



U.S. Department  
of Transportation

**Federal Aviation  
Administration**

Office of the Administrator

800 Independence Ave., S.W.  
Washington, D.C. 20591

December 20, 2016

The Honorable John Thune  
Chairman, Committee on Commerce,  
Science and Transportation  
United States Senate  
Washington, DC 20515

Dear Mr. Chairman:

As required by Section 317 of the FAA Modernization and Reform Act of 2012, enclosed is a report to Congress outlining the results of a review conducted on Off Airport, Low Altitude Aircraft: Weather Observation Technology.

Identical letters have been sent to Chairman Smith, Senator Nelson, and Congresswoman Johnson.

Sincerely,

A handwritten signature in black ink, appearing to read "Michael P. Huerta", with a circled "1" at the end.

Michael P. Huerta  
Administrator

Enclosure



U.S. Department  
of Transportation

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Administration**

Office of the Administrator

800 Independence Ave., S.W.  
Washington, D.C. 20591

December 20, 2016

The Honorable Bill Nelson  
Committee on Commerce  
Science and Transportation  
United States Senate  
Washington, DC 20515

Dear Senator Nelson:

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Identical letters have been sent to Chairmen Thune and Smith and Congresswoman Johnson.

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December 20, 2016

The Honorable Lamar Smith  
Chairman, Committee on Science,  
Space, and Technology  
House of Representatives  
Washington, DC 20515

Dear Mr. Chairman:

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of Transportation

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Administration**

Office of the Administrator

800 Independence Ave., S.W.  
Washington, D.C. 20591

December 20, 2016

The Honorable Eddie Bernice Johnson  
Committee on Science, Space, and  
Technology  
House of Representatives  
Washington, DC 20515

Dear Congresswoman Nelson:

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Identical letters have been sent to Chairmen Thune and Smith and Senator Nelson.

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Michael P. Huerta  
Administrator

Enclosure

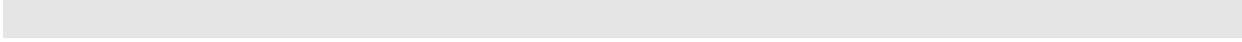
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# **Off Airport, Low Altitude Aircraft: Weather Observation Technology**



November 2016

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Prepared by:

Office of NextGen

Aviation Weather Division

# Off Airport, Low Altitude Aircraft: Weather Observation Technology

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## Introduction

The Next Generation Air Transportation System (NextGen) is the ongoing transformation of the National Airspace System (NAS). At its most basic level, NextGen represents an evolution from a ground-based radar system of air traffic control to a satellite-based system of air traffic management. NextGen will open America's skies to continued growth and increased safety while reducing aviation's environmental impact. The Federal Aviation Administration (FAA) will realize these goals by developing aviation-specific applications for existing, widely used technologies, such as the Global Positioning System (GPS), as well as technological innovation in areas such as weather forecasting, data networking, and digital communications.

NextGen capabilities—and weather technology specifically—apply not only to operations at airports and at altitude. They also apply to intentional low-altitude operations away from an airport. In fact, the U.S. Congress has taken an interest in the safety of these operations and their relationship to weather and weather reporting.

This document is the FAA's report on its review of off-airport, low-altitude aircraft weather observation technologies requested by section 317 of the FAA Modernization and Reform Act, Pub. L. 112-95. Section 317 states:

- **STUDY**—The Administrator of the Federal Aviation Administration shall conduct a review of off-airport, low-altitude aircraft weather observation technologies.
- **SPECIFIC REVIEW**—The review shall include, at a minimum, an examination of off-airport, low-altitude weather reporting needs, an assessment of technical alternatives (including automated weather observation stations), an investment analysis, and recommendations for improving weather reporting.
- **REPORT TO CONGRESS**—Not later than 1 year after the date of enactment of this Act, the Administrator shall submit to Congress a report containing the results of the review.

## **Section I: Background**

Low-altitude operations not at an airport, often with weather as a constraining factor, have been a concern of the FAA and aviation operators for many years, especially since investigators frequently cite weather as a factor in accidents. In order to maintain a safe National Airspace System (NAS), the FAA has continuously refined existing weather observation technologies and introduced new tools and technologies to help mitigate the effect of weather on air operations throughout the NAS.

The FAA's approach to determining whether additional weather observations were necessary in the off-airport, low-altitude domain included the following tasks:

- Reviewing the National Transportation Safety Board (NTSB) Accident Database, paying particular attention to incidents where weather was cited as a factor
- Studying weather observation technologies used in each of the studied cases to identify any gaps in the existing weather observations
- Identifying ways to improve weather observations in the off-airport, low-altitude domain and making recommendations for technical alternatives where necessary as well as conducting an investment analysis for technical alternatives identified through research
- Making recommendations for technical alternatives

## **Section II: Off-Airport, Low-Altitude Aircraft Weather Reporting Needs**

In order to assess the need for additional weather reporting needs at off-airport locations, the FAA conducted a review of the NTSB Accident Database (Appendix A). A summary of our review of the NTSB's detailed accident reports (provided since 2000) and the NTSB's Aviation Accident Database (collected since 2002) follow:

- Over the study period, the NTSB investigated 18,134 accidents/incidents.
- In 32.5 percent (5,894) of the accidents/incidents, the NTSB cited weather as a factor. However, this did not mean that a meteorological condition caused the accident/incident.
- In 2.8 percent (165) of the weather-related accidents/incidents, rotary wing (RW) aircraft were intentionally operating at a low level in areas removed from an airport, while 11 percent (647) involved fixed wing (FW) aircraft operating under the same conditions. NTSB did not consider agricultural application operations meeting the same criteria since they will not operate when there is any significant chance of precipitation occurring or when there winds are strong enough to cause dispersal of herbicide or pesticide.

