National Transportation Safety Board
Washington, D.C. 20594

Safety Recommendation

Date: June 9, 2011

In reply refer to: A-11-48 through -51
A-09-10 and -11 (Reiteration)

The Honorable J. Randolph Babbitt
Administrator
Federal Aviation Administration
Washington, DC 20591

On August 9, 2010, about 1442 Alaska daylight time, a single-engine, turbine-powered, amphibious float-equipped de Havilland DHC-3T airplane, N455A, impacted mountainous, tree-covered terrain about 10 nautical miles (nm) northeast of Aleknagik, Alaska.[1] The airline transport pilot and four passengers received fatal injuries, and four passengers received serious injuries. The airplane sustained substantial damage, including deformation and breaching of the fuselage. The flight was operated by GCI Communication Corp. (GCI), of Anchorage, Alaska, under the provisions of 14 *Code of Federal Regulations* (CFR) Part 91. About the time of the accident, meteorological conditions that met the criteria for marginal visual flight rules (MVFR)[2] were reported at Dillingham Airport, Dillingham, Alaska, about 18 nm south of the accident site. No flight plan was filed. The flight departed about 1427 from a GCI-owned private lodge on the shore of Lake Nerka and was en route to a remote sport fishing camp about 52 nm southeast on the Nushagak River.

The National Transportation Safety Board (NTSB) determined 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.

[1] For more information, see *Collision into Mountainous Terrain, GCI Communication Corp., de Havilland DHC-3T, N455A, Aleknagik, Alaska, August 9, 2010*, Aircraft Accident Report NTSB/AAR-11/03 (Washington, DC: National Transportation Safety Board, 2011).

[2] According to Federal Aviation Administration handbook FAA-H-8083-25A, "Pilot's Handbook of Aeronautical Knowledge," MVFR conditions are defined as ceilings between 1,000 and 3,000 feet above ground level inclusive and/or visibility between 3 and 5 miles inclusive. A ceiling is defined as the height above the earth's surface of the lowest layer of clouds that is reported as "broken" or "overcast" or the vertical visibility into an obscuration.

Background

The accident pilot was highly experienced and familiar with the route from the lodge to the fishing camp. In addition, the accident airplane was equipped with a variety of avionics to assist the pilot with navigation, situational awareness, and terrain avoidance, including two global positioning system (GPS) units with moving map and terrain display capabilities and a radar altimeter with visual annunciator and aural tone capabilities. However, at some point during the final few minutes of the flight, the airplane turned east-northeast (away from its destination) towards mountainous terrain and crashed into the mountainous terrain.

No air traffic control communications or air traffic radar data were available for the accident flight, and the airplane was not equipped with a cockpit voice recorder (CVR), flight data recorder (FDR), or other crash-resistant flight recorder. Without such information, the accident sequence was determined by analyzing the sparse position reports (provided at 3-minute intervals) from the airplane's Sky Connect tracking system,[3] the limited data extracted from the nonvolatile memory of the digital engine instruments, the available weather information (which was limited because of the potential for localized variability and because the nearest official weather reporting facility was 18 nm from the accident site), the information from the two surviving passengers who were awake at the time of the accident (neither of whom were seated with a clear view of the pilot), ground impact evidence, and airplane crush damage. Based on examinations of the ground marks and the airplane's deformation, the investigation determined that the airplane was in a climbing left turn when it impacted terrain and that flight control inputs occurred shortly before terrain impact; however, the available information was insufficient for the investigation to ascertain the pilot's actions (or lack thereof) in the nearly 3-minute period between the airplane's last reported position and his last-moment control inputs. The accident pilot experienced an intracerebral hemorrhage (ICH)[4] in March 2006; thus, the investigation thoroughly examined the accident pilot's medical history, the Federal Aviation Administration's (FAA) issuance of his unrestricted first-class airman medical certificate, and the potential for medical impairment, both related to and independent of his previous ICH.

