NATIONAL TRANSPORTATION SAFETY BOARD
Public Meeting of April 25, 2017
(Information subject to editing)

Collision with Terrain, Promech Air, Inc., de Havilland DHC-3
N270PA, Ketchikan, Alaska
June 25, 2015
NTSB/AAR-17/02

This is a synopsis from the NTSB's report and does not include the Board's rationale for the conclusions, probable cause, and safety recommendations. NTSB staff is currently making final revisions to the report from which the attached conclusions and safety recommendations have been extracted. The final report and pertinent safety recommendation letters will be distributed to recommendation recipients as soon as possible. The attached information is subject to further review and editing to reflect changes adopted during the Board meeting.

Executive Summary

On June 25, 2015, about 1215 Alaska daylight time, a single-engine, turbine-powered, float-equipped de Havilland DHC-3 (Otter) airplane, N270PA, collided with mountainous, tree-covered terrain about 24 miles east-northeast of Ketchikan, Alaska. The commercial pilot and eight passengers sustained fatal injuries, and the airplane was destroyed. The airplane was owned by Pantechnicon Aviation, of Minden, Nevada, and operated by Promech Air, Inc., of Ketchikan. The flight was conducted under the provisions of 14 *Code of Federal Regulations* (*CFR*) Part 135 as an on-demand sightseeing flight; a company visual flight rules flight plan (by which the company performed its own flight-following) was in effect. Marginal visual flight rules weather conditions were reported in the area at the time of the accident. The flight departed about 1207 from Rudyerd Bay about 44 miles east-northeast of Ketchikan and was en route to the operator's base at the Ketchikan Harbor Seaplane Base, Ketchikan.

The accident airplane was the third of four Promech-operated float-equipped airplanes that departed at approximate 5-minute intervals from a floating dock in Rudyerd Bay. The accident flight and the two Promech flights that departed before it were carrying cruise-ship passengers who had a 1230 "all aboard" time for their cruise ship that was scheduled to depart at 1300. (The fourth flight had no passengers but was repositioning to Ketchikan for a tour scheduled at 1230; the accident pilot also had his next tour scheduled for 1230.) The sightseeing tour flight, which the cruise ship passengers had purchased from the cruise line as a shore excursion, overflew remote inland fjords; coastal waterways; and mountainous, tree-covered terrain in the Misty Fjords National Monument Wilderness.

Promech pilots could choose between two standard tour routes between Rudyerd Bay and Ketchikan, referred to as the "short route" (which is about 52 nautical miles [nm], takes about 25 minutes to complete, and is primarily over land) and the "long route" (which is about 63 nm, takes about 30 minutes to complete, and is primarily over seawater channels). Although the long route

was less scenic, it was generally preferred in poor weather conditions because it was primarily over water, which enabled the pilots to fly at lower altitudes (beneath cloud layers) and perform an emergency or precautionary landing, if needed. Route choice was at each pilot's discretion based on the pilot's assessment of the weather. The accident pilot and two other Promech pilots (one of whom was repositioning an empty airplane) chose the short route for the return leg, while the pilot of the second Promech flight to depart chose the long route.

Information obtained from weather observation sources, weather cameras, and photographs and videos recovered from the portable electronic devices (PEDs) of passengers on board the accident flight and other tour flights in the area provided evidence that the accident flight encountered deteriorating weather conditions. Further, at the time of the accident, the terrain at the accident site was likely obscured by overcast clouds with visibility restricted in rain and mist. Although the accident pilot had climbed the airplane to an altitude that would have provided safe terrain clearance had he followed the typical short route (which required the flight to pass two nearly identical mountains before turning west), the pilot instead deviated from that route and turned the airplane west early (after it passed only the first of the two mountains). The pilot's route deviation placed the airplane on a collision course with a 1,900-ft mountain, which it struck at an elevation of about 1,600 ft mean sea level. In the final 2 seconds of the flight, the airplane pitched up rapidly before colliding with terrain. The timing of this aggressive pitch-up maneuver strongly supports the scenario that the pilot continued the flight into near-zero visibility conditions, and, as soon as he realized that the flight was on a collision course with the terrain, he pulled aggressively on the elevator flight controls in an ineffective attempt to avoid the terrain.

