

**NATIONAL TRANSPORTATION SAFETY BOARD**  
**Public Meeting of February 2, 2010**  
**(Information subject to editing)**

**Aircraft Accident Report**  
**Loss of Control on Approach, Colgan Air, Inc.,**  
**Operating as Continental Connection Flight 3407**  
**Bombardier DHC-8-400, N200WQ**  
**Clarence Center, New York**  
**February 12, 2009**  
**NTSB/AAR-10-01**

This is a synopsis from the Safety Board's report and does not include the Board's rationale for the conclusions, probable cause, and safety recommendations. Safety Board 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.

**EXECUTIVE SUMMARY**

On February 12, 2009, about 2217 eastern standard time, a Colgan Air, Inc., Bombardier DHC-8-400, N200WQ, operating as Continental Connection flight 3407, was on an instrument approach to Buffalo-Niagara International Airport, Buffalo, New York, when it crashed into a residence in Clarence Center, New York, about 5 nautical miles northeast of the airport. The 2 pilots, 2 flight attendants, and 45 passengers aboard the airplane were killed, one person on the ground was killed, and the airplane was destroyed by impact forces and a postcrash fire. The flight was operating under the provisions of 14 Code of Federal Regulations Part 121. Night visual meteorological conditions prevailed at the time of the accident.

**CONCLUSIONS**

1. The flight crew was properly certificated and qualified in accordance with applicable Federal regulations.
2. The airplane was properly certified, equipped, and maintained in accordance with Federal regulations.
3. The recovered components showed no evidence of any preimpact structural, engine, or system failures, including no indications of any problems with the airplane's ice protection system.
4. The air traffic controllers who were responsible for the flight during its approach to Buffalo-Niagara International Airport performed their duties properly and responded immediately and appropriately to the loss of radio and radar contact with the flight.
5. This accident was not survivable.
6. The captain's inappropriate aft control column inputs in response to the stick shaker caused the airplane's wing to stall.

7. The minimal aircraft performance degradation resulting from ice accumulation did not affect the flight crew's ability to fly and control the airplane.
8. Explicit cues associated with the impending stick shaker onset, including the decreasing margin between indicated airspeed and the low-speed cue, the airspeed trend vector pointing downward into the low-speed cue, the changing color of the numbers on the airplane's indicated airspeed display, and the airplane's excessive nose-up pitch attitude, were presented on the flight instruments with adequate time for the pilots to initiate corrective action, but neither pilot responded to the presence of these cues.
9. The reason the captain did not recognize the impending onset of the stick shaker could not be determined from the available evidence, but the first officer's tasks at the time the low-speed cue was visible would have likely reduced opportunities for her timely recognition of the impending event; the failure of both pilots to detect this situation was the result of a significant breakdown in their monitoring responsibilities and workload management.
10. The flight crew did not consider the position of the reference speeds switch when the stick shaker activated.
11. The captain's response to stick shaker activation should have been automatic, but his improper flight control inputs were inconsistent with his training and were instead consistent with startle and confusion.
12. The captain did not recognize the stick pusher's action to decrease angle-of-attack as a proper step in a stall recovery, and his improper flight control inputs to override the stick pusher exacerbated the situation.
13. It is unlikely that the captain was deliberately attempting to perform a tailplane stall recovery.
14. No evidence indicated that the Q400 was susceptible to a tailplane stall.
15. Although the reasons the first officer retracted the flaps and suggested raising the gear could not be determined from the available information, these actions were inconsistent with company stall recovery procedures and training.
16. The Q400 airspeed indicator lacked low-speed awareness features, such as an amber band above the low-speed cue or airspeed indications that changed to amber as speed decrease toward the low-speed cue, that would have facilitated the flight crew's detection of the developing low-speed situation.
17. An aural warning in advance of the stick shaker would have provided a redundant cue of the visual indication of the rising low-speed cue and might have elicited a timely response from the pilots before the onset of the stick shaker.
18. The captain's failure to effectively manage the flight (1) enabled conversation that delayed checklist completion and conflicted with sterile cockpit procedures and (2) created an environment that impeded timely error detection.
19. The monitoring errors made by the accident flight crew demonstrate the continuing need for specific pilot training on active monitoring skills.
20. Colgan Air's standard operating procedures at the time of the accident did not promote effective monitoring behavior.
21. Specific leadership training for upgrading captains would help standardize and reinforce the critical command authority skills needed by a pilot-in-command during air carrier operations.