- From 2000 onward, NTSB prepared 8 Aircraft Accident Reports (AAR) pertaining to purposeful, low-level operations away from an airport where weather was a factor in an accident/incident. These 8 accidents/incidents constitute 0.2 of the 1.0 percent of weather-related accidents during the same period.

Accidents/incidents during intentional low-level operations where weather was a factor generally fell into two distinct categories:

1. A Visual Flight Rules (VFR) operation flew into Instrument Meteorological Conditions (IMC) followed by either loss of control due to spatial disorientation or controlled flight into terrain (CFIT).
2. During good visibility, a RW operation did not consider the impact of density altitude or winds on the aircraft performance, causing loss of control.

## ***Analysis***

The FAA reviewed and analyzed 8 reports from the NTSB's Aviation Accident database. The FAA reviewed these reports specifically because weather *may* have played role in causing the incident as well as because the NTSB may have referenced correcting deficiencies in systems providing weather information to pilots in the off-airport, low-altitude domain.

Probable causes drawn from the most relevant accident reports include the following:

1. Pilot's decision to take off from a remote, mountainous landing site in dark (moonless) night, windy, instrument meteorological conditions.
2. Pilot's temporary unresponsiveness for reasons that could not be established from the available information. Contributing to the investigation's inability to determine exactly what occurred in the final minutes of the flight was the lack of a cockpit recorder system with the ability to capture audio, images, and parametric data.
3. Helicopter operator (1) intentionally understated the helicopter's empty weight; (2) altered the power available chart to exaggerate the helicopter's lift capacity, among others.
4. Pilot attempted to regain visual conditions by performing rapid descent and a failure of the Potomac Consolidated Terminal Radar Approach Control (PCT) controller to provide the current ADW weather observation to the pilot.
5. Pilot's decision to continue flight under visual flight rules into an area of turbulent, reduced visibility weather conditions, which resulted in the pilot's spatial disorientation and loss of control of the helicopter. Contributing to this accident was the pilot's inexperience in assessing local weather conditions.

6. Pilot's decision to continue flight into adverse weather conditions, which resulted in a loss of control due to an encounter with a microburst.
7. Factors contributing to the accident were high-density altitude and the pilot's decision to maneuver the helicopter in proximity to precipitous terrain, which effectively limited remedial options available.
8. Pilot's decision to continue visual flight into instrument meteorological conditions (IMC) in an area of cloud-covered mountainous terrain.

A majority of the NTSB's accident reports cited a pilot's or operator's decision to continue operations without taking into consideration all of the available weather data, which suggests that the availability of information was not a major factor in these incidents. Rather, in a majority of the cases the FAA studied, it was a pilot's or operator's error that set into motion a chain of events leading to an accident, which may or may not have been complicated by local weather conditions.

Furthermore, the FAA's analysis of NTSB's reports revealed that additional off-airport weather equipment would not necessarily have alleviated the risk for the type of accidents described (since sufficient weather information was already available to the pilots who were subjects of NTSB investigations). Moreover, some pilots had not obtained weather briefings from Flight Services or other sources; and of those who did have access to weather information, they may not have appropriately acted on the information provided to them.

Of the 8 NTSB reports that the FAA reviewed, 2 mentioned weather equipment, but neither is relevant to the off-airport domain. NTSB recommendation A-11-49, referenced in their Aircraft Accident Report AAR-11-03,<sup>1</sup> stated that the FAA should correct deficiencies of Automated Weather Sensors Systems (AWSS). NTSB recommendation A-10-166,<sup>2</sup> referenced in their Aircraft Accident Report AAR-10-06, called for helispots to have basic weather instrumentation with the capability to measure wind speed and direction, temperature, and pressure.

While NTSB's recommendations have merit for other operations, neither one is relevant to the issue at hand for the following reasons:

1. AWSS are located on airports such that correction of any deficiencies with that system would have no bearing on off-airport low-altitude operational needs.
2. A helispot is an aerodrome, not an off-airport low-altitude operating location. The NTSB did not conclude in any report that additional low-level weather observations would have alleviated the investigated accident or incident.

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<sup>1</sup> NTSB Case No. AAR-11-03, August 9, 2010

<sup>2</sup> NTSB Case No. AAR-10-06, December 7, 2010

Therefore, the FAA concludes that the accident rate attributable to lack of observations in the off-airport low altitude operational domain is extremely low. Nonetheless, any potential safety issue, no matter how small, is of concern to the FAA. Therefore, as will be shown below, the FAA continues to improve observations and develop meteorological analyses and forecasts to fill any gaps in observations.

