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Breakdown in Coordination by Commuter Crew During Unstabilized Approach Results in Controlled-flight-into-terrain Accident

The captain of the accident flight had failed three proficiency check flights for either deficient judgment or poor crew resource management.

Russell Lawton
Aviation Consultant

The crash of a British Aerospace Jetstream BA-3100 operated by Express II Airlines Inc. has resulted in recommendations by the U.S. National Transportation Safety Board (NTSB) that the U.S. Federal Aviation Administration (FAA) improve its surveillance and oversight of commuter air carriers. The two pilots and all 16 passengers were killed in the December 1, 1993, accident.

The crew was flying a localizer back course approach to the Hibbing, Minnesota, U.S., airport at night in instrument meteorological conditions (IMC). Because icing was reported, the captain (the pilot) made a steeper than normal descent to minimize time in the clouds and reduce the possibility of airframe icing. An unstabilized approach ensued, with a descent rate that ranged from 2,250 to 2,500 feet (686 to 762 meters) per minute. The captain kept the first officer so busy during the approach that none of the altitude call-outs required by the company's standard operating procedures were made. The airplane collided with terrain 2.89 nautical miles (5 kilometers) from the runway threshold, the NTSB report said.

"The probable causes of this accident were the captain's actions that led to a breakdown in crew coordination and the loss of altitude awareness by the flight crew during an unstabilized approach in night instrument meteorological conditions. Contributing to the accident were: The failure of the company management to adequately address the previously identified deficiencies in airmanship and crew resource management of the captain; the failure of the company to identify and correct a widespread, unapproved practice during instrument approach procedures; and the Federal Aviation Administration's inadequate surveillance and oversight of the air carrier," the NTSB said.

The Jetstream (operated by Express II Airlines Inc. as Northwest Airlink Flight 5719 under an agreement with Northwest Airlines) was on a regularly scheduled passenger flight under Federal Aviation Regulations (FARs) Part 135 from Minneapolis/St. Paul International Airport, Minnesota (MSP) to Hibbing (HIB). Flight 5719 departed MSP at 1852 local time. The departure was 42 minutes later

than scheduled because of the late arrival of the preceding flight, the replacement of landing light bulbs and the removal of a passenger.

As the flight approached HIB, Duluth Approach Control (which handles the approaches into HIB) told the crew to expect radar vectors for the instrument landing system (ILS) to Runway 31. The controller then gave the crew the latest HIB weather: sky partially obscured, 400 feet (122 meters) overcast, visibility one mile (2 kilometers), light freezing drizzle, fog, wind 180 degrees at 10 knots. The crew was also advised that the braking action on Runway 31 was reported as poor.

The cockpit voice recorder (CVR) revealed that the captain told the first officer that they would not be able to accept the ILS approach to Runway 31. (This was because of a British Aerospace service letter, which advised against downwind landings when a runway is covered with precipitation.) The crew then asked, and was cleared, for the localizer back course to Runway 13. The minimum descent altitude (MDA) for this approach was 428 feet (130 meters) above ground level (AGL). The decision altitude (DA) for the ILS Runway 31 was 250 feet (76 meters) AGL.

The captain … was flying the arc at 8,000 feet (2,440 meters). The minimum altitude … for flying the arc was 3,500 feet (1,067 meters).

The controller told the crew that the cloud tops in the Duluth area were reported at 7,700 feet (2,348 meters), and that light to moderate mixed ice had been reported in the clouds, with cloud bases reported at 300 feet (91 meters) AGL. At 1931, the flight was cleared from its cruising altitude of 13,000 feet (3,965 meters) to descend at pilot's discretion to maintain 7,000 feet (2,135 meters), which the crew acknowledged, the report said.

Shortly thereafter, the crew was told to maintain their heading to intercept the 20-mile (32-kilometer) distance measuring equipment (DME) arc for the localizer back course approach. The captain then conducted an approach briefing as the first officer flew the aircraft. After completing the briefing, the captain took control of the airplane. At 1934, Duluth Approach cleared the flight to descend at pilot's discretion to maintain 5,000 feet (1,525 meters), which the crew acknowledged.

The captain then handed the approach chart to the first officer and said, "Just put it on your clipboard and talk me through it when I need information, okay?"

