefulness: Dose-Response Effects on Neurobehavioral Functions and Sleep Physiology from Chronic Sleep Restriction and Total Sleep Deprivation," *Sleep*, vol. 26, no. 2 (2003), pp. 117–126.

[115] See NTSB/SS-94/01.

[116] See GRA, Inc., *Flight and Rest Time Safety and Cost Analysis*, Report prepared for FAA Office of Aviation Policy and Plans under Contract No. DTFA01-98-C-00096 (Washington, DC: GRA, Inc. 2000).

[117] See (a) M.S. Borowsky and R. Wall, "Naval Aviation Mishaps and Fatigue," *Aviation, Space, and Environmental Medicine*, vol. 54, no. 6 (1983), pp. 535–538; (b) M.S. Borowsky and R. Wall, "Flight Experience and Naval Aircraft Mishaps," *Aviation, Space, and Environmental Medicine*, vol. 54, no. 5 (1983), pp. 440–446; (c) M.S. Borowsky, *Pilot Flight Experience and Aircraft Mishaps* (Norfolk, Virginia: U.S. Naval Safety Center, 1986); and (d) D.W. Yacavone and others, "Flight Experience and Likelihood of U.S. Navy Aircraft Mishaps," *Aviation, Space, and Environmental Medicine*, vol. 63, no. 1 (1992), pp. 72–74.

2.3.2 Self-Induced Pressure

Self-induced pressure might also have contributed to the pilot's decision to accept the mission and then take off from the remote landing site. The pilot was described by his colleagues as having an exceptionally high degree of motivation for work-related tasks. According to some statements, the pilot may also have had a tendency to act before thinking things through. Specifically, the NMSP fixed-wing pilot told investigators that the accident pilot tended to "act right away before thinking things out." Further, the part-time helicopter pilot told NTSB investigators that he thought the accident pilot lacked "temperance."

The pilot's wife and other aviation section pilots described the accident pilot as being "heroic" and indicated that it was in his nature to take personal risks to try to save others. Although the pilot did not know that the hiker lacked warm clothing and other survival equipment when he accepted the mission,[118] he likely recognized that it would take ground SAR teams a long time to reach her remote location. Because of this concern and his awareness of the cold nighttime conditions on the mountain, the accident pilot was likely concerned that if he did not accept the mission, the hiker would not survive on the mountain overnight. Furthermore, successful past rescue outcomes for the pilot (for example, his recent commendations for the successful rescue of a man trapped in a flooded arroyo) may have reinforced his tendency toward risk-taking in the line of duty. It is likely that the pilot's nature in this regard, combined with his concern for the well-being of the hiker, created significant self-induced pressure for him to ensure that the mission was successfully completed, despite increasingly difficult conditions.

In addition, the accident pilot's relatively brief tenure (about 6 months) in the chief pilot position may have left him vulnerable to management pressure to accept missions**.** Postaccident interviews with NMSP aviation section pilots and management personnel indicated that the DPS cabinet secretary's questioning of pilots regarding launch decisions and his evident displeasure when the NMSP pilots did not accept a mission when others did (such as the New Mexico National Guard) sent the message that he wanted NMSP aviation section pilots to accept SAR missions, without adequate regard for the potential risks involved. Further, the accident pilot was likely aware that the former chief pilot was relieved of his chief pilot duties by the DPS cabinet secretary after he decided not to accept a high-risk mission that would have involved less experienced pilots. The pilot's decision to accept the accident mission, while not inappropriate, was consistent with his understanding of NMSP management's priorities. (Management priorities and influence are further discussed in section 2.4.1.)

2.3.3 Situational Stress

The stress associated with the mission may have also played a role in the pilot's determination to depart from the mountain. The pilot's communications with the dispatcher indicated elevated concern after landing on the mountain, as evidenced by his statements, "It's gonna start snowing up here and if it does that I've gotta get the [expletive] out of here," "I'm not gonna spend a lot of time or we're going to have two search and rescues," and, "Just tell her to start blowing her [expletive] whistle and I'll try to find her, okay?" These statements and the pilot's use of profanity (which was absent during earlier communications with the dispatcher)

[118] The pilot became aware of the hiker's situation during the mission.

suggest that the pilot was experiencing increased situational stress as a result of the perceived challenge posed by the deteriorating conditions. Cognitive effects of stress can include narrowing of attention, response rigidity, longer reaction time to peripheral stimuli, and increased errors.[119] It is possible, therefore, that the "tunnel vision" created by acute situational stress caused the pilot to fixate on the goal of taking off from the remote landing site as soon as possible and to disregard mounting evidence that it was not safe to take off after he returned with the hiker.

2.3.4 Summary of Factors Affecting the Pilot's Decision-Making

The NTSB concludes that the pilot decided to take off from the remote landing site, despite mounting evidence indicating that the deteriorating weather made an immediate return to SAF inadvisable, because his fatigue, self-induced pressure to complete the mission, and situational stress distracted him from identifying and evaluating alternative courses of action.

2.4 Organizational Issues

A number of organizational and management issues, including NMSP aviation section staffing, pilot flight and duty time and rest period limitations, and SMS programs and policies, were identified in this accident investigation. Although they may not have directly caused the accident, these latent deficiencies represented a culture and foundation of organizational pressures that contributed to a reduction in the safety of flight operations conducted by the NMSP on a daily basis.

2.4.1 Risk Assessments and Safety Management Systems

Investigators noted that, at the time of the accident, the NMSP aviation section did not have an SMS program. Additionally, 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. Such risk assessments would have helped the pilot identify and mitigate some of the factors that affected his decision-making. For example, although it was warm and sunny when the pilot left SAF, the forecast for the accident flight included strong wind conditions, lowered ceilings, and precipitation (freezing at higher elevations). If the pilot had completed a structured risk assessment checklist that included obtaining and evaluating the weather conditions, the approaching darkness, and the potential for pilot fatigue, he may have elected to bring a second pilot along on the flight or wait until morning to search for the hiker. At the very least, a structured preflight risk assessment process would likely have prompted the pilot to mitigate potential risks by bringing night vision goggles[120] and cold-weather survival gear on the accident

[119] E. Salas, J.E. Driskell, and S. Hughes, "Introduction: The Study of Stress and Human Performance," in J.E. Driskell and E. Salas, eds., *Stress and Human Performance* (Mahwah, New Jersey: Lawrence Erlbaum, 1996), pp. 1–46.