Although Promech's *General Operations Manual* specified that both the pilot and the flight scheduler must jointly agree that a flight can be conducted safely before it is launched, no such explicit concurrence occurred between the accident pilot and the flight scheduler (or any member of company management) before the accident flight. As a result, the decision to initiate the accident tour rested solely with the accident pilot, who had less than 2 months' experience flying air tours in Southeast Alaska and had demonstrated difficulty calibrating his own risk tolerance for conducting tour flights in weather that was marginal or below Federal Aviation Administration (FAA) minimums. Further, evidence from the accident tour flight and the pilot's previous tour flights support that the pilot's decisions regarding his tour flights were influenced by schedule pressure; his attempt to emulate the behavior of other, more experienced pilots whose flights he was following; and Promech's organizational culture, which tacitly endorsed flying in hazardous weather conditions, as evidenced (in part) by the company president/chief executive officer's own tour flight below FAA minimums on the day of the accident.

The National Transportation Safety Board (NTSB) identified the following safety issues as a result of this accident investigation:

- **Need for training program improvements for Ketchikan air tour operators that address pilot human factors issues such as pilot assessment of safe weather conditions, pilot recognition of potentially hazardous local weather patterns, and operational influences on pilot decision-making.** Ketchikan's air tour industry, which involves the operation of float-equipped airplanes at low altitudes through fjords and mountain valleys,

is subject to a dynamic local weather environment. The accident pilot had received cue-based and controlled flight into terrain (CFIT)-avoidance training (specific to operations in Ketchikan) in a basic aircraft training device (BATD). However, the BATD (which is designed to serve as a platform for procedural and operational performance tasks) did not provide a realistic decision-making scenario, and the training was insufficient to counteract the cultural and peer influences that encouraged the pilot to continue flight into deteriorating weather.

- **Need for collaboration among Ketchikan air tour operators to identify and mitigate operational hazards through analysis of automatic dependent surveillance-broadcast (ADS-B) data.** During the investigation, NTSB investigators reviewed ADS-B data from Ketchikan-area tour flights to gain valuable insight into where and at what altitudes tour flights were conducted. However, there is no mechanism for Ketchikan-area air tour operators to review and discuss such objective data to identify any operational hazards reflected in the data and collaborate on mitigation strategies.

- **Lack of conservative weather minimums for Ketchikan air tour operators.** The Ketchikan air tour industry is competitive, and, on the day of the accident, Promech and other operators that were willing to take the most weather risks were able to fly more revenue passengers. It is likely that, unless corrective action is taken, some operators will continue to disregard weather minimums, thus putting pressure on other operators to follow suit to stay competitive. More conservative minimums, particularly when combined with open discussions of how actual behavior compares with the established requirements (for example, through a review and discussion of ADS-B data as described above), can help establish a safety-oriented culture that will encourage pilots to fly more conservatively.

- **Lack of defined curriculum segments for CFIT-avoidance training for all 14 *CFR* Part 135 operators.** Although the accident pilot received some CFIT-avoidance training, such training is not required for pilots of fixed-wing aircraft operated under Part 135; FAA-approved training programs and the guidance for principal operations inspectors for evaluating CFIT-avoidance training programs (as specified in FAA Order 8900.1) applies only to helicopter operations.