## **Section III: Assessment of Technical Alternatives**

Over the past two decades, weather observations have transitioned from manual, human observations to mostly automated observations. However, the FAA continues to perform manual augmentation and backup at select high-volume airports. With few exceptions, the observations are at an airport or heliport. Few non-aerodrome certified weather observation sites exist; however, of those that do exist, most occur in mountain passes.

Since 1990, the number of certified observation stations across the contiguous United States has more than doubled, from fewer than 900 to 1,997. These observations represent the meteorological conditions only at the point of their location plus perhaps a five-mile radius from that point. To represent all points in the continental United States with that precision would require approximately 25 times as many observation points as we have today. This may not be an affordable solution.

Alternatively, meteorological models can infer conditions in existing gaps between observation stations by extrapolation and interpolation and report the results to pilots and dispatchers. Remote sensing technologies, such as satellite imagery, radar, lightning detection, and web cameras, also help to fill gaps. While some coverage gaps remain, the FAA's assessment shows that existing research and technology enhancements continue to improve and close those gaps in low-altitude weather observations.

### ***Research and Technology Enhancements***

Another limitation of relying on observations is that a point observation is not a reliable predictor of weather conditions remote from that point—nor even into the future at that point. Forecasts are more useful, both for looking ahead—even in the short term, and for filling the gaps between weather observation points.

#### **Research**

The FAA's Aviation Weather Research Program (AWRP) is conducting significant research under NextGen to improve analysis and forecasts of weather conditions at off-airport sites. The FAA sponsors most of this research, but the National Oceanic and Atmospheric Administration (NOAA) is making significant contributions, solely or in collaboration with the FAA. The AWRP's research efforts include the following:

- **Improved Numerical Modeling**—NOAA, with sponsorship from the FAA, continues to develop and operate higher-resolution, more accurate atmospheric models yielding improved forecasts of all aviation impact variables. Such model improvements continue to increase the accuracy of forecast conditions such as ceiling and visibility at both on-airport and off-airport locations.
- **Digital Gridded Forecasts**—NOAA forecasters produce nationwide gridded analyses and forecasts of most sensible weather parameters (temperature, winds, etc.) allowing the public to get a “point” forecast at their location. Select National Weather Service (NWS) offices are developing similar grids for ceiling and visibility with a goal to expand nationally in the next several years. Such point and click forecasts cover off-airport locations of interest for rotary wing operators.
- **Improved access to weather information**—The FAA’s Weather Technology in the Cockpit research program is developing standards and procedures to guide industry partners and others to provide important, relevant data directly to the cockpit in real time. The FAA’s Common Services System for Weather Program (CSS-Wx) will provide low cost, widespread access to relevant weather information on the ground, and the Aircraft Access to the System Wide Information Management (SWIM) program (AAtS) will facilitate airborne access to relevant information.

**Technology**

More specific to the needs of rotary wing users operating in the low altitude off-airport domain is the development by the FAA, and implementation by the National Weather Service, of a decision support tool for the Helicopter Emergency Medical Services (HEMS) community. The FAA’s Aviation Safety Organization, Flight Standards Service, and the FAA’s NextGen Aviation Weather Research Program (AWRP) have working with the research community to develop the HEMS Tool. This tool, widely used as a “No-Go” only decision aid (i.e., conditions are not suitable for proceeding with the flight), is operational at the National Weather Service Aviation Weather Center and is available to all HEMS operators. The HEMS Tool provides valuable estimates of ceiling and visibility in areas between reporting stations. It uses interpolation, extrapolation, and other techniques to determine the estimates.

## **Section IV: Investment Analysis**

Due to the aforementioned improvements to weather observations, which address accidents occurring with low-altitude operations, the FAA continues to make improvements to Surface Observations. As such, no additional investment is necessary at this time, which obviates the need for an investment analysis. This decision is supported in the research and technology enhancements, as well as in the accident history analysis (Appendix A), which points to causes other than a lack of weather observation.

The FAA's current efforts in research and technology enhancements in weather observations are sufficient in the improvement of low-altitude operations.

## **Section V: Recommendations for Improving Weather Reporting and Conclusions**

### ***Recommendations***

Due to the FAA's ongoing enhancements to existing weather observation technologies in NextGen, as well as the deployment of new capabilities in the NAS, such as the HEMS Tool, we do not currently have recommendations for additional observation investment analysis.

### ***Conclusions***

The FAA's review of the NTSB reports of weather-related accidents does not support the safety need for additional weather observations in the off-airport low altitude domain. The off-airport, low-altitude operations accident history demonstrates a low accident rate attributable to observable weather phenomena, such as low ceilings and visibility. Even where the NTSB implicates weather as a causal factor, the issue was not the availability of weather information; rather, the issue was whether pilots obtained or appropriately considered the information that was available to them.

While the safety risk is quite low, improvements in both observations and forecasts of low-altitude weather continue at a significant pace. On-airport observations have more than doubled over the past two decades and off-airport observations—from cameras and selected automated surface observations—have increased by a similar proportion. Moreover, improved extrapolation and interpolation techniques, as well as remote sensing capabilities, help to fill the gaps between observation points. Enhanced weather modeling continues to improve the accuracy of forecasts of low-altitude weather conditions, both on- and off-airport, and provides the most useful information to operators. Dissemination of these improved forecasts to operators in preflight and enroute is becoming both faster and easier through net-centric capabilities and data link applications.