22. Because of the continuing number of accidents involving a breakdown of sterile cockpit discipline, collaborative action by the Federal Aviation Administration and the aviation industry to promptly address this issue is warranted.
23. The flight crewmembers' performance during the flight, including the captain's deviations from standard operating procedures and the first officer's failure to challenge these deviations, was not consistent with the crew resource management (CRM) training that they had received or the concepts in the Federal Aviation Administration's CRM guidance.
24. The pilots' performance was likely impaired because of fatigue, but the extent of their impairment and the degree to which it contributed to the performance deficiencies that occurred during the flight cannot be conclusively determined.
25. All pilots, including those who commute to their home base of operations, have a personal responsibility to wisely manage their off-duty time and effectively use available rest periods so that they can arrive for work fit for duty; the accident pilots did not do so by using an inappropriate facility during their last rest period before the accident flight.
26. Colgan Air did not proactively address the pilot fatigue hazards associated with operations at a predominantly commuter base.
27. Operators have a responsibility to identify risks associated with commuting, implement strategies to mitigate these risks, and ensure that their commuting pilots are fit for duty.
28. The first officer's illness symptoms did not likely affect her performance directly during the flight.
29. The captain had not established a good foundation of attitude instrument flying skills early in his career, and his continued weaknesses in basic aircraft control and instrument flying were not identified and adequately addressed.
30. Remedial training and additional oversight for pilots with training deficiencies and failures would help ensure that the pilots have mastered the necessary skills for safe flight.
31. Colgan Air's electronic pilot training records did not contain sufficient detail for the company or its principal operations inspector to properly analyze the captain's trend of unsatisfactory performance.
32. Notices of disapproval need to be considered along with other available information about pilot applicants so that air carriers can fully identify those pilots who have a history of unsatisfactory performance.
33. Colgan Air did not use all available sources of information on the flight crew's qualifications and previous performance to determine the crew's suitability for work at the company.
34. Colgan Air's procedures and training at the time of the accident did not specifically require flight crews to cross-check the approach speed bug settings in relation to the reference speeds switch position; such awareness is important because a mismatch between the bugs and the switch could lead to an early stall warning.
35. The current air carrier approach-to-stall training did not fully prepare the flight crew for an unexpected stall in the Q400 and did not address the actions that are needed to recover from a fully developed stall.
36. The circumstances of this and other accidents in which pilots have responded incorrectly to the stick pusher demonstrate the continuing need to train pilots on the actions of the stick pusher and the airplane's initial response to the pusher.

37. Pilots could have a better understanding of an airplane's flight characteristics during the post-stall flight regime if realistic, fully developed stall models were incorporated into simulators that are approved for such training.
38. The inclusion of the National Aeronautics and Space Administration icing video in Colgan Air's winter operations training may lead pilots to assume that a tailplane stall might be possible in the Q400, resulting in negative training.
39. The current Federal Aviation Administration surveillance standards for oversight at air carriers undergoing rapid growth and increased complexity of operations do not guarantee that any challenges encountered by the carriers as a result of these changes will be appropriately mitigated.
40. Mandatory flight operational quality assurance programs would enhance flight safety because all operators would have readily available data to identify operational risks and use in developing corrective actions.
41. The viability of flight operational quality assurance programs depends on the confidentiality of the data, which would currently not be guaranteed if operators were required to implement these programs and required to share the data with the Federal Aviation Administration.
42. The systematic monitoring of all available safety data, as part of a flight operational quality assurance program, could provide operators with objective information regarding the manner in which flights are conducted, and a periodic review of this information would enhance flight safety by assisting operators in detecting and correcting deviations from standard operating procedures.
43. Distractions caused by personal portable electronic devices affect flight safety because they can detract from a flight crew's ability to monitor and cross-check instruments, detect hazards, and avoid errors.
44. The current use of safety alerts for operators to transmit safety-critical information is not effective because oversight and documentation of an operator's response are not required and critical safety issues may not be effectively addressed.
45. Weather documents missing key weather products or containing products that are no longer valid prevent flight crewmembers from having relevant, readily available weather related safety information for preflight and in flight decision-making.
46. Detailed icing definitions that include accretion rates and recommended pilot actions would help pilots more accurately determine the icing conditions to report in airframe icing pilot reports and more effectively respond to those conditions.

## **PROBABLE CAUSE**

The National Transportation Safety Board determines that the probable cause of this accident was the captain's inappropriate response to the activation of the stick shaker, which led to an aerodynamic stall from which the airplane did not recover. Contributing to the accident were (1) the flight crew's failure to monitor airspeed in relation to the rising position of the low-speed cue, (2) the flight crew's failure to adhere to sterile cockpit procedures, (3) the captain's failure to effectively manage the flight, and (4) Colgan Air's inadequate procedures for airspeed selection and management during approaches in icing conditions.