- **Nuisance alerts from the Class B terrain awareness and warning system (TAWS) during tour operations.** The accident airplane's Chelton EFIS included an integrated caution/warning/advisory (CWA) system that could provide an auditory voice annunciation (such as "pull up") accompanied by a red flag with text (such as "PULL UP") on the display. Based on its turbine-power and passenger-seating configuration, the accident airplane was required to be equipped with Class B TAWS, which specifies an alerting threshold of 700 ft above ground level (agl) during cruise flight and 500 ft agl during descent. However, the float-equipped accident airplane was authorized, per 14 *CFR* 135.203(a)(1), to cruise over the surface as low as 500 ft agl, which is below the Class B TAWS design alerting threshold. Several tour pilots reported that frequent nuisance alerts during tour operations prompted them to inhibit the alerts. (Technical Standard Order C151c defines a nuisance alert as "an inappropriate alert, occurring during normal safe operations, which is the result of the design performance limitation of TAWS.") The switch

controlling the accident airplane's TAWS CWA auditory and flag alerting functions was set to the "inhibit" position. Nuisance alerts and the associated increase in the use of the inhibit mode prevent TAWS from effectively providing the intended protection.

- **Limitations of older software and terrain database versions for the legacy Chelton Flight Systems FlightLogic electronic flight instrument system (EFIS).** The accident airplane was equipped with a Chelton EFIS, which is a legacy system still in use in many airplanes operated in Alaska. The system's original 2003 terrain database, which was installed in the accident airplane, does not distinguish small, inland bodies of water from the surrounding terrain. The more-detailed 2007 terrain database update depicts bodies of water in blue. The Chelton system is also capable of depicting terrain hazards on the multifunction display as a red (warning) or yellow (caution) overlay on the terrain map. According to the system's manufacturer, EFIS software version 6.0B (which was installed in the accident airplane) displays these red and yellow overlays with some degree of transparency so that the underlying terrain outlines can be distinguished. However, for operators using older versions of the EFIS software, these overlays may not be as transparent and may obscure the terrain depiction on the map. Thus, the limitations of the older software and terrain database versions can negatively affect the usefulness of these systems for reference.

- **Lack of minimum training requirements for operational control personnel and lack of guidance for FAA inspectors for performing oversight of operational control training programs.** Promech's training and supervision of the flight scheduler who was on duty on the day of the accident was insufficient to ensure that she fully understood and was performing her responsibilities to work jointly with the pilots to make safe and appropriate operational control decisions. Although 14 *CFR* 119.69 requires that a person exercising operational control be qualified through training, experience, and expertise, the FAA has no minimum training requirements for personnel authorized to exercise operational control and provides no guidance for inspector oversight of operational control training programs.

- **Need for cruise line industry awareness of schedule pressures associated with air tours sold as shore excursions.** The cruise industry may not be aware that air tour operators that fly air tours as cruise line shore excursions may face schedule pressures to return passengers to the ship on time.

- **Lack of a requirement for a safety management system (SMS) for Part 135 operators.** Promech lacked an SMS, which has been recognized in the industry as an effective way to establish and reinforce a positive safety culture. This accident is one of many Part 135 accidents and incidents in which the NTSB has determined that operational issues played a role. An SMS would have helped Promech learn from previous safety-related incidents, including those in which pilots had difficulty avoiding adverse weather during tour flights, and establish policies to reduce the risks of recurrence.

- **Lack of a crash-resistant flight recorder system.** The airplane was not equipped, and was not required to be equipped, with any crash-resistant flight recording system. However,

data retrieved from other devices, including the Chelton system and passenger PEDs, as well as recorded ADS-B data, provided information about the accident flight. Had these devices been destroyed by the accident sequence or ADS-B not been installed, the accident airplane's flightpath and altitude, the localized weather conditions, and the pilot's actions at the end of the flight would have been in doubt. Although the recovered data were invaluable to this investigation, the nonregulated nature of the devices challenged the investigation because their data lacked the types of critical details provided by the devices that meet the criteria specified in FAA Technical Standard Order C197, "Information Collection and Monitoring Systems."

Findings

1. The pilot was properly certificated and qualified in accordance with federal regulations and company requirements. No evidence was found indicating that the pilot's performance was affected by fatigue, medical conditions, toxins, alcohol or other drugs.

2. The airplane had no preimpact anomalies that would have precluded its normal operation.

3. Based on the damage and high loads sustained during the impact sequence, the accident was not survivable.

4. The accident flight encountered deteriorating weather conditions over the southern half of Ella Lake, and, at the time of the accident, the terrain at the accident site was likely obscured by overcast clouds with visibility restricted in rain and mist.