[120] Night vision goggles would provide the wearer with visual images with increased levels of illumination in low ambient light conditions (such as moonless nights), which might have allowed the pilot to better maintain outside visual references during the accident flight. However, the benefits of the night vision goggles would have been reduced by the precipitation at the time.

flight.[121] Further, if the NMSP aviation section had implemented a thorough risk assessment program that included interim risk assessments, the accident pilot would have evaluated the associated risks before landing at the remote site and (if he determined that such a landing was prudent) again before departing the remote landing site. The lack of such a risk assessment allowed the decision-making errors that manifested themselves in this accident situation to occur. (Since the accident, the NMSP aviation section has implemented a risk assessment checklist.)

Upper management plays a key role in any safety program because, ultimately, management has control over the personnel and resources that generate exposure to risk. The safety management approach places a responsibility on senior management to develop a formal safety policy, establish safety objectives, develop standards of safety performance, and take the lead in fostering an organizational safety culture. It specifies that management should take responsibility for an organization's safety performance by designating a senior manager as the executive who is accountable for safety performance. Research has shown that this kind of management involvement plays a key role in the success of organizational safety programs.[122, 123]

The New Mexico DPS policies placed responsibility for safety exclusively on pilots and aviation maintenance technicians. No organizational policy established a formal management commitment to safety. The DPS cabinet secretary was the senior manager who devoted the most attention to the aviation section and seemed to have the greatest influence over it. He did not, however, take responsibility for the safety performance of the aviation section, nor did he take the initiative to ensure that it had an effective safety program. In fact, he engaged in behaviors that were actually detrimental to safety. As previously noted, in 2006, when the former chief pilot declined to send two inexperienced helicopter pilots on a SAR mission in mountainous terrain in poor weather and dark lighting conditions, the DPS cabinet secretary relieved the former chief pilot of his chief pilot duties (and associated launch decision-making authority). According to interviews with NMSP aviation section pilots, the DPS cabinet secretary demanded an explanation whenever a pilot declined a SAR mission and complained vigorously when New Mexico National Guard pilots launched on a mission that NMSP pilots had declined. Aviation section pilots stated that the DPS cabinet secretary sometimes asked NMSP pilots to continue checking the weather when they had already decided that the weather was not good enough for an executive transport flight. The NTSB believes that this pattern of behavior sent a message to NMSP pilots that the highest-ranking official in the DPS prioritized mission completion over flight safety and that he was closely monitoring their decisions.

There is no evidence that the DPS cabinet secretary or any NMSP manager advised the pilot to accept the accident mission or that they urged him to take off from the remote landing site. The accident pilot had previously engaged in behaviors that demonstrated a high degree of

[121] As previously stated, the DPS cabinet secretary stated that when he was a pilot in the NMSP aviation section, cold-weather gear was carried on board, and he routinely carried a survival kit and extra blankets on missions.

[122] M.J. Smith and others, "Characteristics of Successful Safety Programs," *Journal of Safety Research*, vol. 10, no. 1 (1978), pp. 5–15.

[123] H.S. Shannon, J. Mayr, and T. Haines, "Overview of the Relationship Between Organizational and Workplace Factors and Injury Rates," *Safety Science*, vol. 26, no. 3 (1997), pp. 201–217.

risk tolerance, and, as discussed, his judgment was likely degraded by a combination of fatigue, stress, and self-induced pressure. These factors are sufficient to explain his decision-making. The DPS cabinet secretary's history of inappropriately involving himself in pilot launch decisions, however, encouraged NMSP pilots to accept higher levels of risk without ensuring that appropriate controls were in place to mitigate those risks. NMSP management's lack of attention to safety management resulted in the absence of an effective safety program. Therefore, the NTSB concludes that, although there was no evidence of any direct NMSP or DPS management pressure on the pilot during the accident mission, there was evidence of management actions that emphasized accepting all missions, without adequate regard for conditions, which was not consistent with a safety-focused organizational safety culture, as emphasized in current SMS guidance.

The NTSB has previously discussed the benefits of risk assessment and management programs and issued related safety recommendations. For example, in 2006, the NTSB issued related safety recommendations in its special investigation report on EMS operations.[124] In addition, in 2009, as a result of the NTSB's public hearing on HEMS safety and the investigative findings of several 2008 HEMS accidents,[125] the NTSB issued safety recommendations related to the incorporation of SMS programs, including risk assessment and management practices.

Although the NTSB has noted the need for all operators—both public and civil—to develop and implement flight risk assessment and evaluation programs, public operators would not be required to comply with such programs because the FAA does not have the authority to regulate public operators. The NTSB concludes that if operators of public aircraft implemented structured, task-specific risk assessment and management programs, their pilots would be more likely to thoroughly identify, and make efforts to mitigate, the potential risks associated with a mission.

The incorporation of the policies, procedures, and guidelines published by ALEA in its "Standards for Law Enforcement Aviation Units" and related material would provide an organization like the NMSP aviation section with a comprehensive foundation upon which to build a thorough, explicit set of policies and procedures. However, the NTSB's evaluation of the NMSP aviation section's policies indicated that they did not conform to ALEA's standards. The NMSP aviation section's "Policies and Procedures" document lacked adequate SOPs[126] in several areas, including those of risk management and pilot rest periods, thereby reducing the safety of NMSP aviation operations. Therefore, the NTSB recommends that the governor of the state of New Mexico require the New Mexico DPS to bring its aviation section policies and operations into conformance with industry standards, such as those established by ALEA. Because other state and/or public organizations would also benefit from incorporation of industry standards and policies, such as those developed by ALEA, the NTSB further recommends that the National Association of State Aviation Officials (NASAO)[127] and the International

[124] For more information, see NTSB/SIR-06-01at <http://www.ntsb.gov/publictn/A_Stu.htm>.

[125] The associated safety recommendation letter cited several accidents. The briefs for these accidents can be accessed at <http://www.ntsb.gov/ntsb/aviationquery.index.aspx>.

[126] See appendix B for a reproduction of the complete document.

[127] NASAO was established by the states in 1931 to ensure uniformity of safety measures, standardize airport regulations, and develop a truly national air transportation system responsive to local, state, and regional needs.

Association of Chiefs of Police (IACP)[128] encourage members to conduct an independent review and evaluation of their policies and procedures and make changes as needed to align those policies and procedures with safety standards, procedures, and guidelines, such as those outlined in ALEA guidance. In addition, because other state and/or public organizations would also benefit from the incorporation of risk assessment and management procedures and policies, the NTSB recommends that NASAO and the IACP encourage members to develop and implement risk assessment and management procedures specific to their operations.

2.4.2 NMSP Flight and Duty Time, Rest Period Limitations, and Staffing

NMSP aviation section policies limited the pilots to 12 hours of duty time and 6 hours of flight time per day. When the accident pilot accepted the accident mission, he had been on duty 8 hours, with 4.5 hours of flight time in the 24 hours preceding the SAR mission. Because the pilot's total flight and duty times did not approach the aviation section's limits,[129] NMSP policies did not prevent him from accepting the accident mission; however, as stated previously, the accident pilot was likely fatigued as a result of his sleep restriction the preceding day.