The FAA concludes that these measures are more effective and efficient than increased observations in the off-airport locations to address the most pressing needs of the operators in the off-airport, low-altitude environment.

## Appendix A: NTSB Data

### NTSB Data Base Low-Altitude Off-Airport Wx Factor Information

Date	Case #	Description	Wx Factor?	What?	NTSB Wx Recommended?	Remarks
6/9/09	*AAR-11-04	H, NM State Police, VFR	X	IMC Conditions		
8/9/10	* AAR-11-03	FW into terrain, AK			Improve AWSS	Nothing about additional sensors
6/5/08	*AAR-10-06	H, Fire Fighting, CA	X	elevation > 6K	Obs at helispots	Helispot is an aerodrome
9/27/08	*AAR-09-07	H, MD State Police, VFR	X	Into IMC with divert		
1/10/05	AAB-07/04	H, Potomac River, night VFR				
9/20/03	AAB-07/03	H, Grand Canyon, VFR				
10/11/06	AAR-07/03	FW into building, NYC, VFR				
9/24/04	*AAR-07-03	H, HI, VFR into IMC; impact terrain	X	into IMC, turbc		
9/23/05	*AAB-07-01	H, HI, VFR into IMC; impact sea	X	into IMC, microburst		
3/23/04	AAR-06/02	H, Oil, TX, Night VMC; impact sea				
9/10/01	*AAB-04/02	H, AZ, Uncontrolled Decent, VMC	X	high density altitude		
9/25/99	*AAB-01/02	FW, HI, VFR into IMC. Hit mtn 10, 100'	X	into IMC		Pilot failure to obtain wx briefing

**Cases: 12**

**Cases with Wx Factor: 7**  
**Percent w/ wx: 58.3**

**2 Weather Equipment Addressed**

H: Helicopter

FW: Fixed Wing

\*Summary reproduced on following pages

On following Appendix A pages, **shading** highlights weather equipment related and weather accident causal text.

## Case AAR-11-04

### ***Crash After Encounter with Instrument Meteorological Conditions During Takeoff from Remote Landing Site, New Mexico State Police Agusta S.p.A. A-109E, N606SP***

*Santa Fe, New Mexico  
June 9, 2009*

*NTSB Number: AAR-11-04  
NTIS Number: PB2011-910404  
Adopted: May 24, 2011*

#### **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.

#### **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 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.

## **Recommendations**

### **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* Section 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)

### **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 continuous flight tracking during missions. (A-11-59)

### **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. Encourage your members to install flight-tracking equipment on all public aircraft that would allow for continuous flight tracking during missions. (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)

### **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 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)

## **Case AAR-11-03**

### ***Collision into Mountainous Terrain, GCI Communication Corp. de Havilland DHC-3T, N455A***

*Aleknagik, Alaska, August 9, 2010*

*NTSB Number: AAR-11-03*

*NTIS Number: PB2011-910403*

*Adopted May 24, 2011*

#### **Executive Summary**

This accident report discusses the August 9, 2010, accident involving a single-engine, turbine-powered, amphibious float-equipped de Havilland DHC-3T airplane, N455A, which impacted mountainous, tree-covered terrain about 10 nautical miles northeast of Aleknagik, Alaska. The safety issues discussed in this report relate to the lack of a Federal Aviation Administration (FAA) requirement for a crash-resistant flight recorder system, improperly designed or maintained emergency locator transmitter mounting and retention mechanisms, inadequate FAA guidance related to the medical certification of pilots who have had a cerebrovascular event, and the lack of passenger briefings related to survival and communications equipment. Although **no weather data deficiencies were found to be related to the accident**, the investigation also identified areas in which continued enhancements could further improve aviation safety. Four new safety recommendations concerning these issues are addressed to the FAA, and one new safety recommendation is addressed to the Aircraft Owners and Pilots Association; two safety recommendations to the FAA are reclassified; and two safety recommendations to the FAA are reiterated in this report.

#### **Probable Cause**

The National Transportation Safety Board determines that the probable cause of this accident was the pilot's temporary unresponsiveness for reasons that could not be established from the available information. Contributing to the investigation's inability to determine exactly what occurred in the final minutes of the flight was the lack of a cockpit recorder system with the ability to capture audio, images, and parametric data.

#### **Recommendations**

##### ***New Recommendations***

**The National Transportation Safety Board makes the following recommendations to the Federal Aviation Administration:**

Consult with appropriate specialists and revise the current internal Federal Aviation Administration guidance on issuance of medical certification subsequent to ischemic stroke

or intracerebral hemorrhage to ensure that it is clear and that it includes specific requirements for a neuropsychological evaluation and the appropriate assessment of the risk of recurrence or other adverse consequences subsequent to such events. (A-11-48)

Correct the deficiencies with the in-service automated weather sensor system (AWSS) stations, specifically the known problems with present weather sensors and ceilometers, to ensure that the AWSS stations provide accurate information as soon as practical. (A-11-49)

Implement a collaborative test program in Alaska between the Federal Aviation Administration, the National Weather Service (NWS), the local academic community, and private entities to establish the viability of relaying weather information collected from airborne aircraft equipped with existing data-link technology, such as universal access transceivers, to the NWS Alaska Aviation Weather Unit in real-time. (A-11-50)