5. The pilot's continued flight in low-visibility conditions at a lower-than-normal vantage point in an area in which he lacked extensive flying experience reduced his ability to visually identify landmarks and resulted in a navigational error due to geographic disorientation.

6. For single-engine airplanes operated under 14 *Code of Federal Regulations* Part 135 that frequently operate at altitudes below their respective terrain awareness and warning system class design alerting threshold, the nuisance alerts and associated increase in the use of the inhibit mode prevents the system from effectively providing the intended protection.

7. For legacy Chelton systems in use by many Alaska operators, the more-detailed 2007 terrain database update and the current electronic flight instrument system software version provide pilots with more useful terrain information for position reference and for use in escaping an inadvertent encounter with instrument meteorological conditions during visual flight.

8. The pilot's decision to fly a riskier, overland route despite marginal weather conditions and the availability of a safer, overwater route was influenced by schedule pressure and his attempt to emulate the behavior of other, more experienced pilots whose flights he was following.

9. As evidenced by the company president/chief executive officer's own tour flights on the day of the accident, Promech management fostered a company culture that tacitly endorsed operating in weather conditions that were below Federal Aviation Administration minimums.

10. The cue-based and controlled flight into terrain avoidance training modules that Promech provided the accident pilot were insufficient to counteract cultural and peer influences that encouraged the pilot to continue the flight into deteriorating weather conditions.

11. Controlled flight into terrain (CFIT)-avoidance training for 14 *Code of Federal Regulations* (*CFR*) Part 135 airplane pilots, similar to that which is specified for helicopter pilots in Federal Aviation Administration Order 8900.1, could reduce the risk of CFIT accidents for all 14 *CFR* Part 135 airplane operations.

12. Promech did not exercise an adequate level of operational control of the accident pilot's flights on the morning of the accident.

13. Promech's training and supervision of the flight scheduler were insufficient to ensure that she was qualified under 14 *Code of Federal Regulations* 119.69 and fully understood and could perform her responsibilities to work jointly with the pilots to make safe and appropriate operational control decisions.

14. A flight scheduler with more in-depth operational control training might have played a more influential role in ensuring that flights conducted on the morning of the accident were safe for pilots to initiate and complete.

15. Guidance for establishing a Federal Aviation Administration-approved structured training program and qualification module would help operators ensure that persons authorized to exercise operational control are appropriately trained and possess the knowledge and experience required to make safe and appropriate operational control decisions.

16. All 14 *Code of Federal Regulations* Part 135 operators could benefit from best practices guidance on operational control, similar to that which is provided in Advisory Circular 120-96A, "Operations Control Center for Helicopter Air Ambulance Operators."

17. A quantitative and qualitative standard would enable the Federal Aviation Administration to evaluate the training methods and content of operational control training programs.

18. Although Promech had a hazard reporting system, the system was underused by the pilots, and the company's informal safety processes were not effective for identifying major risks in the company's flight operations and did not facilitate organizational learning about major areas of risk.

19. A safety management system can benefit all 14 *Code of Federal Regulations* Part 135 operators because they require the operators to incorporate formal system safety methods into their internal oversight programs.

20. The establishment of a more conservative set of weather minimums that are tailored to the types of air tour operations that occur in Ketchikan and are applied to all area air tour operators would help balance competing goals of production and safety and remove the incentive of individual operators to adopt the lowest possible weather minimums to stay competitive.

21. Automatic dependent surveillance-broadcast information from a focused operational area could serve as a basis for the Federal Aviation Administration to promote open, nonpunitive discussions of safety issues reflected in objective data to increase awareness of operational hazards.

22. A robust discussion by the Cruise Lines International Association's safety committee with its members about the scheduling pressures associated with air tour shore excursions identified in this investigation would benefit the entire cruise industry.

23. A flight recorder system that captured images of the pilot's forward view would have benefitted this accident investigation and provided potentially valuable information for air tour operator training programs.