A safety issue related to the FAA's medical certification of pilots who have had a cerebrovascular event was identified during the accident investigation. Further, although no weather data deficiencies were found to be related to the accident, the investigation identified areas in which continued enhancements could further improve aviation safety. Also, the NTSB continues to believe that crash-resistant flight recorder systems, which can help investigators identify accident factors (some of which may not otherwise be detectable), are critical tools for the prevention of future accidents. These safety issues are discussed below.

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[3] The airplane was equipped with a Sky Connect system that transmitted time-stamped, GPS-based position reports (including the airplane's location, ground track heading, altitude, and ground speed) to the Sky Connect server via satellite every 3 minutes. According to a Sky Connect representative, the accuracy of the system's GPS is "within 15 meters" (about 49 feet).

[4] ICH, also known as hemorrhagic stroke, involves bleeding from a blood vessel in the brain.

Federal Aviation Administration Issuance of Airman Medical Certificate

Based on the information provided with the accident pilot's March 26, 2008, airman medical certificate application, the FAA was aware that the pilot had a spontaneous ICH with intraventricular extension, persistent and obvious cognitive deficits for many months following the event, and a strong family history of ICH. However, the FAA Alaska Regional Flight Surgeon reviewed the pilot's application and determined that the pilot was eligible for an unrestricted first-class airman medical certificate.

During a postaccident interview, the Alaska Regional Flight Surgeon stated that he primarily used the FAA *Aeromedical Certification Reference Manual* (an internal FAA reference) to guide his evaluation. He stated that he did not speak with any outside consultants about the accident pilot because he was comfortable with the results he received from the evaluations of the pilot, including a status report provided by a local neurologist whom the flight surgeon considered reputable. He noted that neither the neurologist with whom he was familiar nor the pilot's treating neurologists indicated the need for any additional testing.

According to 14 CFR 67.109, "a transient loss of control of nervous system function(s) without satisfactory medical explanation of the cause" is disqualifying for every class of airman medical certificate. According to 14 CFR 67.401, an authorization for special issuance of a medical certificate may be granted to a person who does not meet the regulatory provisions if the person shows to the satisfaction of the Federal Air Surgeon (or, by delegated authority, a regional flight surgeon or the manager of the Aerospace Medical Certification Division) that the duties authorized by the class of medical certificate applied for can be performed without endangering public safety. The FAA's internal *Aeromedical Certification Reference Manual* notes under "cerebrovascular accidents" that "special issuance consideration will be given to those who can demonstrate full recovery of motor, sensory, language, and intellectual function." The Alaska Regional Flight Surgeon stated that he did not issue the accident pilot a special issuance medical certificate because such a certificate would require follow up, and he did not think that any follow up was necessary.

The NTSB notes that the neurologist's evaluation upon which the Alaska Regional Flight Surgeon relied did not specifically address the pilot's medical fitness for flight duties; further, there is no indication that any neuropsychological evaluation (formal cognitive testing) of the pilot had been performed. In addition, the Alaska Regional Flight Surgeon had no formal training in clinical adult medicine or neurology and had never personally treated a case of spontaneous ICH in an adult, yet he did not ask for assistance from other FAA medical personnel or from external FAA consultants in determining whether to provide the accident pilot with a first-class airman medical certificate. However, the Alaska Regional Flight Surgeon was a specialist in aerospace medicine, with extensive experience in the military, the National Aeronautics and Space Administration, and the FAA in fitness-for-duty determinations for pilots; thus, he should have been aware that the information available to him about the accident pilot was insufficient for him to be able to render an appropriate certification decision. The NTSB concludes that the Alaska Regional Flight Surgeon's decision to issue the pilot an unrestricted first-class airman medical certificate, based largely on a local neurologist's in-office evaluation and without conferring with any other FAA physicians or consultants or attempting to address the etiology of the hemorrhage, the likelihood of recurrence, or the extent of any remaining cognitive deficit, was inappropriate. The NTSB also concludes that, it is not clear that a sufficiently thorough aeromedical evaluation of the pilot would have denied the pilot eligibility for a first-class airman medical certificate; however, a more rigorous decision-making process for evaluating this pilot with a history of ICH would have decreased the potential for adverse consequences.