If the Federal Aviation Administration's test program recommended in Safety Recommendation A-11-50 establishes that the use of existing data-link technology, such as universal access transceivers, is a viable means of relaying collected information in real-time from an airborne platform, encourage and provide incentives to data link-equipped aircraft operators in Alaska to outfit their aircraft with weather-sensing equipment for real-time data relay. (A-11-51)

**The National Transportation Safety Board makes the following recommendation to the Aircraft Owners and Pilots Association:**

Educate pilots of 14 Code of Federal Regulations Part 91 flight operations about the benefits of notifying passengers about the location and operation of survival and emergency communication equipment on board their airplanes. (A-11-52)

**Previously Issued Recommendations Resulting from this Accident Investigation and Reclassified in this Report**

**The NTSB issued the following safety recommendations to the Federal Aviation Administration on January 5, 2011:**

Require a detailed inspection, during annual inspections, of all emergency locator transmitters installed in general aviation aircraft to ensure that the emergency locator transmitters are mounted and retained in accordance with the manufacturer's specifications. (A-10-169)

The NTSB reclassified Safety Recommendation A-10-169 "Open—Unacceptable Response" in section 2.5.2 of this report.

Determine if the emergency locator transmitter (ELT) mounting requirements and retention tests specified by Technical Standard Order (TSO) C91a and TSO C126 are adequate to

assess retention capabilities in ELT designs. Based on the results of this determination, revise, as necessary, TSO requirements to ensure proper retention of ELTs during airplane accidents. (A-10-170)

The NTSB reclassified Safety Recommendation A-10-170 “Open—Acceptable Response” in section 2.5.2 of this report.

### **Previously Issued Recommendations Reiterated in this Report**

The NTSB reiterates Safety Recommendations A-09-10 and -11 to the Federal Aviation Administration, as follows:

Require all existing turbine-powered, non-experimental, non-restricted-category aircraft that are not equipped with a cockpit voice recorder and are operating under 14 Code of Federal Regulations Parts 91, 121, or 135 to be retrofitted with a crash-resistant flight recorder system. The crash-resistant flight recorder system should record cockpit audio, a view of the cockpit environment to include as much of the outside view as possible, and parametric data per aircraft and system installation, all to be specified in European Organization for Civil Aviation Equipment document ED-155, “Minimum Operational Performance Specification for Lightweight Flight Recorder Systems,” when the document is finalized and issued. (A-09-10)

Require all existing turbine-powered, non-experimental-, non-restricted-category aircraft that are not equipped with a flight data recorder and are operating under 14 Code of Federal Regulations Parts 91, 121, or 135 to be retrofitted with a crash-resistant flight recorder system. The crash-resistant flight recorder system should record cockpit audio (if a cockpit voice recorder is not installed), a view of the cockpit environment to include as much of the outside view as possible, and parametric data per aircraft and system installation, all to be specified in European Organization for Civil Aviation Equipment document ED-155, “Minimum Operational Performance Specification for Lightweight Flight Recorder Systems,” when the document is finalized and issued. (A-09-11)

## Case AAR-10-06

### ***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*

*NTSB Number: AAR-10/06*

*NTIS Number: PB2010-910406*

*Adopted December 7, 2010*

#### **Executive Summary**

On August 5, 2008, about 1941 Pacific daylight time, a Sikorsky S-61N helicopter, N612AZ, impacted trees and terrain during the initial climb after takeoff from Helispot 44 (H-44), located at an elevation of about 6,000 feet in mountainous terrain near Weaverville, California. The pilot-in-command, the safety crewmember, and seven firefighters were fatally injured; the copilot and three firefighters were seriously injured. Impact forces and a post-crash fire destroyed the helicopter, which was being operated by the U.S. Forest Service (USFS) as a public flight to transport firefighters from H-44 to another helispot. The USFS had contracted with Carson Helicopters, Inc. (CHI) of Grants Pass, Oregon, for the services of the helicopter, which was registered to CHI and leased to Carson Helicopter Services, Inc. of Grants Pass. Visual meteorological conditions prevailed at the time of the accident, and a company visual flight rules flight plan had been filed.

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.

The safety issues discussed in this report involve the accuracy of hover performance charts, USFS and FAA oversight, flight crew performance, accident survivability, weather observations at helispots, fuel contamination, flight recorder requirements, and certification of seat supplemental type certificates. Safety recommendations concerning these issues are addressed to the FAA and the USFS.