The NTSB has issued many safety recommendations related to pilot flight, duty, and rest times.[130] To ensure optimal performance, regulations should not only limit daily flight and duty times but also ensure that pilots are provided with a rest period that provides sufficient time for meals, personal hygiene, and obtaining at least 8 hours of uninterrupted sleep in every 24-hour period. Although NMSP SAR operations are not subject to FAA regulations, the FAA defines a rest period in 14 CFR 91.1057 as follows:

> …a period of time required...that is free of all responsibility for work or duty prior to the commencement of, or following completion of, a duty period, and during which the flight crewmember…cannot be required to receive contact from the program manager. A rest period does not include any time during which the program manager imposes on a flight crewmember…any duty or restraint, including any actual work or present responsibility for work should the occasion arise.

A review of NMSP aviation section policies revealed that, although the NMSP had established maximum pilot flight and duty times for a 24-hour period, it had not defined what constituted a pilot "rest period" or established a minimum continuous pilot rest period before being assigned to another flight. NMSP management had assigned the accident pilot multiple duties (full-time pilot, chief pilot of the NMSP aviation section, and part-time PIO), which, in

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NASAO represents the men and women in state government aviation agencies who serve the public interest in all 50 states, Guam, and Puerto Rico.

[128] The IACP Aviation Committee's goals are to "provide guidance to IACP in all matters relating to the use of police aircraft; to enhance cooperation and the sharing of information between agencies who use aircraft and those exploring the possibility of starting an aviation operation; to sponsor police aviation management training; and publish articles to assist in the understanding of the benefits, costs, and complexities of aviation management."

[129] The NMSP policies did not specifically address pilot rest periods.

[130] For example, see NTSB/AAR-06/01 at <http://www.ntsb.gov/publictn/A_Acc1.htm>.

combination, often interfered with the pilot's ability to get adequate rest for flying.[131] For example, the accident pilot had performed work-related duties at various times of the day and night during the preceding 72 hours, without adequate opportunity for a contiguous, ensured restful sleep period. As a result, when the pilot reported for duty about 0300 the day before the accident, he was functioning on, at most, 4 hours 9 minutes of interrupted sleep.[132] Thus, the pilot's work duties did not afford him an opportunity for sufficient restful sleep in the days before the accident, even though they were not in violation of the NMSP aviation section's pilot flight and duty policies.

Because the NMSP aviation section is a public operator, it has no flight and duty time or pilot rest limitations imposed on it by the FAA, and the NMSP is responsible for monitoring its own compliance with flight and duty time policies. However, FAA regulations for similar civil operations (commuter or on-demand charter operations under 14 CFR Part 135) state that each flying assignment must provide for "at least 10 consecutive hours of rest during the 24-hour period that precedes the planned completion time" of the flight and "no certificate holder may assign any flight crewmember to any duty with the certificate holder during any required rest period." (A slightly shorter minimum rest period of 8 consecutive hours per 24-hour period is allowed for HEMS pilots, but 10 consecutive hours of rest are required before a HEMS pilot transitions to "on-call" status.)

Although the accident pilot's schedule during the 2 days leading up to the accident flight was permitted by NMSP flight and duty time policies, the pilot's PIO duties prevented him from obtaining sufficient rest, and NMSP policies did not ensure protected rest periods for its pilots. Fatigue was one of several factors that likely affected the pilot's decisions and actions on the night of the accident. The NTSB concludes that an effective pilot flight and duty time program would address not only maximum flight and duty times but would also contain requirements for minimum contiguous ensured rest periods to reduce pilot fatigue; the NMSP aviation section's flight and duty time policies did not ensure minimum contiguous rest periods for its pilots.

The NTSB reviewed the NMSP aviation section's staffing level of two full- and one part-time helicopter pilots[133] to determine whether this level of staffing was sufficient to support helicopter availability 24 hours per day, 7 days per week, while also ensuring that each pilot could receive a protected rest period of at least 10 consecutive hours per 24 contiguous hours (a rest period sufficient to allow for adequate sleep, meals, and personal hygiene) and could be afforded 2 full days off per week. (In its evaluation, the NTSB also took into account the fact that the accident pilot had additional duties and responsibilities associated with his chief pilot and PIO assignments, which imposed unpredictable demands on his time and interfered with his ability to obtain adequate rest.) The NTSB found that it was not possible to devise such a schedule with this level of staffing. The NTSB further noted that NMSP aviation section staffing

[131] The pilot had asked to be relieved of the PIO duties for safety-related reasons; however, his requests were denied, largely because NMSP upper management did not understand how the pilot's PIO duties conflicted with his pilot and chief pilot responsibilities.

[132] The part-time helicopter pilot also reported being called out to fly missions late in the evening after he had worked all day.

[133] One of the two full-time helicopter pilots (the accident pilot) also held chief pilot and PIO responsibilities. The part-time helicopter pilot was typically called to fly missions in the evening, after he had already worked a day shift performing duties unrelated to aviation.

levels also limited its ability to assign two pilots to potentially high-risk missions (such as the accident flight) in an effort to mitigate the potential risks during such missions.[134]

A recent study sponsored by the U.S. Air Force assessed the minimum number of flight crews required to provide 24-hour availability for an aircraft; the study found that four flight crews provided the optimal balance between "the work, health, social, and safety demands placed upon the shiftworker (in terms of hours worked per unit time…) and personnel cost to the employer for safe and productive system operation."[135] Thus, based on this study, the NMSP aviation section would be unable to support an appropriate 24 hours per day, 7 days per week schedule under existing staffing levels. The NTSB concludes that at the time of the accident, the NMSP aviation section staffing level was insufficient to allow helicopter operations 24 hours a day, 7 days a week without creating an unacceptable risk of pilot fatigue. Therefore, the NTSB recommends that the governor of the state of New Mexico require the New Mexico DPS to develop and implement a comprehensive fatigue management program for the NMSP aviation section pilots that, at a minimum, requires NMSP to provide its pilots with protected rest periods and defines pilot rest (in a manner consistent with 14 CFR 91.1057) and ensures adequate pilot staffing levels and aircraft hours of availability consistent with the pilot rest requirements.