The NTSB recently investigated an accident in which inadequate oversight of a pilot's known medical condition was determined to have contributed to the accident. On December 29, 2010, an airline transport pilot flying a Eurocopter BK117-C2 helicopter with two medical crewmembers on board (the helicopter was operated by Air Methods Corporation under 14 CFR Part 135) suffered a recurrent stroke in flight in Cherry Point, North Carolina.[5] The helicopter pilot declared an emergency and landed the helicopter hard on the runway with assistance on the flight controls from the medical crewmember in the helicopter's left seat; the helicopter sustained substantial damage, and the pilot and medical crewmembers were not injured. The pilot, age 61, held a second-class airman medical certificate issued on August 12, 2010, with the limitation, "not valid for any class after August 31, 2011."

During a postaccident interview, the helicopter pilot stated that, when he was preparing to descend the helicopter, he found that he could not move his right arm and that his speech was becoming slurred. The NTSB's review of the helicopter pilot's FAA medical records found that he had experienced a small stroke (with no identified cause) about 4 years before the accident, had a family history of strokes, and had become increasingly obese. The FAA records also showed that the helicopter pilot's physician had discontinued a medication prescribed in part to reduce the pilot's risk of a future stroke. The FAA records contained no evidence of any formal evaluation of the helicopter pilot's risk of a recurrent stroke or of any formal neuropsychological evaluation. The NTSB determined that the probable cause of the accident was "the pilot's impairment during cruise flight due to a recurring stroke. Contributing to the accident was the [FAA's] inadequate oversight of the pilot's known medical condition."

In response to a request for information during the Aleknagik, Alaska, investigation, the FAA indicated that it has issued a total of 19 first-class airman medical certificates to pilots (including the accident pilot) following ICH.[6] Like the accident pilot, three other pilots were issued their first-class medical certificates by a regional flight surgeon. Of these three pilots, two had experienced an ICH with identified sources that were surgically removed, and the third pilot underwent neurology consultation and a neuropsychological evaluation (formal cognitive testing).

The NTSB notes that, although the Alaska Regional Flight Surgeon should have exercised more appropriate medical judgment in his decision to issue an airman medical certificate to the accident pilot (such as conferring with other FAA physicians or consultants or attempting to address the etiology of the stroke, the likelihood of recurrence, or the extent of any remaining cognitive deficit), the NTSB's review of two FAA reference manuals for internal FAA

[5] The report for this accident, NTSB case number ERA11LA106, is available online at <http://www.ntsb.gov/aviationquery/index.aspx >.

[6] The FAA provided the information in a January 5, 2011, response to the NTSB's request for information (FAA request number 11-107).

use in evaluating pilot eligibility for an airman medical certificate found that some aspects of the guidance regarding strokes could be improved.

NTSB investigators reviewed both the paper-copy *Aeromedical Certification Reference Manual* (which the Alaska Regional Flight Surgeon said that he used) and the electronic *Medical Certification Manual* that provides guidance for evaluating pilot eligibility for an airman medical certificate. Under "Brain hemorrhage," both manuals refer to "spontaneous bleeds" without further defining that term, and the *Medical Certification Manual* references spontaneous bleeds only under "epidural and subdural hematoma." Spontaneous bleeds require a 1-year recovery period. Under "cerebrovascular accident," the *Aeromedical Certification Reference Manual* refers only to "infarction" (which is a term sometimes used to describe ischemic stroke) and not to hemorrhagic stroke, whereas the *Medical Certification Manual* refers to both ischemic and hemorrhagic strokes. Both references indicated that a 2-year recovery period is required for a cerebrovascular accident.