PROBABLE CAUSE

The National Transportation Safety Board determines that the probable cause of this accident was (1) the pilot's decision to continue visual flight into an area of instrument meteorological conditions, which resulted in his geographic disorientation and controlled flight into terrain; and (2) Promech's company culture, which tacitly endorsed flying in hazardous weather and failed to manage the risks associated with the competitive pressures affecting Ketchikan-area air tour operators; its lack of a formal safety program; and its inadequate operational control of flight releases.

RECOMMENDATIONS

New Recommendations

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

To the Federal Aviation Administration:

1. Implement ways to provide effective terrain awareness and warning system (TAWS) protections while mitigating nuisance alerts for single-engine airplanes operated under 14 *Code of Federal Regulations* Part 135 that frequently operate at altitudes below their respective TAWS class design alerting threshold.

2. Discuss at the next Ketchikan Air Safety meeting database and software considerations for legacy Chelton systems and encourage operators to use the most current terrain database and electronic flight instrument system software.

3. Work with members of the Ketchikan air tour industry to improve existing training programs aimed at reducing the risk of weather-related accidents involving continuation of flight under visual flight rules into instrument meteorological conditions, with special attention paid to the human factors issues identified in this investigation, including (1) the need to help pilots better calibrate what constitutes safe weather conditions to conduct flights based on objective standards and requirements, such as set criteria for what landmarks must be clearly visible from which locations in order to proceed on a particular route; (2) the need to help pilots who are new to the area recognize dynamic local weather patterns that can place them in a dangerous situation; and (3) operational influences on pilot decision-making.

4. Expand the application of Federal Aviation Administration Order 8900.1, Volume 3, Chapter 19, Section 6, "Safety Assurance System: Flight Training Curriculum Segments," paragraphs 3-1251(B) and 3-1252, which address controlled-flight-into-terrain-avoidance training programs for 14 *Code of Federal Regulations* (*CFR*) Part 135 helicopter operations, to all 14 *CFR* Part 135 operations.

5. Establish minimum initial and recurrent training requirements for personnel authorized to exercise operational control, including, but not limited to, approved subject knowledge areas, training hours, subject hours, and qualification modules.

6. Publish an advisory circular that provides guidance on operational control best practices, including but not limited to such areas as risk mitigation strategies, joint flight safety responsibilities, prior experience of operational control personnel, and operational control personnel duty time limitations.

7. Revise Federal Aviation Administration Order 8900.1 to include guidance for inspector oversight of operational control training program subject areas, including, but not limited to, the criteria for a qualification module.

8. Analyze automatic dependent surveillance-broadcast data from Ketchikan air tour operations on an ongoing basis and meet annually with Ketchikan air tour operators to engage in a nonpunitive discussion of any operational hazards reflected in the data and collaborate on mitigation strategies for any hazards identified.

9. Develop and implement special operating rules for the Ketchikan air tour industry that include en route visual flight rules weather minimums that are tailored to the industry's unique requirements and are more conservative than those specified in 14 *Code of Federal Regulations* Part 135.

To Cruise Lines International Association:

10. Encourage your members that sell air tours as shore excursions to review the circumstances of this accident and to consider ways to mitigate associated risks.

Safety Recommendations Reiterated in this Report

To the Federal Aviation Administration:

1. Require all 14 *Code of Federal Regulations* Part 135 operators to establish safety management system programs. (A-16-36)

2. Require the installation of a crash-resistant flight recorder system on all newly manufactured turbine-powered, nonexperimental, nonrestricted-category aircraft that are not equipped with a flight data recorder and a cockpit voice recorder and are operating under 14 *Code of Federal Regulations* Parts 91, 121, or 135. The crash-resistant flight recorder system should record cockpit audio and images with 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 as specified in Technical Standard Order C197, "Information Collection and Monitoring Systems." (A-13-12)

3. Require all existing turbine-powered, nonexperimental, nonrestricted-category aircraft that are not equipped with a flight data recorder or 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 and images with 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 as specified in Technical Standard Order C197, "Information Collection and Monitoring Systems." (A-13-13)