The NTSB also reviewed ALEA's requirements for organizations operating public aircraft under its accreditation program. ALEA's program (which conducts routine audits to ensure compliance) specifies that participating operators must establish a maximum number of flight and duty hours that a pilot may work in a 24-hour period with a specified rest period, specifically taking into consideration the type of operation and the environmental conditions (for example, challenging weather or night operations). However, ALEA standards do not require an operator's flight and duty time policy to define rest, establish minimum rest periods, or prevent the assignment of additional, conflicting duties. Because public aircraft operators who are members of ALEA base their operating policies and procedures on the standards set forth by ALEA and because protected rest periods are critically important to minimize fatigue, ALEA policies regarding pilot flight and duty time should define rest and establish minimum, protected rest periods. Therefore, the NTSB further recommends that ALEA revise its standards to define pilot rest and ensure that pilots receive protected rest periods that are sufficient to minimize the likelihood of pilot fatigue during aviation operations.

2.5 Relationship with the Volunteer Search and Rescue Organization

The overall communication and coordination of efforts between the NMSP and the volunteer New Mexico SAR personnel did not ensure that the accident mission was performed as safely as possible. The accident helicopter was equipped with a radio that received and transmitted on police band frequencies and a very high frequency transceiver radio. Using the two radios, the pilot could monitor two frequencies simultaneously but could transmit on only one frequency. As a result, the pilot could not monitor and communicate on both the NMSP dispatch frequency and a SAR frequency at the same time. SAR personnel, with the use of their

[134] A two-pilot operation would allow for additional monitoring and reduces an individual pilot's workload.

[135] See J.C. Miller, *Fundamentals of Shift-Work Scheduling,* Technical Report No. AFRL-HE-BR-TR-2006-0011. (Brooks City Base, Texas: U.S. Air Force Research Laboratory, Human Effectiveness Directorate, Biosciences and Protection Division, Biobehavioral Performance Branch, 2006), p. 26.

multiband transceiver radio, were able to communicate on three frequencies simultaneously. (The helicopter that was purchased to replace the accident helicopter was equipped with a multiband transceiver radio that allowed for communications on three frequencies simultaneously.)

Although SAR command personnel communicated with the dispatcher and with the spotter (through cellular telephone calls with the NMSP dispatcher and SAR personnel) during the mission, they could not communicate directly with the pilot. After the helicopter had landed to pick up the hiker, SAR command personnel suggested to the spotter (via cellular telephone) that the helicopter remain on the mountain if the weather deteriorated to the point that it was not safe to take off. There is no indication that the pilot was apprised of this suggestion; if this suggestion had been passed on to the accident pilot, he might have been prompted to reassess his decision to take off.

During postaccident interviews, it was apparent that NMSP personnel were confused about how the chain of command was supposed to work during airborne SAR missions. The SAR plan indicated that the SAR field coordinator was responsible for directing all SAR resources (including NMSP aviation section personnel); however, postaccident interviews indicated that NMSP personnel often conducted SAR missions based on 911 notifications before receiving SAR initialization. Additionally, the NMSP aviation section SOP did not address procedures for SAR missions. These issues likely resulted in the accident pilot believing that he did not need to communicate with SAR field commanders during the accident mission, and, as a result, he did not. If the pilot had communicated with SAR field commanders, he would have been aware of the SAR ground teams' efforts, which might have influenced his decision to takeoff from the remote landing site. The NTSB concludes that NMSP personnel did not regularly follow the SAR plan, and NMSP pilots, including the accident pilot, did not routinely communicate directly with SAR commanders during SAR efforts, which reduced the safety and effectiveness of SAR missions. Therefore, the NTSB recommends that the governor of the state of New Mexico revise or reinforce NMSP SAR policies to ensure direct communication between NMSP aviation units and SAR ground teams and field personnel during a SAR mission.

2.6 Instrument Flying

According to the spotter, when the pilot departed the mountain for SAF, he pointed out the right-side window and then flew in that direction. The spotter stated that he thought the pilot intended to maneuver toward lower and more open terrain in VFR conditions. However, the low clouds and snow likely obscured the mountains and led to an inadvertent IMC encounter shortly after takeoff. Although the pilot had a fixed-wing instrument rating and met instrument currency and proficiency requirements for that rating, he did not have a helicopter instrument rating. The pilot's lack of a helicopter instrument rating was not technically an issue when he accepted the accident mission because VMC prevailed and NMSP aviation section pilots were not required to have instrument ratings for helicopter operations. NMSP management personnel explained that the section helicopters were not expected to operate in IFR conditions because the nature of those operations (for example, SAR missions) required VMC. Further, NMSP helicopter pilots were expected to stay clear of clouds.

As a result of its 2009 public hearing on HEMS safety and the investigative results of several 2008 HEMS accidents, the NTSB issued Safety Recommendation A-09-97, which recommended that public HEMS operators conduct scenario-based training, to include inadvertent flight into IMC, frequently enough to ensure proficiency. Although the accident flight was not a HEMS flight, if the accident pilot been trained in how to exit inadvertent IMC in a helicopter, he might have followed different procedures (for example, he might have climbed to a safe altitude and contacted ATC for assistance) or a different route (with potentially better results) when the helicopter departed the landing site and thus avoided the subsequent collision with terrain. The NTSB concludes that, because the accident pilot did not have a helicopter instrument rating, experience in helicopter instrument operations, or training specific to inadvertent helicopter IMC encounters, he was not prepared to react appropriately to the loss of visual references that he encountered shortly after takeoff. Because ALEA has the broadest membership of public operators and can affect the most pilots and operators, the NTSB recommends that ALEA revise its accreditation standards to require that all pilots receive training in methods for safely exiting inadvertently encountered IMC for all aircraft categories in which they operate.

2.7 Emergency Locating Equipment

The accident helicopter was equipped with an ELT that transmitted on both the 406- and 121.5-MHz frequencies. The ELT's signal was not received by the two geostationary operational environmental satellites most likely because of the topography of the crash site and the relative positions of the two satellites. However, ELT signals were received by low-Earth polar orbiting satellites. Within about 1 hour of the accident, SAR personnel had an ELT location that allowed them to focus their search efforts in the region where the accident occurred instead of the helicopter's last known location (near the hiker's location). The SAR ground teams' use of the information provided by the accident helicopter's 406-MHz ELT allowed them to identify and reach the accident location as soon as practical, especially given the challenging conditions (for example, the remote location, rugged and snowy/icy terrain, adverse weather, and nighttime conditions) under which the SAR efforts were conducted.[136] The NTSB concludes that the 406-MHz ELT signals received from the accident helicopter's 406-MHz ELT were primarily responsible for focusing searchers on areas near the accident site and for eventually locating both the survivor and the helicopter wreckage. Because of the benefits of 406-MHz ELTs, the NTSB recommends that ALEA, NASAO, and IACP encourage members to install 406-MHz ELTs on all of their aircraft.