Both the *Aeromedical Certification Reference Manual* and the *Medical Certification Manual* state that, "[i]f there is evidence or suspicion of impaired cognitive function, a current neuropsychological evaluation in accordance with specifications may be required." Such a neuropsychological evaluation, also referred to as formal cognitive testing, consists of a battery of tests (often administered via computer) on a variety of complex tasks and usually requires between 45 minutes and several hours to complete. The NTSB notes that the FAA requires such testing for all pilots with certain other medical conditions to identify potential subtle cognitive impairment. For example, pilots infected with the human immunodeficiency virus are required to submit an assessment of cognitive function testing at the time of the initial application and each year for first- and second-class applicants and every 2 years for third-class applicants.[7] An FAA-required seminar for aviation medical examiners (presented in 2009) included a presentation on "Cerebrovascular Disease" given by a Columbia University neurologist. The presentation did not address risk of recurrence or impairment in ICH other than to note that only 20 percent of individuals experiencing such hemorrhage are functional at 6 months. The presentation noted, in part, that the "2-year rule" for "ischemic cerebrovascular disease" had "no published scientific basis" and was an "arbitrary decision probably based upon review of recommendations of individual consultants in neurology."

The NTSB found that the FAA guidance references do not adequately define key terms or consistently organize information into groups and subgroups for medical conditions variously referred to as brain hemorrhage, cerebrovascular accident, ischemic stroke, and hemorrhagic stroke. Also, both FAA references indicate that, if there is evidence or suspicion of impaired cognitive function, a current neuropsychological evaluation "may be required." However, the NTSB notes that subtle cognitive impairment is often not obvious on casual observation and may become apparent only on particularly complex tasks. Thus, a neuropsychological evaluation is usually necessary to identify this type of impairment. Although the FAA requires such testing to

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[7] According to the FAA's 2010 *Guide for Aviation Medical Examiners*, medical applicants infected with the human immunodeficiency virus must submit "[a]n assessment of cognitive function (preferably by Cogscreen or other test battery acceptable to the Federal Air Surgeon)… ." The guide also states that "[a]dditional cognitive function tests may be required as indicated by results of the cognitive tests…" and that "…the results of cognitive function studies will be required at annual intervals for medical clearance or medical certification of…first- and second-class applicants. Third-class applicants will be required to submit cognitive function studies every 2 years."

identify potential subtle cognitive impairment for all pilots infected with the human immunodeficiency virus, it only suggests the use of such testing following a diagnosed stroke (and only if there is evidence or suspicion of impaired cognitive function, which, if readily observable, is likely more than a subtle impairment).

Further, the FAA guidance materials do not suggest an evaluation of risk for recurrence. Evaluation of the risk for recurrence is an important consideration from an aviation safety perspective; although zero risk of sudden medical incapacitation or impairment is not possible for any pilot, a substantially elevated risk would not be acceptable. Thus, a thorough evaluation must be applied to determine whether a pilot's risk, based on his or her medical history, is acceptable for medical certification.

The NTSB concludes that the FAA's internal guidance for medical certification of pilots following a diagnosed stroke is inadequate because it is conflicting and unclear, does not specifically address the risk of recurrence associated with such an event, nor does it specifically recommend a neuropsychological evaluation (formal cognitive testing) to evaluate potential subtle cognitive impairment. Therefore, the NTSB recommends that the FAA consult with appropriate specialists and revise the current internal FAA guidance on issuance of medical certification subsequent to ischemic stroke or ICH 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.

Weather Station Functionality

The investigation found that problems with the automated weather sensor system (AWSS) installation at New Stuyahok Airport (station identifier PANW), New Stuyahok, Alaska, limited the accuracy of certain aspects of the weather information, particularly regarding ceiling reporting and precipitation. For example, automated observations from the PANW AWSS around the time of the accident indicated that visibility at the station dropped from 10 miles at 1426 to 1.5 miles at 1456. During this time, the lowest cloud base height was reported as 800 feet; however, automated remarks indicated that the ceiling was variable between 100 and 1,300 feet.