## **Recommendations**

### ***New Recommendations***

**As a result of this investigation, the National Transportation Safety Board makes the following safety recommendations to the Federal Aviation Administration:**

Require that the hover performance charts published by helicopter manufacturers reflect the true performance of the helicopter in all conditions for which the charts are applicable, including light and variable wind conditions. (A-10-148)

Develop and implement a surveillance program specifically for 14 Code of Federal Regulations (CFR) Part 135 operators with aircraft that can operate both as public aircraft and as civil aircraft to maintain continual oversight ensuring compliance with 14 CFR Part 135 requirements. (A-10-149)

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. (A-10-150)

Require the installation of fuel tanks that meet the requirements of 14 Code of Federal Regulations 29.952 on S-61 helicopters that are used for passenger transport. (A-10-151)

Require that S-61 helicopters that are used for passenger transport be equipped with passenger seats and seat mounting structures that provide substantial improvement over the requirements of Civil Air Regulations 7.260, such as complying with portions of 14 Code of Federal Regulations 29.561 and 29.562. (A-10-152)

Require operators of transport-category helicopters to equip all passenger seats with restraints that have an appropriate release mechanism that can be released with minimal difficulty under emergency conditions. (A-10-153)

Require that Advisory Circular 21-34 be used to evaluate all shoulder harness retrofit installations and to determine that the installations reduce the risk of occupant injury. (A-10-154)

Require operators of Sikorsky S-61 helicopters with General Electric model CT58-140 engines to install 10-micron airframe fuel filters. (A-10-155)

Require Carson Helicopters, Inc., to put a conspicuous notification on the title page of the Instructions for Continuing Airworthiness that accompany its supplemental type certificate for installing side-mounted seats indicating that the installation does not provide enhanced occupant protection over that provided by the originally installed seats and meets Civil Air Regulations 7.260 standards. (A-10-156)

Require all applicants for supplemental type certificate (STC) seat installations in any type of aircraft to put a conspicuous notification on the title page of the Instructions for Continuing Airworthiness that accompany the STC indicating whether the installation provides enhanced occupant protection over that provided by the originally installed seats and the certification standard level met by the seating system. (A-10-157)

Require supplemental type certificate (STC) applicants to improve the crashworthiness design of the seating system, such as complying with portions of 14 Code of Federal Regulations 29.561 and 29.562, when granting STC approval for older transport-category rotorcraft certificated to Civil Air Regulations 7.260 standards. (A-10-158)

**As a result of this investigation, the National Transportation Safety Board makes the following safety recommendations to the U.S. Forest Service:**

Develop mission-specific operating standards for firefighter transport operations that include procedures for completing load calculations and verifying that actual aircraft performance matches predicted performance, require adherence to aircraft operating limitations, and detail the specific Part 135 regulations that are to be complied with by its contractors. (A-10-159)

Require its contractors to conduct firefighter transport operations in accordance with the mission-specific operating standards specified in Safety Recommendation A-10-159. (A-10-160)

Create an oversight program that can reliably monitor and ensure that contractors comply with the mission-specific operating requirements specified in Safety Recommendation A-10-159. (A-10-161)

Provide specific training to inspector pilots on performance calculations and operating procedures for the types of aircraft in which they give evaluations. (A-10-162)

Require a hover-out-of-ground effect power check to be performed before every takeoff carrying passengers from helispots in confined areas, pinnacles and ridgelines. (A-10-163)

Review and revise policies regarding the type and use of gloves by firefighting personnel during transport operations, including but not limited to, compatibility with passenger restraints and opening emergency exits. (A-10-164)

Review and revise your contract requirements for passenger transport by aircraft so that the requirement to install shoulder harnesses on passenger seats provides improved occupant crashworthiness protection consistent with the seat design. (A-10-165)

Require that helispots have basic weather instrumentation that has the capability to measure wind speed and direction, temperature, and pressure and provide training to helitack personnel in the proper use of this instrumentation. (A-10-166)

Modify your standard manifest form to provide a place to record basic weather information and require that this information be recorded for each flight. (A-10-167)

Require all contracted transport-category helicopters to be equipped with a cockpit voice recorder and a flight data recorder or a cockpit image recorder with the capability of recording cockpit audio, crew communications, and aircraft parametric data. (A-10-168)

***Previously Issued Recommendation Reiterated in this Report***

**The National Transportation Safety Board reiterates the following safety recommendation to the Federal Aviation Administration:**

Do not permit exemptions or exceptions to the flight recorder regulations that allow transport-category rotorcraft to operate without flight recorders, and withdraw the current exemptions and exceptions that allow transport-category rotorcraft to operate without flight recorders. (A-06-18)

## **Case AAR-09-07**

### ***Crash During Approach to Landing of Maryland State Police Aerospatiale SA365N1, N92MD***

*District Heights, Maryland, September 27, 2008*

*NTSB Number: AAR-09-07*

*NTIS Number: PB2009-910407*

*Adopted October 27, 2009*

#### **Executive Summary**

On September 27, 2008, about 2358 eastern daylight time, an Aerospatiale (Eurocopter) SA365N1, N92MD, call sign Trooper 2, registered to and operated by the Maryland State Police (MSP) as a public medical evacuation flight, impacted terrain about 3.2 miles north of the runway 19R threshold at Andrews Air Force Base (ADW), Camp Springs, Maryland, during an instrument landing system approach. The commercial pilot, one flight paramedic, one field provider, and one of two automobile accident patients being transported were killed. The other patient being transported survived with serious injuries from the helicopter accident and was taken to a local hospital. The helicopter was substantially damaged when it collided with trees and terrain in Walker Mill Regional Park, District Heights, Maryland. The flight originated from a landing zone at Wade Elementary School, Waldorf, Maryland, about 2337, destined for Prince George's Hospital Center, Cheverly, Maryland. Night visual meteorological conditions prevailed for the departure; however, Trooper 2 encountered instrument meteorological conditions en route to the hospital and diverted to ADW. No flight plan was filed with the Federal Aviation Administration (FAA), and none was required. The MSP System Communications Center (SYSCOM) was tracking the flight using global positioning system data transmitted with an experimental automatic dependent surveillance-broadcast communications link.