At the time of the accident, the NMSP did not use a flight-following system to ensure consistent tracking of its aircraft. The NTSB has advocated the installation and use of such systems. For example, as a result of its 2006 special investigation of EMS operations,[137] the NTSB recommended that the FAA require EMS operators to use formalized dispatch and flight-following procedures. Additionally, in its report on the September 27, 2008, accident

[136] Although SAR command personnel had received a last known position from radar data shortly before the SAR ground teams located the spotter, it is unlikely that SAR ground teams were provided that information before they found the spotter.

[137] For additional information, see NTSB/SIR-06/01 at <http://www.ntsb.gov/Publictn/A_Stu.htm>.

involving an MSP helicopter,[138] the NTSB expressed concern that HEMS operators may not have dispatch and flight-following procedures and issued a related recommendation.

Low-cost units that use satellite-based technology to follow flights are commercially available. The satellite tracking data obtained by these units can be downloaded as frequently as desired by the operator (depending on the supporting program's subscription) and can be viewed on a communications or dispatch center computer.[139] Given the remote locations of many of the NMSP SAR missions and the possibility that the location of the accident helicopter and its occupants could have been identified more rapidly if it had been equipped with a flight-following technology, such a system would be invaluable to the NMSP. Since the accident, the NMSP purchased a portable flight-following unit, which it primarily intends for use in its helicopter. The flight-following unit service plan purchased by NMSP automatically provides updated helicopter position information at 5-minute intervals and every time the helicopter stops. The NTSB concludes that, although it is unlikely that the use of flight-tracking systems would have resulted in a different outcome in this case, the use of such systems, which provide real-time information regarding an agency's assets, could shorten search times for downed public aircraft and their occupants. Therefore, the NTSB recommends that ALEA, NASAO, and IACP encourage members to install flight-tracking equipment on all public aircraft that would allow for near-continuous flight tracking during missions.

[138] For additional information, see NTSB/AAR-09/07 at <http://www.ntsb.gov/Publictn/A_Acc1.htm>.

[139] Flight-following devices transmit self-contained GPS coordinates to satellites instead of relying on signal triangulation as occurs with an ELT.

3. Conclusions

3.1 Findings

1. The investigation determined that the accident helicopter was properly certificated and maintained in accordance with New Mexico State Police policies and the manufacturer's recommended maintenance program. There was no evidence of any preimpact structural, engine, or system failures.

2. The investigation found no evidence that the pilot had any preexisting medical or toxicological condition that adversely affected his performance during the accident flight.

3. Postaccident examination of the helicopter's seats and restraint systems revealed no evidence of preimpact inadequacies. The pilot and the hiker were ejected from the helicopter when their seats and restraint systems were subjected to forces beyond those for which they were certificated during the helicopter's roll down the steep, rocky mountainside.

4. Neither the airborne nor the ground search and rescue (SAR) personnel could have reached the pilot before he died of exposure given the adverse weather conditions, which precluded a prompt airborne SAR response and hindered the ground SAR teams' progress; the darkness and the rugged terrain in which the ground SAR teams were responding; the distance they had to travel; and the seriousness of the pilot's injuries.

5. When the pilot made the decision to launch, the weather and lighting conditions, even at higher elevations, did not preclude the mission; however, after accepting a search and rescue mission involving flight at high altitudes over mountainous terrain, with darkness approaching and with a deteriorating weather forecast, the pilot should have taken steps to mitigate the potential risks involved, for example, by bringing cold-weather survival gear and ensuring that night vision goggles were on board and readily available for the mission.

6. The pilot exhibited poor decision-making when he chose to take off from a relatively secure landing site at night and attempt visual flight rules flight in adverse weather conditions.

7. 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, and situational stress distracted him from identifying and evaluating alternative courses of action.

8. Although there was no evidence of any direct New Mexico State Police or Department of Public Safety management pressure on the pilot during the accident mission, there was evidence of management actions that emphasized accepting all missions, without adequate regard for conditions, which was not consistent with a safety-focused organizational safety culture, as emphasized in current safety management system guidance.

9. If operators of public aircraft implemented structured, task-specific risk assessment and management programs, their pilots would be more likely to thoroughly identify, and make efforts to mitigate, the potential risks associated with a mission.

10. An effective pilot flight and duty time program would address not only maximum flight and duty times but would also contain requirements for minimum contiguous ensured rest periods to reduce pilot fatigue; the New Mexico State Police aviation section’s flight and duty time policies did not ensure minimum contiguous rest periods for its pilots.

11. At the time of the accident, the New Mexico State Police aviation section staffing level was insufficient to allow helicopter operations 24 hours a day, 7 days a week without creating an unacceptable risk of pilot fatigue.

12. New Mexico State Police (NMSP) personnel did not regularly follow the search and rescue (SAR) plan, and NMSP pilots, including the accident pilot, did not routinely communicate directly with the SAR commanders during SAR efforts, which reduced the safety and effectiveness of SAR missions.

13. Because the accident pilot did not have a helicopter instrument rating, experience in helicopter instrument operations, or training specific to inadvertent helicopter instrument meteorological condition encounters, he was not prepared to react appropriately to the loss of visual references that he encountered shortly after takeoff.

14. The 406-megahertz (MHz) emergency locator transmitter (ELT) signals received from the accident helicopter’s 406-MHz ELT were primarily responsible for focusing searchers on areas near the accident site and for eventually locating both the survivor and the helicopter wreckage.

15. Although it is unlikely that the use of flight-tracking systems would have resulted in a different outcome in this case, the use of such systems, which provide real-time information regarding an agency’s assets, could shorten search times for downed public aircraft and their occupants.

3.2 Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the pilot's decision to take off from a remote, mountainous landing site in dark (moonless) night, windy, instrument meteorological conditions. Contributing to the accident were an organizational culture that prioritized mission execution over aviation safety and the pilot's fatigue, self-induced pressure to conduct the flight, and situational stress. Also contributing to the accident were deficiencies in the New Mexico State Police aviation section's safety-related policies, including lack of a requirement for a risk assessment at any point during the mission; inadequate pilot staffing; lack of an effective fatigue management program for pilots; and inadequate procedures and equipment to ensure effective communication between airborne and ground personnel during search and rescue missions.