The automated remarks in each PANW observation indicated that precipitation discriminator information was not available and that the system needed maintenance. There is no evidence that any inaccurate information from the PANW AWSS affected the safety of the accident flight. However, because of the importance of weather reporting information for the safety of flight operations in Alaska, the NTSB sought further information from the FAA about the PANW and other AWSS station deficiencies.[8]

In its December 2, 2010, response to the NTSB, the FAA indicated that the AWSS present weather sensor is susceptible to radio frequency interference and that, depending on the radio frequency strength, varying false precipitations are reported. The FAA reported that, at the 25 AWSS sites in Alaska,[9] the system's very high frequency radio antenna is located in close

[8] The FAA Technical Operations Service, Accident Investigation Division, provided the information on December 2, 2010, in response to the NTSB's request (FAA request number 11.055).

[9] As of May 13, 2011, there were 24 AWSS sites in Alaska.

proximity to its present weather sensor and that, therefore, the interference problem is widespread. The FAA also indicated that the AWSS ceilometer sensor is not accurate during periods of heavy rain. During heavy rain, the ceilometer's laser reflects off the rain drops, and the sensor interprets the information as a very low ceiling, about 100 to 200 feet. The FAA indicated that the AWSS manufacturer is in the process of redesigning a circuit card component to correct the problems and that the estimated time to replace the deficient equipment is 1 to 2 years.

The NTSB is pleased that the FAA has determined the cause of the AWSS problems and that a redesign process has been initiated. Accurate weather observations from an adequate number of well-located reporting points are necessary to provide National Weather Service (NWS) forecasters with information to produce detailed, accurate forecasts and advisories and to enable pilots to make informed decisions about their flights. The NTSB concludes that the known, widespread AWSS site deficiencies, if not corrected as soon as possible, will continue to adversely affect the weather reporting network's ability to offer adequate coverage for providing NWS forecasters and pilots with accurate ceiling and/or precipitation information. Therefore, the NTSB recommends that the FAA correct the deficiencies with the in-service AWSS stations, specifically the known problems with present weather sensors and ceilometers, to ensure that the AWSS stations provide accurate information in a timely manner.

Airborne Weather Data Collection and Dissemination

At present, the bulk of meteorological data that is collected in Alaska comes from aviation routine weather reports (METARs) that originate from surface-based weather observation stations (such as automated surface observing system, automated weather observing system, and AWSS stations), rawinsonde (weather-balloon) launches that can be widely spaced geographically and routinely occur only twice per 24-hour period, and pilot reports (PIREPs) that relay meteorological information from pilots to ground stations during flight. Although PIREPs are a valuable source of near real-time weather information that is used to improve advisories related to turbulence and icing severity, the use of PIREPs alone does not ensure the spatial and temporal consistency required for a reliable meteorological dataset. For example, PIREPs are made sporadically at the pilot's discretion, and each pilot's report of hazard severity (such as levels of turbulence and icing severity) can be highly subjective. In addition, weather cameras, which can capture images at airports and mountain passes, provide nonquantitative information about ceiling and visibility conditions; however, cameras are mostly restricted to daytime use.

Aviation safety in Alaska is highly dependent upon the quality of weather forecast products produced and disseminated by the NWS. U.S. government weather forecast model output and NWS weather advisory products can benefit substantially from improved meteorological data collected not only at the surface of the earth, but also from airborne aircraft.

Airborne aircraft provide the optimal platform for retrieving quantitative meteorological data pertinent to aviation. Weather sensing instrumentation is already installed on some aircraft (like tropospheric airborne meteorological data reporting-equipped airplanes) operating in select areas of the United States. These airborne data collection and dissemination efforts have shown that in-flight retrieval and near-real time dissemination of important quality-controlled meteorological data are possible and advantageous.[10] Meteorological parameters that are routinely collected include the aircraft's position and time (based on GPS), wind speed and direction, outside air temperature, moisture information, barometric pressure, and objective reports of icing and turbulence. As such airborne data collection becomes more widespread, aviation weather monitoring and forecasting in Alaska can be greatly improved.