## RECOMMENDATIONS

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

1. Require 14 Code of Federal Regulations Part 121, 135, and 91K operators to review their standard operating procedures to verify that they are consistent with the flight crew monitoring techniques described in Advisory Circular (AC) 120 71A, “Standard Operating Procedures for Flight Deck Crewmembers”; if the procedures are found not to be consistent, revise the procedures according to the AC guidance to promote effective monitoring. (A 10-XX)
2. For all airplanes engaged in commercial operations under 14 Code of Federal Regulations Parts 121, 135, and 91K, require the installation of low-airspeed alert systems that provide pilots with redundant aural and visual warnings of an impending hazardous low-speed condition. (Supersedes Safety Recommendations A 03-53 and 54)
3. Require that airspeed indicator display systems on all aircraft certified under 14 Code of Federal Regulations Part 25 and equipped with electronic flight instrument systems depict a yellow/amber cautionary band above the low-speed cue or the digits on the airspeed indicator change from white to amber/yellow as the speed approaches the low-speed cue, consistent with Federal Aviation Administration Advisory Circular 25-11A.
4. Issue an advisory circular with guidance on leadership training for upgrading captains at 14 Code of Federal Regulations Part 121, 135, and 91K operators, including methods and techniques for effective leadership; professional standards of conduct; strategies for briefing and debriefing; reinforcement and correction skills; and other knowledge, skills, and abilities that are critical for air carrier operations. (A-10-XX)
5. Require all 14 Code of Federal Regulations Part 121, 135, and 91K operators to provide a specific course on leadership training to their upgrading captains that is consistent with the advisory circular requested in Safety Recommendation [4]. (A 10 XX)
6. Develop, and distribute to all pilots, multimedia guidance materials on professionalism in aircraft operations that contain standards of performance for professionalism; best practices for sterile cockpit adherence; techniques for assessing and correcting pilot deviations; examples and scenarios; and a detailed review of accidents involving breakdowns in sterile cockpit and other procedures, including this accident. Obtain the input of operators and air carrier and general aviation pilot groups in the development and distribution of these guidance materials. (A-10-XX) (Supersedes Safety Recommendation A 07-8)
7. Require all 14 Code of Federal Regulations Part 121, 135, and 91K operators to address fatigue risks associated with commuting, including identifying pilots who commute, establishing policy and guidance to mitigate fatigue risks for commuting pilots, using scheduling practices to minimize opportunities for fatigue in commuting pilots, and developing or identifying rest facilities for commuting pilots. (A-10-XX)
8. Require 14 Code of Federal Regulations Part 121, 135, and 91K operators to document and retain electronic and/or paper records of pilot training and checking events in sufficient detail so that the carrier and its principal operations inspector can fully assess a pilot’s entire training performance. (A 10-XX)

9. Require 14 Code of Federal Regulations Part 121, 135, and 91K operators to include the training records requested in Safety Recommendation [8] as part of the remedial training program requested in Safety Recommendation A-05-14.
10. Require 14 Code of Federal Regulations Part 121, 135, and 91K operators to provide the training records requested in Safety Recommendation [8] to hiring employers to fulfill their requirement under Pilot Records Improvement Act.
11. Develop a process for verifying, validating, auditing, and amending pilot training records at 14 Code of Federal Regulations Part 121, 135, and 91K operators to guarantee the accuracy and completeness of the records. (A 10 XX)
12. Direct all 14 Code of Federal Regulations Part 121, 135, and 91K operators of airplanes equipped with a reference speeds switch or similar device to (1) develop procedures to establish that, during approach and landing, airspeed reference bugs are always matched to the position of the switch and (2) implement specific training to ensure that pilots demonstrate proficiency in this area. (A-10-XX)
13. Require 14 Code of Federal Regulations Part 121, 135, and 91K operators and 14 Code of Federal Regulations Part 142 training centers to develop and conduct training that incorporates stalls that are fully developed; are unexpected; involve autopilot disengagement; and include airplane-specific features, such as a reference speeds switch. (A-10-XX)
14. Require all 14 Code of Federal Regulations Part 121, 135, and 91K operators of stick pusher-equipped aircraft to provide their pilots with pusher familiarization simulator training. (A-10-XX) (Supersedes Safety Recommendation A-07-4)
15. Define and codify minimum simulator model fidelity requirements to support an expanded set of stall recovery training requirements, including recovery from stalls that are fully developed. These simulator fidelity requirements should address areas such as required angle-of-attack and sideslip angle ranges, motion cueing, proof-of-match with post-stall flight test data, and warnings to indicate when the simulator flight envelope has been exceeded. (A-10-XX)
16. Identify which airplanes operated under 14 Code of Federal Regulations Part 121, 135, and 91K are susceptible to tailplane stalls and then (1) require operators of those airplanes to provide an appropriate airplane-specific tailplane stall recovery procedure in their training manuals and company procedures and (2) direct operators of those airplanes that are not susceptible to tailplane stalls to ensure that training and company guidance for the airplanes explicitly state this lack of susceptibility and contain no references to tailplane stall recovery procedures. (A-10-XX)
17. Develop more stringent standards for surveillance of 14 Code of Federal Regulations (CFR) Part 121, 135, and 91K operators that are experiencing rapid growth, increased complexity of operations, accidents and/or incidents, or other changes that warrant increased oversight, including the following: (1) verify that inspector staffing is adequate to accomplish the enhanced surveillance that is promulgated by the new standards, (2) increase staffing for those certificates with insufficient staffing levels, and (3) augment the inspector staff with available and airplane-type-qualified inspectors from all Federal Aviation Administration regions and 14 CFR Part 142 training centers to provide quality assurance over the operators' aircrew program designee workforce. (A-10-XX)
18. Require all 14 Code of Federal Regulations Part 121, 135, and 91K operators to (1) develop and implement flight operational quality assurance programs that collect