4. Recommendations

As a result of this investigation, the National Transportation Safety Board makes the following recommendations to the governor of the state of New Mexico:

> Require the New Mexico Department of Public Safety to bring its aviation section policies and operations into conformance with industry standards, such as those established by the Airborne Law Enforcement Association. (A-11-53)

> Require the New Mexico Department of Public Safety to develop and implement a comprehensive fatigue management program for the New Mexico State Police (NMSP) aviation section pilots that, at a minimum, requires NMSP to provide its pilots with protected rest periods and defines pilot rest (in a manner consistent with 14 *Code of Federal Regulations* 91.1057) and ensures adequate pilot staffing levels and aircraft hours of availability consistent with the pilot rest requirements. (A-11-54)

> Revise or reinforce New Mexico State Police (NMSP) search and rescue (SAR) policies to ensure direct communication between NMSP aviation units and SAR ground teams and field personnel during a SAR mission. (A-11-55)

As a result of this investigation, the National Transportation Safety Board makes the following recommendations to the Airborne Law Enforcement Association:

> Revise your standards to define pilot rest and ensure that pilots receive protected rest periods that are sufficient to minimize the likelihood of pilot fatigue during aviation operations. (A-11-56)

> Revise your accreditation standards to require that all pilots receive training in methods for safely exiting inadvertently encountered instrument meteorological conditions for all aircraft categories in which they operate. (A-11-57)

> Encourage your members to install 406-megahertz emergency locator transmitters on all of their aircraft. (A-11-58)

> Encourage your members to install flight-tracking equipment on all public aircraft that would allow for near-continuous flight tracking during missions. (A-11-59)

As a result of this investigation, the National Transportation Safety Board makes the following recommendations to the National Association of State Aviation Officials:

> Encourage your members to conduct an independent review and evaluation of their policies and procedures and make changes as needed to align those policies and procedures with safety standards, procedures, and guidelines, such as those outlined in Airborne Law Enforcement Association guidance. (A-11-60)

> Encourage your members to develop and implement risk assessment and management procedures specific to their operations. (A-11-61)
>
> Encourage your members to install 406-megahertz emergency locator transmitters on all of their aircraft. (A-11-62)
>
> Encourage your members to install flight-tracking equipment on all public aircraft that would allow for near-continuous flight tracking during missions. (A-11-63)

As a result of this investigation, the National Transportation Safety Board makes the following recommendations to the International Association of Chiefs of Police:

> Encourage your members to conduct an independent review and evaluation of their policies and procedures and make changes as needed to align those policies and procedures with safety standards, procedures, and guidelines, such as those outlined in Airborne Law Enforcement Association guidance. (A-11-64)
>
> Encourage your members to develop and implement risk assessment and management procedures specific to their operations. (A-11-65)
>
> Encourage your members to install 406-megahertz emergency locator transmitters on all of their aircraft. (A-11-66)
>
> Encourage your members to install flight-tracking equipment on all public aircraft that would allow for near-continuous flight tracking during missions. (A-11-67)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

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Adopted: May 24, 2011

5. Appendixes

Appendix A

Investigation and Public Hearing

Investigation

The National Transportation Safety Board (NTSB) was initially notified of this accident on June 9, 2009. The following investigative groups were formed: Operations and Human Performance, Meteorology, Airworthiness, Medical Factors, and Survival Factors.

Parties to the investigation were the Federal Aviation Administration and New Mexico State Police. In accordance with the provisions of Annex 13 to the Convention on International Civil Aviation, the Agenzia Nazionale per la Sicurezza del Volo (ANSV) and the Transportation Safety Board of Canada (TSB Canada) participated in the investigation as the representatives of the State of Design and Manufacture (Airframe and Engines, respectively). Agusta S.p.A., and Pratt and Whitney Canada participated in the investigation as technical advisors to ANSV and TSB Canada, respectively.

Public Hearing

No public hearing was held for this accident.

Appendix B

NMSP Aviation Section "Policies and Procedures" Document

DEPARTMENT OF PUBLIC SAFETY POLICIES & PROCEDURES	POLICY NUMBER OPR:49	
	EFFECTIVE DATE: 05/23/2007	ORIGINAL ISSUED ON: 05/23/2007
SUBJECT: STATE POLICE AVIATION SECTION AND OPERATIONS	REVISION NO: ORIGINAL	

1.0 PURPOSE

It is the purpose of this policy to establish guidelines and operational procedures for the State Police Aviation Section, as well as guidelines for requesting aircraft support.

2.0 POLICY

It is the policy of the Department of Public Safety to maintain a highly flexible and skilled Aviation Section for the performance of aircraft-related assignments.

3.0 APPLICABILITY

This policy applies to all commissioned personnel within the Department of Public Safety.

4.0 REFERENCES

Federal Aviation Rules (FAR) Part 61 and 91

5.0 DEFINITIONS

A. **Chief Pilot -** The manager of the Aviation Section responsible for all aviation operations.

B. **DPS –** Department of Public Safety.

C. **FAA –** Federal Aviation Administration.

6.0 PROCEDURE

A. **Organization**

1. The Special Operations Bureau commander will be responsible for all aviation operations of the DPS. Aircraft and pilots will be stationed in Santa Fe and at strategic locations within the state, as designated by the State Police Chief, and utilized as needed.
2. All pilots assigned to the Aviation Section will work under the direct supervision of the chief pilot. The chief pilot and all other DPS pilots shall serve in the Aviation Section at the pleasure of the Chief.
3. Aircraft maintenance technicians will be under the direct supervision of the Special Operations Bureau commander.
4. The chief pilot will be responsible to the Special Operations Bureau commander for all daily flight operations, maintenance coordination, purchasing, training, planning,

and personnel matters involving aircraft and pilots of the Aviation Section. The chief pilot will also be responsible for making sure departmental aircraft are prepared for any use designated by the Chief.

B. Programs

1. The department aircraft shall be utilized effectively and economically to further the work of the DPS. The principal uses for the departmental aircraft are as follows:

   a. Searches – felons, lost persons, etc

   b. Rescue – lost, sick, or injured persons, etc

   c. Reconnaissance – disaster areas, riots, law enforcement operations, critical incidents, etc

   d. Surveillance – narcotics and criminal investigations, etc

   e. Air traffic operations and highway patrol

   f. Miscellaneous law enforcement operations

   g. Personnel transportation

   h. Equipment and materials transportation

   i. Assist, as needed, all other federal, state, county and municipal law enforcement and other agencies.

C. Regulations

1. The state police aircraft shall be used only for official business. All requests to use the department aircraft shall be approved by the Special Operations Bureau commander or his/her designee.

2. The aircraft shall be operated in compliance with applicable state and federal laws, rules and regulations, as well as department policy. Pilots, crew members, observers, and passengers will not be permitted to smoke in the aircraft at any time.

3. The chief pilot must designate an acting chief pilot when on leave or out of the headquarters area for more than twenty-four (24) hours.

4. Only qualified pilots who are certified by the chief pilot and approved by the state police chief, and meet all fixed/rotary wing FAA and insurance requirements, shall operate DPS aircraft.