Aircraft in Alaska equipped with certain data-link technologies, such as the universal access transceiver (UAT), may offer the most appropriate platform to facilitate a future robust network of meteorological data collection and the subsequent dissemination of such data to the NWS's Alaska Aviation Weather Unit (AAWU) because aircraft-to-ground data link technology (like the UAT) has already been developed via the FAA's Alaska Capstone Program. In addition, because UATs facilitate the use of automatic dependent surveillance-broadcast systems, the operational use of UATs will become more prolific in the coming decade. The development of a framework for successful implementation of data collection and transfer is part of an effort currently underway at the University of Alaska, Anchorage, Alaska. The NTSB concludes that the use of data link-equipped aircraft to collect meteorological data and to disseminate this information may provide NWS forecast offices with a more widespread, reliable meteorological dataset to improve the quality of weather forecast products. Such improved data collection in Alaska can also benefit weather forecasting in the continental United States because Alaska's geographic position is "upstream" of the continental United States. Therefore, the NTSB recommends that the FAA implement a collaborative test program in Alaska between the FAA, 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 UATs, to the NWS Alaska Aviation Weather Unit in real-time. The NTSB further recommends that, if its test program recommended in the previous safety recommendation establishes that the use of existing data-link technology, such as UATs, is a viable means of relaying collected information in real time from an airborne platform, the FAA 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.

Lack of Flight Recorder System

The lack of available data significantly increased the difficulty of investigating this accident. As a result, it was not possible to draw many definitive conclusions about the accident flight. The NTSB is particularly disappointed that one potential source of information, a crash-protected flight recorder system, was not required to be on board the airplane. On December 22, 2003, the NTSB issued Safety Recommendation A-03-64, which asked the FAA to require that such equipment be installed on aircraft like the accident airplane by January 1, 2007.[11] The FAA, however, did not implement this recommendation.

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[10] W.R. Moninger and others, "Evaluation of Regional Aircraft Observations Using TAMDAR," *Weather and Forecasting*, vol. 25, no. 2 (2010), pp. 627-645.

[11] Safety Recommendation A-03-64 specifically asked the FAA to do the following: "Require all turbine-powered, nonexperimental, nonrestricted-category aircraft that are manufactured prior to January 1, 2007, that are not equipped with a [CVR], and that are operating under 14 [CFR] Parts 91, 135, and 121 to be retrofitted with a crash-protected image recording system by January 1, 2007."

The NTSB faced similar challenges while investigating the July 27, 2007, midair collision involving two helicopters in Phoenix, Arizona;[12] these helicopters also would have been required to be equipped with image recorders if the FAA had implemented Safety Recommendation A-03-64. During the investigation of that accident, the NTSB noted that recorder technology had advanced considerably since the time that the recommendation was issued and that manufacturers had made significant progress toward developing affordable image recording systems for smaller (nontransport-category) aircraft. At the time of that accident investigation, the performance specification for such systems, document ED-155, "Minimum Operational Performance Specification for Lightweight Flight Recorder Systems," was under development by a European Organization for Civil Aviation Equipment (EUROCAE) working group.[13]

Because of the progress made in the development of recorder technology and the performance specification and because the FAA had not taken timely action in response to Safety Recommendation A-03-64, on February 9, 2009, the NTSB classified Safety Recommendation A-03-64 "Closed—Unacceptable Action/Superseded." In its place, the NTSB issued Safety Recommendation A-09-10, which asked the FAA to do the following:

> Require all existing turbine-powered, nonexperimental, nonrestricted-category aircraft that are not equipped with a [CVR] and are operating under 14 [CFR] 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 [EUROCAE] document ED-155, "Minimum Operational Performance Specification for Lightweight Flight Recorder Systems," when the document is finalized and issued.

Safety Recommendation A-09-10 is on the NTSB's Most Wanted List of Transportation Safety Improvements.

On February 9, 2009, the NTSB also issued Safety Recommendation A-09-11, which superseded Safety Recommendation A-03-65[14] and asked the FAA to do the following:

> Require all existing turbine-powered, nonexperimental, nonrestricted-category aircraft that are not equipped with [an FDR] and are operating under 14 [CFR]

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[12] See *Midair Collision of Electronic News Gathering Helicopters, KTVK-TV, Eurocopter AS350B2, N613TV, and U.S. Helicopters, Inc., Eurocopter AS350B2, N215TV, Phoenix, Arizona, July 27, 2007*, Aircraft Accident Report NTSB/AAR-09/02 (Washington, DC: National Transportation Safety Board, 2009).