At 1944, with the airplane established on the 20-mile arc, Duluth Approach cleared the flight for the approach. The captain had levelled the aircraft and was flying the arc at 8,000 feet (2,440 meters). The minimum altitude on the chart for flying the arc was 3,500 feet (1,067 meters). The first officer asked the captain, "You just gonna stay up here as long as you can?"

"Yes," replied the captain.

Radar data showed that the airplane remained at 8,000 feet until intercepting the localizer, approximately 19 nautical miles (35 kilometers) from the HIB very high frequency omnidirectional radio range (VOR).

"Prior to the descent, conversation within the cockpit centered around getting the airplane ready for the before-landing checklist. The propeller RPM's were increased, both Hibbing localizers were identified, the flaps were set to 10 [degrees], the radio frequency was changed, the gear was lowered, the flaps were lowered to 20 [degrees], and the first officer asked the captain if he wanted the checklist," the report said.

The captain told the first officer to wait until they had crossed the final approach fix (FAF) to complete the before-landing checklist. At 1949:30, the airplane crossed the FAF and was 1,200 feet (366 meters) above the published minimum altitude of 3,500 feet. The average descent rate of the airplane at this point was 2,250 feet (686 meters) per minute.

"At 1950:10, while at 3,000 feet [915 meters] MSL, the first officer stated, 'One to go' [1,000 feet (305 meters) above the published minimum altitude]. Four seconds later, the captain responded 'To what alt- [altitude] to twenty forty [2,040 feet (622 meters) MSL], okay.' At 1950:15, the first officer stated, 'Twenty forty to ten point oh [10 nautical miles (18 kilometers) DME].' About 11 seconds later, the captain stated, 'Did you click the runway lights, make sure the co- common traffic advisory frequency is set.' The airplane descended through the 2,040-foot step-down altitude at 1950:30, at a point approximately 11.6 nautical miles [21 kilometers] from the HIB VOR. The final recorded radar data point shows the airplane descending through 1,800 feet [549 meters] MSL at 2,500 fpm at a point approximately 11.35 nautical miles from the HIB VOR," the report said.

"At 1950:40.3, the captain asked the first officer, 'Click it seven times?' About two seconds later, the first officer responded with, 'Yup yeah I got it now.' Approximately one-half second later, sounds similar to scraping were heard for 3.0 seconds until the end of the recording. The accident occurred about 1950, and the airplane was found 2.89 nautical miles [5 kilometers] northwest of the HIB Runway 13 threshold. The airplane was destroyed by the impact with terrain. The airplane's value was estimated at around 3.85 million [U.S.] dollars."

When investigators examined the wreckage path of the airplane, several impact points were found before the airplane came to rest. "The first impact point was with the top of a tree, about 1,200 feet [366 meters] from the main wreckage. … The next impact occurred 634 feet [193 meters] from the first one, and 36 feet [11 meters] (3 degrees down), along a 143-degree magnetic ground track, and involved the clipping of a group of aspen trees," the report said.

The airplane then hit two ridges in succession, and the main wreckage came to rest slightly beyond the second ridge. The wreckage path and crash site were within the boundaries of the localizer back course to Runway 13.

The report said, "The airplane's fuselage came to rest inverted and lying on its right side. The right side of the fuselage sustained severe crushing damage and was destroyed from the nose radome to the aft fuselage area." All three landing gear showed evidence of being down-and-locked at impact. All flight control surfaces were found along the wreckage path and at the accident site. Evidence also showed that the flaps were set at 20 degrees at impact.

"There was no evidence of in-flight fire. Small post-crash fires occurred along the crash path. … The cockpit had sustained severe impact damage that precluded complete documentation at the accident site," the report said.

"The GPWS simulation results indicate that if the accident airplane had been equipped with … GPWS … the crew would have received a … warning starting approximately 33 seconds prior to the impact …"

A postmortem examination of the flight crew did not find any pre-existing conditions that contributed to the accident. Tests for alcohol and other drugs were negative. "Examinations of the passengers indicated that all injuries were due to multiple extreme blunt force trauma. … The accident was not survivable due to the longitudinal impact forces and breakup of the airplane," the report said.

The maintenance records of the accident airplane were reviewed. "The airplane had been maintained in accordance with an FAA-approved continuous maintenance program. All periodic and non-routine inspections had been completed. There were no 'open' discrepancies, and there were no repetitive discrepancies noted in the records," the report said.