objective flight data; (2) analyze these data and implement corrective actions to identified systems safety issues; and (3) share the deidentified aggregate data generated through these analyses with other interested parties in the aviation industry through appropriate means. (A 10 XX)

19. Seek specific statutory and/or regulatory authority to protect data that operators share with the Federal Aviation Administration as part of any flight operational quality assurance program. (A 10 XX)
20. Require 14 Code of Federal Regulations Part 121, 135, and 91K operators to (1) routinely download and analyze all available sources of safety information, as part of their flight operational quality assurance program, to identify deviations from established norms and procedures; (2) provide appropriate protections to ensure the confidentiality of the deidentified aggregate data; and (3) ensure that this information is used for safety-related and not punitive purposes. (A-10-XX)
21. Require 14 Code of Federal Regulations Part 121, 135, and 91K operators to incorporate explicit guidance to pilots, including checklist reminders as appropriate, prohibiting the use of personal portable electronic devices on the flight deck. (A 10 XX)
22. Implement a process to document that all 14 Code of Federal Regulations Part 121, 135, and 91K operators have taken appropriate action in response to safety-critical information transmitted through the safety alert for operators process or another method. (A-10-XX)
23. Require 14 Code of Federal Regulations Part 121, 135, and 91K operators to revise the methodology for programming their adverse weather phenomena reporting and forecasting subsystems so that the subsystem-generated weather document for each flight contains all pertinent weather information, including Airmen's Meteorological Information, Significant Meteorological Information, and other National Weather Service in-flight weather advisories, and omits weather information that is no longer valid. (A 10-XX)
24. Require principal operations inspectors of 14 Code of Federal Regulations Part 121, 135, and 91K operators to periodically review the weather documents generated for their carriers to verify that those documents are consistent with the information requested in Safety Recommendation [23] (A 10-XX)
25. Update the definitions for reportable icing intensities in the Aeronautical Information Manual so that the definitions are consistent with the more detailed intensities defined in Advisory Circular 91 74A, "Pilot Guide: Flight in Icing Conditions." (A-10-XX)

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

The NTSB reiterates the following recommendations to the Federal Aviation Administration:

Require all Part 121 and 135 air carriers to obtain any notices of disapproval for flight checks for certificates and ratings for all pilot applicants and evaluate this information before making a hiring decision. (A-05-1)

Require all 14 Code of Federal Regulations Part 121 air carrier operators to establish training programs for flight crewmembers who have demonstrated performance deficiencies or experienced failures in the training environment that would require a review of their whole

performance history at the company and administer additional oversight and training to ensure that performance deficiencies are addressed and corrected. (A-05-14)

Require that all pilot training programs be modified to contain modules that teach and emphasize monitoring skills and workload management and include opportunities to practice and demonstrate proficiency in these areas. (A-07-13)

### **Previously Issued Recommendations Reclassified in This Report**

Safety Recommendation A-07-13 is reclassified “Open—Unacceptable Response” in section 2.3.1 of this report.

Safety Recommendations A-03-53 and -54 are reclassified “Closed—Unacceptable Action/Superseded” in section 2.3.3 of this report. The recommendations are superseded by Safety Recommendation [2].

Safety Recommendation A-07-8 is reclassified “Closed—Unacceptable Action/Superseded” in section 2.4.2 of this report. The recommendation is superseded by Safety Recommendation [6].

Safety Recommendation A-05-1 is reclassified “Open—Unacceptable Response” in section 2.7.3 of this report.

Safety Recommendation A-07-4 is reclassified “Closed—Unacceptable Action/Superseded” in section 2.9.1 of this report. The recommendation is superseded by Safety Recommendation [14].