#### **Probable Cause**

The National Transportation Safety Board determined that the probable cause of this accident was the pilot's **attempt to regain visual conditions by performing a rapid descent** and his failure to arrest the descent at the minimum descent altitude during a non-precision approach. Contributing to the accident were (1) the pilot's limited recent instrument flight experience, (2) the lack of adherence to effective risk management procedures by the MSP, (3) the pilot's inadequate assessment of the weather, which led to his decision to accept the flight, (4) the **failure of the Potomac Consolidated Terminal Radar Approach Control (PCT) controller to provide the current ADW weather observation to the pilot**, and (5) the increased workload on the pilot due to inadequate FAA air traffic control handling by the Ronald Reagan National Airport Tower and PCT controllers.

The safety issues discussed in this report involve risk assessments, pilot performance and training, terrain awareness and warning systems, air traffic control deficiencies, SYSCOM duty

officer performance, and emergency response. Also discussed are patient transport decisions, flight recorder requirements, and FAA oversight. Safety recommendations concerning these issues are addressed to the FAA, the MSP, Prince George's County, all public helicopter emergency medical services operators, and six other organizations whose members are involved in search and rescue activities.

## **Recommendations**

### ***New Recommendations***

As a result of this investigation, the National Transportation Safety Board makes the following safety recommendations:

#### **To the Federal Aviation Administration:**

Seek specific legislative authority to regulate helicopter emergency medical services (HEMS) operations conducted using government-owned aircraft to achieve safety oversight commensurate with that provided to civil HEMS operations. (A-09-130)

#### **To All Public Helicopter Emergency Medical Services Operators:**

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. (A-09-131)

Use formalized dispatch and flight-following procedures that include up-to-date weather information and assistance in flight risk assessment decisions. (A-09-132)

Install terrain awareness and warning systems on your aircraft and provide adequate training to ensure that flight crews are capable of using the systems to safely conduct helicopter emergency medical services operations. (A-09-133)

#### **To the Maryland State Police:**

Implement a program to screen and-if necessary-treat your pilots for obstructive sleep apnea. (A-09-134)

Revise your policy regarding incident commanders to specify that, in any event involving a missing or overdue aircraft, an Aviation Command trooper will serve as the incident commander. (A-09-135)

Provide additional training to your dispatchers on the use of cell phone "pinging" and include instruction about how to integrate the data obtained from cell phone pinging into an overall search and rescue plan. (A-09-136)

**To Prince George's County, Maryland:**

Provide additional training to your dispatchers on the use of cell phone "pinging" and include instruction about how to integrate the data obtained from cell phone "pinging" into an overall search and rescue plan. (A-09-137)

**To the National Association of Air Medical Communications Specialists, the Association of Public-Safety Communications Officials International, the National Emergency Number Association, the International Association of Police Chiefs, the National Sheriffs' Association, and the International Association of Fire Chiefs:**

Inform your members through your websites, newsletters, and conferences of the lessons learned from the emergency response to this accident, particularly emphasizing that search and rescue personnel need to understand how to interpret and use both global positioning system coordinates and the results of cell phone "pinging." (A-09-138)

***Previously Issued Recommendations Reiterated in this Report***

**The National Transportation Safety Board reiterates the following safety recommendations to the Federal Aviation Administration:**

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. (A-06-13)

Require all rotorcraft operating under 14 Code of Federal Regulations Parts 91 and 135 with a transport-category certification to be equipped with a cockpit voice recorder (CVR) and a flight data recorder (FDR). For those transport-category rotorcraft manufactured before October 11, 1991, require a CVR and an FDR or an onboard cockpit image recorder with the capability of recording cockpit audio, crew communications, and aircraft parametric data. (A-06-17)

Require all emergency medical services (EMS) operators to install terrain awareness and warning systems on their aircraft and to provide adequate training to ensure that flight crews are capable of using the systems to safely conduct EMS operations. (A-06-15)

## Case AAR-09-07

### ***Weather Encounter and Subsequent Collision into Terrain Bali Hai Helicopter Tours, Inc. Bell 206B, N16849***

*Kalaheo, Hawaii, September 24, 2004*

*NTSB Number: AAR-07-03*

*NTIS Number: PB2007-910404*

*Adopted February 13, 2007*

#### **Executive Summary**

On September 24, 2004, about 1642 Hawaiian standard time, a Bell 206B helicopter, N16849, registered to and operated by Bali Hai Helicopter Tours, Inc., of Hanapepe, Hawaii, impacted mountainous terrain in Kalaheo, Hawaii, on the island of Kauai, 8.4 miles northeast of Port Allen Airport, in Hanapepe. The commercial pilot and the four passengers were killed, and the helicopter was destroyed by impact forces and post-impact fire. The nonstop sightseeing air tour flight was operated under the provisions of 14 *Code of Federal Regulations* Part 91 and visual flight rules with no flight plan filed. Instrument meteorological conditions prevailed near the accident site.