The records also showed that two FAA airworthiness directives (ADs) had been complied with. The first AD (issued in 1991) regarded methods to prevent sudden uncommanded pitch-down tendencies from tailplane icing. The second AD (issued in 1993) regarded the prevention of tailplane de-ice system malfunctions.

The airplane was equipped with a cockpit voice recorder. "A flight data recorder (FDR) was not installed, nor was it required to be installed, according to the existing regulations. Although Federal regulations require Part 135 airplanes, containing between 10 and 19 seats that entered U.S. registry after October 11, 1991, be equipped with FDRs, there is no plan to require retrofits of airplanes that were entered on the registry prior to October 11, 1991," the report said. The accident airplane entered the U.S. in 1986.

The accident airplane was not equipped with a ground-proximity warning system (GPWS), however, Express II was in the process of equipping its fleet with GPWS at the time of the accident to comply with FAA regulations.

The NTSB performed a computer simulation to determine if GPWS warnings would have been provided to the crew of the accident flight if the equipment had been on board. "The GPWS simulation results indicate that if the accident airplane had been equipped with a radio altimeter and typical commuter airplane GPWS (such as the Sundstrand MK-VI), the crew would have received a GPWS Mode 1 'SINK RATE' aural (via the cockpit public address system) and visual (via GPWS alert lamp) warning starting approximately 33 seconds prior to the impact with terrain. The airplane would have been at approximately 2,600 feet [793 meters] MSL, 1,120 [feet] [341 meters] AGL and descending at 3,000 feet [915 meters] per minute. The Mode 1 'SINK RATE' warning would have continued for approximately 12 seconds (until around 2,100 feet [640 meters] MSL , or just above the 2,040-foot step-down altitude), at which time the crew would have received an urgent GPWS Mode 1 'PULL UP' warning," the report said.

The accident airplane was equipped and was approved for operations in icing conditions. The icing intensity levels in which the airplane was approved to operate were: trace, light, moderate and severe. Express II prohibited operation of their aircraft in forecast or reported severe icing. The FAA-approved flight manual for the Jetstream contained the following precaution about the ice protection system:

"CAUTION: Freezing rain, freezing drizzle, and mixed conditions may result in extreme ice build-up on protected surfaces exceeding the capability of the ice protection system. Freezing rain, freezing drizzle, mixed conditions and descent into icing clouds from above freezing temperatures may result in run-back ice forming beyond protected surfaces. This ice cannot be shed and it may seriously degrade performance and control of the airplane."

Weather precautions on the night of the accident included "AIRMET [see definition below] advisories for occasional instrument meteorological conditions (IMC), moderate turbulence below 10,000 feet [3,050 meters],

and moderate rime/mixed icing below 15,000 feet [4,575 meters] were in effect for Minnesota. No SIGMET [see definition below] advisories were valid around the time of the accident," the report said.

[AIRMET — Inflight weather advisories issued only to amend the area forecast concerning weather phenomena which are of operational interest to all aircraft and potentially hazardous to aircraft having limited capability because lack of equipment, instrumentation, or pilot qualifications. AIRMETs concern weather of less severity than that covered by SIGMETs or Convective SIGMETs. AIRMETs cover moderate icing, moderate turbulence, or visibility less than 3 miles (5 kilometers), and extensive mountain obscurement.]

[SIGMET — A weather advisory issued concerning weather significant to the safety of all aircraft. SIGMET advisories cover severe and extreme turbulence, severe icing, and widespread dust or sandstorms that reduce visibility to less than 3 miles.]

"There were several pilot reports (PIREPS) for the general location and time of the accident at Hibbing," the report said. "The captain of another Express II flight that arrived at Hibbing about 1640 reported that he encountered continuous light and occasional moderate rime icing in the Hibbing area and that the cloud tops were between 8,500 feet [2,592 meters] and 9,000 feet [2,745 meters]. The pilot of a Beechcraft Queen Air airplane that departed Hibbing about 2020 [30 minutes after the accident] stated that he encountered light rime icing in the clouds with cloud tops at around 8,200 feet [2,501 meters]."