5. The pilot is in command of the aircraft, as well as any persons in the aircraft, regardless of rank and authority during flight. The pilot has sole responsibility for determining whether a flight is safe, and for canceling or terminating flights determined to be hazardous.

6. DPS pilots shall complete all reports required by state and federal laws and regulations, and department policy.

7. Any accident or unusual incident involving department aircraft shall be reported immediately (if possible) by the pilot to the chief pilot or the acting chief pilot in the chief pilot's absence, who in turn will report the incident to the Special Operations Bureau commander. A written report concerning the occurrence will be submitted to the chief pilot or the acting chief pilot in the chief pilot's absence, within forty-eight (48) hours from the time of the occurrence.

8. DPS pilots shall be responsible for compliance with all required inspections, including daily checks as required buy the FAA, aircraft manufacturer, engine manufacturer, etc.

9. The chief pilot and maintenance technicians will be responsible for having all aircraft maintenance performed for all required inspections and maintenance, and for keeping the aircraft in generally good condition (such as oil changes, minor repairs, cleaning). They will also be responsible for the proper documentation of services, inspections, maintenance and repairs. The chief pilot and maintenance technicians will ensure strict compliance with all pertinent FAA rules and regulations and guidelines established by applicable aircraft and engine manufacturers. The chief pilot and maintenance technicians will confer with the Special Operations Bureau commander for all major repairs and maintenance.

10. No person may act as pilot in command of the DPS aircraft at night and/or under instrument flight rules (IFR) without meeting the requirements of F.A.R. 6157.

11. Flight operations will generally be conducted at an altitude of not less than 1000 feet above terrain and in no case, other than extenuating circumstances or an emergency, shall an aircraft be operated below 700 AGL (helicopter operations excluded). In all cases, operations are to be governed by appropriate FAA regulations and waivers of regulations, including the specific restrictions contained therein. A helicopter may be operated below 700 AGL and clear of clouds if operated at a speed that allows the pilot adequate opportunity to see any air traffic or obstruction in time to avoid a collision.

D. Flight Duty Limitations

1. No pilot shall act as pilot in command of DPS aircraft for more than six (6) hours in any twenty-four (24) hour period. Flight time during any seven day period shall not exceed twenty-five (25) hours.

2. Duty time will be limited to twelve (12) hours in a twenty-four (24) hour period. Under emergency or extraordinary conditions, this may be increased to fifteen (15) hours. Any duty time in excess of fifteen (15) hours in a twenty-four (24) hour time period will not include any flight time as pilot-in-command. Duty time in any seven (7) day period will not exceed sixty five (65) hours. A minimum of eight (8) hours rest is required following any duty day that exceeds twelve (12) hours prior to subsequent duty time.

3. Deviations from any limitations will only be permitted in situations of extreme emergency or extraordinary circumstances. A written report will be required if deemed necessary by the Special Operations Bureau commander. Any deviation

will require prior approval from the Special Operations Bureau commander, conditions, circumstances and time permitting.

E. Pilot Selection

1. Commissioned members of the DPS who wish to be considered for assignment as a department pilot shall submit a resume through the appropriate chain of command to the Office of the Chief. The resume shall include, but not be limited to, the following information:

   a. Name, rank, current area of assignment, and date of assignment at that location

   b. Make and model of all aircraft in which flight time was logged, listing the amount of flight time in each

   c. Total aircraft flight time and aircraft flight time in the past twelve (12) months

   d. Type of FAA pilot rating and any additional ratings

   e. Any FAA violations or accidents

   f. Any other information that would assist in evaluating pilot qualifications

2. Commanders/Directors will forward the resume to the Office of the Chief with a copy to the Special Operations Bureau commander and the chief pilot.

3. All perspective pilots shall possess a valid commercial pilot certificate with an instrument rating and a current FAA First Class medical certificate. Flying time requirements vary with insurance requirements and aircraft type.

4. Applicant processing may be discontinued at any time at the discretion of the Chief.

5. Resumes, qualifications, and personnel files of perspective pilots requesting consideration will be reviewed and a selection will be made by the Special Operations Bureau commander in consultation with the chief pilot and with the concurrence of the Office of the Chief.

F. DPS Aviation Insignia (Wings)

1. Qualifications for Award

   a. Recipient must be a fully commissioned DPS employee actively employed who has been assigned to the Aviation Section.

2. Display and Wearing of Insignia

   a. The insignia will be displayed on the right side of the staff uniform, field uniform or fatigue shirt, 3/8 of an inch above, and centered on the name plate, or small arms qualification insignia.

b. The insignia will be displayed on the right side of the staff coat or coveralls, horizontally centered with the badge, which is displayed on the left side and vertically centered in a like manner.

G. Pilot Proficiency and Training

1. Each pilot certified by the Department will be allocated three flight hours each month, per assigned aircraft, for flight proficiency/training.

   a. Proficiency/training flights will be conducted in dual capacity, whenever possible.

   b. The pilots should direct this proficiency/training to the practice of intermediate and advanced contact and/or instrument maneuvers.

   c. A summary of maneuvers practiced shall be recorded on the Departmental Flight Report Sheet and in the pilot's flight log book.

2. Pilots shall attend an appropriate instrument or advanced training and re-currency or initial training each year. The expenses will be paid by the Department.

H. Flight Physicals

1. DPS pilots are required to possess a valid FAA First Class medical certificate issued within the last twelve (12) calendar months by a department approved physician.

   a. The Department will pay for the flight physical and other associated medical expenses.

   b. Pilots should instruct the physician to submit the bill to the New Mexico State Police, Attention: Special Operations Bureau commander.

   c. A copy of the first class medical certificate will be placed in the pilot's Aviation Section file.

I. Flight Limitations (Due To Illness, Injury, or Other Physical/Mental Impairment)

1. Illness Preventing Flight Duty

   a. No pilot who is in any way incapacitated, due to illness, injury, or in any way deemed impaired by the chief pilot, with concurrence of the Special Operations Bureau commander, shall fly a department aircraft. A pilot who is under a doctor's care or who thinks that a minor illness would affect his/her flying ability, shall request non-flying duty from the chief pilot, or the Special Operations Bureau commander, in the chief pilot's absence.

   b. If medication is required, it must be approved and the pilot certified fit for flight by an FAA designated medical examiner or flight surgeon.

J. Flight after Consumption of Alcoholic Beverages

1. No person who has consumed any alcoholic beverage within twelve (12) hours preceding a flight, or who may have a B.A.C. of greater than 0.0, will act as a pilot or crew member in the department aircraft.
2. Any violation of this policy will be grounds for immediate removal from flight duty and subject the employee to disciplinary action deemed appropriate by the Office of the Chief.
3. Refer to department policy *PRS:21 Omnibus Drug & Alcohol Testing* for further details concerning alcohol and drug use.