The National Transportation Safety Board determines that the probable cause of this accident was the pilot's decision to continue flight under visual flight rules into an area of turbulent, reduced visibility weather conditions, which resulted in the pilot's spatial disorientation and loss of control of the helicopter. Contributing to this accident was the pilot's inexperience in assessing local weather conditions, inadequate Federal Aviation Administration (FAA) surveillance of Special Federal Aviation Regulation 71 operating restrictions, and the operator's pilot-scheduling practices that likely had an adverse impact on pilot decision-making and performance.

The safety issues discussed in this report include the influence of pilot experience and operator scheduling on in-flight decision-making; the lack of FAA oversight of Part 91 air tour operators; the need for national air tour safety standards; and the lack of direct FAA surveillance of commercial air tour operators in Hawaii.

Nine safety recommendations are addressed to the FAA regarding local weather-training programs for newly hired Hawaii air tour pilots; evaluation of operational practices for commercial air tour helicopter pilots; Honolulu Flight Standards District Office control of the annual safety meetings, as required under approved certificates of waiver or authorization; evaluation of the safety impact of the altitude restrictions in the State of Hawaii; national air tour safety standards; and the potential benefits of automatic dependent surveillance-broadcast technology for Hawaii air tour operators.

## **Case AAB-07-01**

### ***Aircraft Accident Brief Weather Encounter and Subsequent Crash into the Pacific Ocean, Heli-USA Airways, Inc., Aerospatiale AS350BA, N355NT***

*Haena, Hawaii, September 23, 2005*

#### **PROBABLE CAUSE**

The National Transportation Safety Board determines that the probable cause of the accident was the pilot's decision to continue flight into adverse weather conditions, which resulted in a loss of control due to an encounter with a microburst. Contributing to the accident was inadequate Federal Aviation Administration surveillance of Special Federal Aviation Regulation 71 operating restrictions. Contributing to the loss of life in the accident was the lack of helicopter flotation equipment.

#### **Weather-Reporting Facility Limitations**

No weather reporting facility is located on the north end of the island where the accident occurred, and the weather facility on the south end of the island is unable to observe the weather on the north end reliably because of interference from high terrain in the middle of the island. The WSR-88D radar's depiction of the convective area showed only light showers in the immediate vicinity of the accident site; however, the actual weather conditions were likely much stronger than what was depicted. Although a radar system capable of accurately observing the north end of the island could not have detected the presence of a microburst, the characteristics of the storm encountered by the accident helicopter (and two of three other tour helicopters in the area) would have produced strong reflectivity returns.

In the absence of reliable and timely official weather information, Kauai air tour pilots typically use their own judgment on the basis of the appearance of the weather to determine whether to proceed. Because the island's unique weather patterns involve daily, brief, localized rain showers, it is not unusual for Kauai air tour pilots to encounter and briefly penetrate areas of precipitation during tours. For example, of the three other tour pilots who approached the storm associated with the accident, one elected to turn back without entering the conditions and two chose to fly through it. Because of the rapidly changing characteristics of the storm, each pilot likely encountered different conditions. The three pilots (including the accident pilot) who entered the storm found that they did not quickly break out of the weather as expected.

#### **Weather Information Sources Available to the Pilot**

According to company personnel, pilots usually obtain their weather information from a combination of sources, including the FAA Flight Service Station (FSS) in Honolulu, local television reports, various Internet sites, and the LIH automatic terminal information service (ATIS).

According to the pilot, he arrived for work on the day of the accident about 0615, obtained a printout of FAA and NWS weather information from the direct user access terminal system (DUATS) 16 and noted nothing unusual about the information. The accident flight was his seventh tour flight of the day, and he had just finished his lunch break. In preparation for the flight, he spoke with a representative located at the company base in Princeville, Hawaii, on the northern part of Kauai, to see if there were any schedule changes. The pilot did not ask the representative about the weather conditions in that area. The pilot stated that, before departure on the accident flight, he listened to the LIH ATIS, which reported no adverse weather.

For in-flight weather information, tour pilots also use the CTAF to exchange brief, informal statements regarding their weather observations; 17 however, the high terrain in the middle of the island can limit the effective range of these transmissions.

## **Case AAB-04/02**

### ***Uncontrolled Descent and Impact with Terrain, Eurocopter AS350-B2 Helicopter, N169PA***

*Meadview, Arizona, August 10, 2001*

#### **PROBABLE CAUSE**

The National Transportation Safety Board determines that the probable cause of this accident was the pilot's decision to maneuver the helicopter in a flight regime and in a high density altitude environment which significantly decreased the helicopter's performance capability, resulting in a high rate of descent from which recovery was not possible. Factors contributing to the accident were high density altitude and the pilot's decision to maneuver the helicopter in proximity to precipitous terrain, which effectively limited remedial options available.

## **Case AAB-01-02**

### ***Collision with Terrain of Big Island Air flight 58,***

*Volcano, Hawaii, September 25, 1999*

#### **PROBABLE CAUSE**

The National Transportation Safety Board determines that the probable cause of this accident is the pilot's decision to continue visual flight into instrument meteorological conditions (IMC) in an area of cloud-covered mountainous terrain. Contributing to the accident were the pilot's failure to properly navigate and his disregard for standard operating procedures, including flying into IMC while on a visual flight rules flight plan and failure to obtain a current preflight weather briefing.