There were two previous accidents involving Jetstream aircraft, in which tailplane icing was suspected to have resulted in a loss of control during the final approach to landing. In the Hibbing accident, the report said, "The Safety Board considered whether airframe icing might have contributed to the descent of the airplane through the step-down fix altitude and the subsequent crash. Conditions at the time of the accident, with visible moisture present from the surface to 8,000 feet [2,440 meters] and a ground level temperature of 29 degrees F [-2 degrees C], could have caused ice to accumulate on the airplane at a moderate rate. However, evidence does not indicate that the airplane accumulated sufficient ice to have led to the accident.

"The configuration and performance of the [accident] airplane, the on-scene examination of the wreckage, and the CVR transcript indicate that neither tailplane icing nor wing icing, nor other forms of aircraft icing directly contributed to the accident. Tailplane icing is characterized by an uncommanded pitch-over at high speeds and high flap settings, usually just after increasing the flap setting or commanding a nose-down pitch. The flaps were set at an intermediate 20-degree setting, the airspeed was appropriate for the configuration, about 120 to 130 knots, the rate of descent was substantially decreasing, indicating elevator/horizontal stabilizer effectiveness, and the CVR provided no indication of forward stick forces or loss of pitch control.

"Wing icing is characterized by positive stall at speeds higher than clean wing stall speed. Other forms of icing, such as pitot/static system and engine icing, are characterized by unusual fluctuation in altitude and airspeed values and loss of engine performance. Airplane performance data and the CVR indicated normal functioning of the airplane. Consequently, the Safety Board ruled out airframe icing as a factor in the accident," the report said.

The NTSB commented on the fact that the accident airplane was equipped with an ice inspection light only on the captain's side of the airplane. Because the captain was flying the airplane during the approach, "if he had elected to check the ice on the wing, the light configuration might have interrupted his instrument scan and diverted his attention from flying the airplane to performing any ice accumulation inspections. The condition of the ice light bulb suggested that it was on at impact. It was not apparent when the light was turned on; however, it was probably turned on at the beginning of the descent from 8,000 feet. The Safety Board believes that a wing ice observation light installed on the right side of the airplane would have allowed the first officer to perform ice accumulation inspections while the captain remained focused on his flying duties."

"However, evidence does not indicate that the airplane accumulated sufficient ice to have led to the accident."

As a result of a previous Jetstream aircraft accident that occurred in 1991 because of airframe icing, the NTSB had previously recommended that the FAA issue an airworthiness directive to require ice detection lights to illuminate both wings on the BA-3100/3200. The FAA responded that an additional ice detection light on the right wing would not have altered the outcome of the accident and, therefore, did not believe an AD was necessary. In light of its investigation of the Hibbing accident, the NTSB urged the FAA to reconsider this recommendation, the report said.

The NTSB also reviewed the captain's decision to stay above the clouds as long as possible, and to descend at a higher than normal rate to minimize the time in icing conditions. "The investigation revealed that this inappropriate practice was widely used within the airline and probably at other airlines. Although the BA-3100 is certificated for continued operation into known icing conditions, all of the Express II pilots interviewed indicated that it was common practice for them to descend rapidly through icing conditions. This procedure was contrary to the manufacturer's

and Express II's guidance and violated the concept of flying stabilized approaches," the report said.

The Express II company manual was reviewed for guidance provided to its crews during descent for landing. "It [the manual] states that during descents, the pilot not flying (PNF) will call out 1,000 feet [305 meters] and 300 feet [91 meters] above all assigned altitudes. This guidance further states: 'Sink rate should be called out any time it exceeds 1,000 fpm [feet per minute] after reaching initial approach altitude.' In order to adhere to the 1,000-fpm maximum descent rates established by Express II's guidance, the crew would have had to descend to 6,400 feet [1,952 meters] MSL or lower once on the 20-DME arc prior to intercepting the localizer and initiating their descent."

The report continued: "The Climb and Descent Crew Coordination section further requires the PNF to call out 500 feet [152 meters] and 100 feet [30 meters] above DH [decision height] or MDA [minimum descent altitude]. The MDA for the approach was 1,780 feet [543 meters], although at the position where the airplane struck the ground, the minimum altitude was 2,040 feet [622 meters]. When they were interviewed, Express II pilots expressed some confusion concerning call-outs for this approach because an intermediate step-down altitude inside the FAF is not addressed in the Descent Crew Coordination section of the guidance. They were unsure whether the PNF should have called 500 feet and 100 feet, or 300 feet [91 meters], above the 2,040-foot step-down altitude, or above the MDA. In this accident, however, the PNF made none of these calls. Nor did he call out the MDA altitude when the airplane passed through it.