K. Pilot's Records

1. The Special Operation's Bureau and chief pilot shall maintain a file on each pilot. Files will contain the following documents at a minimum:
   a. Copy of pilot certificates
   b. Copies of additional ratings, e.g., flight instructor, etc
   c. Copy of latest medical certificate
   d. Copy of pilot experience form which is submitted to the insurance company annually
   e. Copy of certificate of completion of any school which establishes pilot's proficiency or flight status
   f. Copies of any additional pilot proficiency or qualification checks conducted by the FAA which attest to the pilot's currency or proficiency.
2. Each pilot shall maintain a current personal pilot log book. The log book shall be available for inspection by the Special Operations Bureau commander, the chief pilot, his designee, or the Office of the Chief, upon request.

L. Air Traffic Operations

1. General
   a. An aircraft may be used regularly, weather permitting, for traffic operations. Generally, it will be used over a given section of highway. The section of highway used should be based on the individual needs of the district.
   b. The aircraft will be used as an observation and communications platform from which violations are observed and information given to a ground unit for appropriate enforcement action.
   c. A DPS commissioned employee will ride in the aircraft to observe the road and traffic, and to communicate violator information or other pertinent data to the ground units for appropriate action.

d. The pilot's responsibility and duty will be to fly the aircraft and coordinate the operation, as necessary. The pilot will fly at the most desirable position in relation to the highway and at the appropriate altitude.

2. Highway Selection

   a. Highway selection and location of aircraft zone(s) will be at the discretion of the requesting district.

   b. Each district commander or designated supervisor should coordinate aircraft zone(s) designation and maintenance with the local Department of Transportation office.

3. Observer and Equipment

   a. A DPS commissioned employee from the requesting district will be assigned as an observer and should be familiar with his/her equipment and with the selection of highway to be patrolled. Necessary operational equipment includes:

      1. Stopwatch

      2. Time/speed table based on a 1320 foot distance

      3. Clipboard

4. Air Traffic Operations Procedures

   a. Patrol vehicles will be situated in such a manner as to maximize officer and violator safety and to efficiently conduct the air traffic operation.

   b. The aircraft is to be notified of any activity that may have an effect on the aircraft operation or a subsequent court case.

   c. Upon stopping the subject vehicle, it is suggested that the violator be told that his/her speed was verified by aircraft, by means of a timing device.

   d. In the event that the volume of violator traffic becomes difficult to manage, the pilot should immediately be informed.

   e. Communication during the operation will be conducted primarily on the district frequency, but may be conducted on car to car or Channel 4, under extenuating circumstances. The channel to be used will be coordinated prior to the operation, but may be changed at any time with proper coordination, should the need arise.

   f. If for any reason, the ground officer is unable to positively identify the violator vehicle, as described by the spotter, the ground officer will disregard and continue the operation.

M. Motor Vehicle Speed Check by Aircraft

1. In order to obtain a vehicle's speed from the air, a measured zone must be used and the vehicle timed through this zone. A 1320 foot zone was chosen due to the ease of observation, timing, accuracy, and federal guidelines.

2. A time/speed table based on a 1320 foot zone (1/4 mile) is attached to this policy.

N. Procedure for Assisting Aircraft in Emergency Landings

1. The following procedure is to be used, when practical, when assisting department aircraft in an emergency landing during dark or low-light conditions.

   a. When only one patrol vehicle is available, the vehicle shall be parked at the approach end of the runway or landing area, just to the right of center with the headlights and spotlight shining down the runway, pointing away from the approaching aircraft, and with emergency lights activated.

   b. When two patrol vehicles are available, they should be parked side-by-side on the approach end of the runway, one at the extreme left edge of the runway and the other at the extreme right edge.

   c. Once parked, the officers will exit the units and stage in a safe location. If possible, the officers should attempt to communicate their position to the pilot.

   d. Time permitting, ground officers should place several fusees at the far end of the runway, to enable pilots to observe runway length.

   e. If there is a strong wind, it is suggested that the ground officer identify the runway on which the aircraft can land INTO the wind.

   f. **IN EVERY CASE GROUND OFFICERS SHALL MAKE EVERY ATTEMPT TO LOCATE AND IDENTIFY ANY OBSTRUCTION THAT COULD POTENTIALLY AFFECT THE AIRCRAFT'S SAFE LANDING, SUCH AS POWER LINES, ANTENNAS, TREES, ETC.**

O. Procedures for Requesting Department Helicopter

1. Requests for helicopter emergency medical evacuation due to life threatening automobile crashes or accidental injury should be directed to commercial medical helicopter services with on-board medical technicians and life support equipment.

2. All non-SAR requests for the department helicopter will be submitted through the Special Operations Bureau commander. All SAR requests will be submitted through the appropriate Search and Rescue Area Coordinator. The Special Operations Bureau commander has the final approval of any requests for the department helicopter.

3. If the department helicopter is unable to respond to the request and the situation warrants a call for assistance to the Air Force or Army National Guard, the state police chief, or designee, will make the appropriate request.

4. For any request, the following information must be provided:

   a. The exact nature of the request for service

   b. Exact location

   c. Type of mission and description of person(s) or vehicle(s) involved

   d. Number of people involved and how many will require evacuation

   e. Severity of injuries, if known, and applicable

   f. Weather information (altitude, winds, visibility and terrain)

   g. What units to contact at the scene, their unit numbers, and correct radio frequency

5. Suggestions for officers at the scene:

   a. In mountainous or overgrown terrain, locate a large, safe, flat location where the helicopter can safely land and be able to provide clear, concise directions to that location. If possible, provide a clearly visible marker for the pilot to navigate toward.

   b. If the helicopter is requested for an accident on a highway, it is best to land it outside the right-of-way fence to keep personnel away from rotor blades.

   c. Communicate the wind direction to the pilot, for an approach/landing into the wind.

   d. Keep personnel away from the helicopter. Extreme caution is advised any time working around helicopters, especially near the tail rotor. **Ground officers shall only approach a helicopter from the front and only when the pilot has signaled that it is safe to do so.**

P. Aircraft Regulations and Operations Manual Note

1. Under extraordinary circumstances or emergency conditions, any directive or guideline contained herein may be waived by the Special Operations Bureau commander or the Chief.

7.0 ATTACHMENTS

TIME/SPEED TABLE BASED ON 1320 FOOT (1/4 MILE) DISTANCE

8.0 APPROVAL

APPROVED BY: s/ John Denko DATE: 05/23/2007
DPS Cabinet Secretary