[13] The working group consisted of industry and government representatives, including the FAA and the NTSB.

[14] On December 22, 2003, the NTSB issued Safety Recommendation A-03-65, which asked the FAA to do the following: "Require all turbine-powered, nonexperimental, nonrestricted-category aircraft that are manufactured prior to January 1, 2007, that are not equipped with [an FDR], and that are operating under 14 [CFR] Parts 135 and 121 or that are being used full-time or part-time for commercial or corporate purposes under Part 91 to be retrofitted with a crash-protected image recording system by January 1, 2010." The FAA did not implement the recommendation. As a result, the NTSB classified Safety Recommendation A-03-65 "Closed—Unacceptable Action/Superseded" when it issued Safety Recommendation A-09-11.

> 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 [CVR] 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 [EUROCAE] document ED-155, "Minimum Operational Performance Specification for Lightweight Flight Recorder Systems," when the document is finalized and issued.

On August 17, 2009, EUROCAE finalized and issued document ED-155, and, on November 15, 2010, the FAA published Technical Standard Order (TSO) C197, "Information Collection and Monitoring Systems," which incorporates the requirements of document ED-155. On February 15, 2011, the FAA provided a copy of TSO C197 to the NTSB and stated that it did not intend to mandate the equipage of additional recording systems on all turbine-powered, nonexperimental, nonrestricted-category aircraft as recommended. As a result, Safety Recommendations A-09-10 and -11 (which were classified "Open—Unacceptable Response" on December 23, 2010) remain classified "Open—Unacceptable Response."

The NTSB is disappointed that the FAA does not intend to require crash-resistant flight recorder systems for turbine-powered airplanes engaged in 14 CFR Part 91 passenger-carrying operations (like the accident airplane's operation). The NTSB notes that if the accident airplane had been equipped with a recorder system that captured cockpit audio, images, and parametric data, the recorder would have enabled investigators to determine additional information about the accident scenario, including the airplane's heading, airspeed, and other systems information. Further, recorded images could have provided information on the pilot's actions and weather conditions, such as cloud conditions or restrictions to flight visibility. The NTSB concludes that a crash-resistant flight recorder system that captures cockpit audio, images, and parametric data would have substantially aided investigators in determining the circumstances that led to this accident. The NTSB believes that the challenges experienced during this accident investigation highlight the need for such recorders; recorders can help investigators identify safety issues (some of which may not otherwise be detectable), which is critical for the prevention of future accidents. The NTSB is hopeful that the FAA, in consideration of this accident investigation that serves as yet another example of the need for recorder systems, will reconsider its stance that it will not require crash-resistant flight recorder systems for turbine-powered, nonexperimental, nonrestricted-category aircraft. As a result, the NTSB reiterates Safety Recommendations A-09-10 and -11.

Therefore, 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 also reiterates Safety Recommendations A-09-10 and -11, previously issued to the Federal Aviation Administration:

> Require all existing turbine-powered, nonexperimental, nonrestricted-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, nonexperimental, nonrestricted-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)

The NTSB also issued a safety recommendation to the Aircraft Owners and Pilots Association's (AOPA) Air Safety Institute (a division of the AOPA Foundation).

In response to the recommendations in this letter, please refer to Safety Recommendations A-11-48 through -51 and A-09-10 and -11. If you would like to submit your response electronically rather than in hard copy, you may send it to the following e-mail address: correspondence@ntsb.gov. If your response includes attachments that exceed 5 megabytes, please e-mail us asking for instructions on how to use our secure mailbox. To avoid confusion, please use only one method of submission (that is, do not submit both an electronic copy and a hard copy of the same response letter).

Chairman HERSMAN, Vice Chairman HART, and Members SUMWALT, ROSEKIND, and WEENER concurred in these recommendations.

[Original Signed]

By: Deborah A.P. Hersman
Chairman