"The investigation found that there were serious deficiencies in the flight crew's operating practices and their failure to monitor altitude was a primary reason for the accident."

"The Climb and Descent Crew Coordination section clearly states: '1,000 feet per minute will be considered the maximum usable rate of descent inside the final approach fix. Excessive rates of descent shall be cause to abandon the approach.'"

The NTSB found a conflict in the manual, however, when it reviewed the guidance provided to Express II pilots regarding non-precision straight-in approaches: "During descents, the power should be reduced to maintain a descent rate of at least 1,000 fpm (emphasis added)." Express II Airlines removed the words "at least" from this section after the accident, the report said.

In commenting on the captain's decision to fly at an excessive descent rate to minimize the time in icing conditions, the NTSB stated: "The captain failed to consider the consequences of such actions and further did not take appropriate precautions during the descent. Once the decision was made to fly at the excessive descent rate, the flight crew should have carefully and consistently monitored the altitude. The investigation found that there were serious deficiencies in the flight crew's operating practices and their failure to monitor altitude was a primary reason for the accident."

The background and qualifications of the flight crew were reviewed. The captain, age 42, held a U.S. airline transport pilot (ATP) certificate with ratings and limitations for multiengine land, BA-3100, SF-340, and commercial pilot privileges for single-engine airplanes. He also held a flight instructor certificate with ratings and limitations for airplane single- and multi-engine, instrument airplane. His total pilot time was 7,852 hours, and he had accumulated 2,266 hours in the BA-3100, all of which were as captain.

The captain held a current first class medical certificate with the limitation that he wear correcting lenses while flying. "Eyewitness accounts and evidence from the captain's overnight bag indicated that he did not wear correcting lenses on the day of the accident," the report said.

A review of the captain's training records revealed that he had failed three proficiency checks since being hired by Express II in 1987. The common problem listed in each unsatisfactory proficiency check was either crew coordination or judgment. In each instance, the captain was retrained to proficiency and checked as satisfactory the same day by the same check airman who had found his previous performance to be unsatisfactory.

The report said that an instructor who worked with the captain when he was upgrading to that position commented that the captain "was difficult to train because he was 'head strong, argumentative, and thought that he was always right.' He characterized the captain's crew resource management (CRM) skills as 'weak.' During the course of the training, the captain shut down the incorrect engine and, in another instance, shut off the incorrect generator because of poor crew coordination. He was not responsive to inputs from the first officer.

"The instructor said the first officer candidate seemed to be intimidated by the captain. He [the instructor] said that the captain was extremely overbearing and it took three simulator periods (12 hours) for the first officer to get used to him. He [the instructor] said that the captain had to be trained to slow down and work with the first officer. The instructor said that the captain appeared to be receptive to crew coordination training at the time, but the instructor was not sure if this training was to 'cooperate and graduate' or if the training 'would stick.' He said that the captain performed satisfactorily at the end of the training but that he required all five days of it."

Within two months of the accident, the captain underwent a line check with a company check pilot, who occupied the right seat. The report said that the company check pilot "found the captain's performance satisfactory, but stated, 'his attitude bothered me.' The check pilot said that he knew that the captain had difficulties dealing with people. He had counseled the captain for problems with mechanics. He had heard complaints about the captain, but they were related to getting along with him. No one complained about his technical competence as a pilot.

The report said that during the accident flight, "the CVR transcript showed that most of the captain's communication with the first officer was either to correct him or to tell him what to do. The captain told the first officer how to put the approach plate into the yoke clip, how to set up the radios, how to put the altitude on the standby frequency of the ADF, how to call the station, and when to do the checklist. Others who had flown with this first officer indicated that he performed these routine pilot duties without difficulty. At the time the airplane began to collide with the trees, the captain was telling the first officer how to accomplish a task common to many of the airports they utilized; that was to key the microphone to turn on the runway lights."

"The facts and circumstances surrounding this accident suggest a captain with weak piloting abilities, little appreciation for CRM, and an intimidating and overbearing demeanor toward junior flight crew members."

The report concluded: "The facts and circumstances surrounding this accident suggest a captain with weak piloting abilities, little appreciation for CRM, and an intimidating and overbearing demeanor toward junior flight crew members. These traits should have been identified by the company and acted upon. Because of the company's failure to do so, they allowed this captain to continue to act as pilot in command, despite considerable evidence questioning his competence in that role. Consequently, the Safety Board concludes that the failure of Express II's management to monitor and act upon the captain's deficiencies as a pilot contributed to the cause of the accident."

The background of the first officer, age 25, was also reviewed. He held a U.S. ATP certificate with ratings and limitations for airplane multi-engine land, and commercial pilot privileges for airplane single-engine land. He also held a flight instructor certificate with ratings and limitations for airplane single- and multi-engine, instrument airplane. His total pilot time was 2,019 hours, of which 65 hours were in the BA-3100. He held a current first class medical certificate with a requirement to wear correcting lenses for distant vision while flying. A pair of prescription eyeglasses and two empty contact lens holders were found in the first officer's overnight bag, the report said.

The first officer was hired by Express II less than three months before the accident. Before getting hired by Express II, he worked as a flight instructor and traffic reporter for a fixed-based operator (FBO) in the Minneapolis area. He had previously worked as a flight instructor while attending the University of North Dakota, where he obtained a Bachelor of Science degree in Aeronautical Studies.

"The first officer had paid 8,500 [U.S.] dollars to FlightSafety International, Inc. (FSI) for his BA-3100 training to become an Express II first officer. There were six other first officer candidates in his class at FSI. The training records indicate that he was the only candidate in his class to pass the simulator checkride on the first attempt." After being hired by Express II, the company check pilot who administered his initial operating experience (IOE) said that the first officer "flew the BA-3100 very well and that he was familiar with line operating procedures, even though he was new," the report said.

When investigators examined the wreckage of the accident flight, they found a set of hand-written index cards containing data for Express II destination airports in the first officer's flight case.

The NTSB examined why the first officer failed to make the required company call-out when, during the accident flight, the descent rate exceeded 1,000 feet per minute. The report said that the first officer missed several other call-outs, and that "he did not alert the captain about their descent below the MDA, probably because he was performing other duties, as directed by the captain.

"The evidence suggests that the first officer, because of his probationary status and the captain's intimidating reputation, may have been reluctant to challenge the captain's decision to perform the approach in a manner contrary to Express II's guidance or to call out the need to execute a missed approach. Moreover, given his career aspirations and the extent to which he endeavored to achieve those aspirations, the first officer may have perceived that challenging the judgment of such a captain could indeed jeopardize his career with the airline."

The report added: "In addition, the captain's directing him to key the microphone to switch on the [runway] lights while they were approaching an altitude limit interfered with the first officer's ability to monitor the descent. Nevertheless, Express II procedures were definitive in the call-outs required of non-flying pilots. Had he made them, despite the reputation of the captain and his own probationary status, his actions would have been consistent with company expectations of a non-flying pilot and a probationary first

officer. As a result, the Safety Board believes that his inaction with regard to call-outs contributed to the breakdown in crew coordination that led to the accident."

The NTSB was also concerned that Express II only provided approach charts to its captains. After briefing the approach, the captain of the accident flight gave the approach chart to the first officer and told him to furnish information when he needed it. A question by the captain during the approach indicated that he might have been confused about the airplane's altitude. "The Safety Board believes that having only one set of approach charts available in the airplane is not in the best interests of flight safety," the report said.

The NTSB cited two previous recommendations as a result of two commuter airline accidents that the FAA should require all pilots operating under FARs Part 135 to have access to their own set of approach charts. The report said, "The FAA agreed that both pilots should have access to an approach chart during the instrument approach, but that this can be accomplished either by both pilots having their own set of approach charts or by both pilots having immediate access and use of a shared approach chart. The Safety Board continues to believe that the FAA is still not addressing the intent of this safety recommendation, and that the practice of having only one set of approach charts available in the airplane is not in the best interest of aviation safety."

The NTSB criticized the FAA's surveillance and oversight of Express II's operation and training program. The report stated: "The POI [FAA principal operations inspector] for Express II did not have industry or FAA experience with scheduled FARs Part 135 air carriers and was not qualified to fly either model of airplane that Express Airlines operated. It is questionable whether the Express II POI had the knowledge to provide the necessary oversight of the DO [director of operations] and CP [check pilot], even if he were closer geographically. The POI's geographic location and lack of experience concerning the duties and responsibilities of the DO precluded the opportunity to exercise quality control. Although the location and qualifications of the POI are questionable, the fact remains that only the POI can provide the continuity of oversight necessary to maintain effective ongoing surveillance.

"The POI was located in Des Moines, Iowa, but Express II did not fly to Des Moines. Although the POI had been responsible for its certificate for six months at the time of the accident, he had not visited its principal base of operations in Minneapolis. The POI had telephone contact with the DO, but had never met him."

The NTSB developed 18 findings as a result of its investigation. Some of the more pertinent findings in the report were:

- A right wing ice observation light would allow the first officer to inspect for ice accumulation;
- The captain was flying the airplane during the approach and delayed the start of the descent that subsequently required an excessive descent rate to reach the final approach fix and minimum descent height for the non-precision approach;
- The captain's decision to initiate the excessively steep approach may have been prompted by a desire to minimize time in icing conditions;
- The captain did not exercise proper crew coordination during the approach, and his actions led to distractions during critical phases of flight;
- The first officer did not adequately monitor the approach and alert the captain of the unstabilized nature of the approach and of the descent;
- The flight crew lost altitude awareness and allowed the airplane to descend below mandatory level off points, including the minimum descent altitude for the approach, and the airplane descended into the ground short of the runway;
- The captain's record raised questions about the adequacy of his airmanship and behavior that suggested a lack of crew coordination during flight operations, including intimidation of first officers. Company management did not address these matters adequately;
- The first officer was distracted from his duties of monitoring the altitude as a result of untimely and poorly planned instructions from the captain;
- A GPWS would have provided timely warning to the crew and should have prevented this accident;
- The airline's flight operations management failed to implement provisions to adequately oversee the training of their flight crews and the operation of their aircraft;
- FAA oversight of the airline was inadequate; and,
- FAA guidance provided to FAA inspectors concerning the implementation of Air Carrier Operations Bulletins was inadequate and had failed to transmit valuable safety information as intended to airlines.

Based on its findings, the NTSB made six recommendations to the FAA:

- "Develop specific guidance for the evaluation and oversight of contract training programs used by air carriers and incorporate such guidance into [the FAA *Air Transportation Inspector's* handbook] for FAA principal inspectors to use in approving training programs.

- "Issue an Air Carrier Operations Bulletin directing principal operations inspectors to advise air carriers to reemphasize in pilot training materials the necessity for adhering to the maximum descent rate of 1,000 feet per minute after passing the final approach fix, regardless of the existence of icing conditions.

- "Based on the circumstances and findings of the investigation of the Express II Airlines accident … develop a clear and specific directive to [FAA] Flight Standards inspectors and managers that emphasizes the need for compliance with existing FAA Orders, Directives, and other guidance material during the certification and surveillance of commuter air carriers.

- "Issue an Airworthiness Directive requiring operators of two-pilot airplanes, including the Jetstream 3100/3200, presently equipped with only the left wing ice observation light to install a right wing ice observation light.

- "Amend 14 CFR [Code of Federal Regulations] Part 23.1419, Section (d), to require that airplanes certificated for two-pilot operation be configured with ice observation lights illuminating both wings."

The Safety Board also reiterated a recommendation made in 1993 to "require that all pilots operating aircraft under 14 CFR 135 have access to their own set of instrument approach charts." ♦

Editorial note: This article was adapted from *Aircraft Accident Report: Controlled Collision with Terrain, Express II Airlines, Inc./Northwest Airlink Flight 5719, Jetstream BA-3100, N334PX, Hibbing, Minnesota, December 1, 1993,* Report No. NTSB/AAR-94/05, prepared by the U.S. National Transportation Safety Board. The 108-page report includes illustrations and appendices.

About the Author

Russell Lawton is an aviation safety consultant, a U.S. Federal Aviation Administration accident prevention counselor and editor of IFR Refresher *magazine. Lawton is the former vice president of operations for the Aircraft Owners and Pilots Association (AOPA) Air Safety Foundation and served on the International Civil Aviation Organization (ICAO) Personnel Licensing and Training panel. Lawton holds an airline transport pilot certificate and a flight instructor certificate, and has logged more than 5,000 flight hours.*

ACCIDENT PREVENTION

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