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National Transportation Safety Board

Washington D.C. 20594

Safety Recommendation

Date: September 12, 1997

In reply refer to: A-97-102 through -108

Honorable Jane F. Garvey
Administrator
Federal Aviation Administration
Washington, D. C. 20591

On November 19, 1996, at 1701 central standard time, United Express flight 5925, a Beechcraft 1900C, N87GL, collided with a Beechcraft King Air A90, N1127D, at Quincy Municipal Airport, near Quincy, Illinois. Flight 5925 was completing its landing roll on runway 13, and the King Air was in its takeoff roll on runway 04. A third airplane, a Piper Cherokee, was positioned for a planned takeoff on runway 04 behind the King Air. The collision occurred at the intersection of the two runways. All 10 passengers and two crewmembers aboard flight 5925 and the two occupants aboard the King Air were killed. Flight 5925 was a scheduled passenger flight operating under the provisions of Title 14 Code of Federal Regulations (CFR) Part 135. The flight was operated by Great Lakes Aviation, Ltd., doing business as United Express. The King Air was operating under 14 CFR Part 91.¹

The National Transportation Safety Board has determined that the probable cause of this accident was the failure of the pilots in the King Air A90 to effectively monitor the common traffic advisory frequency (CTAF) or to properly scan for traffic, resulting in their commencing a takeoff roll when the Beech 1900C (United Express flight 5925) was landing on an intersecting runway.

Contributing to the cause of the accident was the Cherokee pilot's interrupted radio transmission, which led to the Beech 1900C pilots' misunderstanding of the transmission as an

¹For more detailed information, read Aircraft Accident Report--"Runway Collision, United Express Flight 5925 and Beechcraft King Air A90, Quincy Municipal Airport, Quincy, Illinois, November 19, 1996" (NTSB/AAR-97/04)

indication from the King Air that it would not take off until after flight 5925 had cleared the runway.

Contributing to the severity of the accident and the loss of life were the lack of adequate aircraft rescue and fire fighting (ARFF) services, and the failure of the air stair door on the Beech 1900C to open.

Scanning to See and Avoid

Witnesses to the accident indicated that the approaching Beech 1900C was visible from at least 10 miles out, 4 minutes before it landed. Although the Safety Board's visibility study indicated that the view of the landing airplane from the cockpit of the King Air would have been partially or momentarily fully obstructed by the cockpit side posts during much of the Beech 1900C's final approach to landing and during the King Air's takeoff roll, those obstructions could have been easily overcome if the King Air's occupants had moved their heads and bodies while scanning. If they had done so at any point during the last 4 minutes of the airplane's approach, they would have been able to see the incoming airplane and would not have commenced their takeoff roll when they did. Therefore, it is clear that neither occupant of the King Air properly scanned for traffic.

There were several indications suggesting that the pilot may have been giving instruction to the pilot/passenger on the accident flight. The pilot/passenger's former husband indicated that she was building hours towards obtaining her airline transport pilot certificate and that she wanted eventually to fly for an air carrier. The pilot had instructed her in the past, and this was the first time the pilot/passenger had flown a King Air. Observations made by the passengers on the King Air's earlier flight to Tulsa and back were consistent with the pilot instructing the pilot/passenger.

After the passengers had departed, the King Air pilot would have had a good opportunity to demonstrate the systems of the King Air to the pilot/passenger. The King Air's 1-minute delay after taxiing onto the runway before power was applied for takeoff is consistent with instruction. The presence of scuff marks associated with hard turning farther down the runway indicates that the occupants of the King Air may not have seen the Beech 1900C until just before the collision,² suggesting that they may have been preoccupied with instructional activities inside the cockpit.

It is conceivable that the King Air pilot assumed that the absence of CTAF transmissions from incoming aircraft indicated that there was no traffic in the area and therefore no need to scan for traffic. However, even if the pilot thought that they were properly tuned to

²Witnesses said they heard the King Air throttle back just before the collision.

the CTAF,³ it would not have been reasonable or prudent for him to assume that the absence of any transmissions would mean that no traffic was in the area because that absence would not preclude the presence of non-radio-equipped aircraft in the area.

The King Air pilot's flying history suggests that he may not have placed sufficient importance on the basics of safe flying. His previous gear-up incident during an instructional flight suggests carelessness, and his subsequent comments to the Federal Aviation Administration (FAA) indicate that he did not consider the incident significant. The fact that he sat on an active runway for an extended time and comments from students indicating that he seemed to be rushing them are consistent with a careless attitude. Further, during his last year as a Trans World Airlines pilot, he had been downgraded from captain to flight engineer because of poor performance during recurrent training.

The accident occurred at 1701, a time often associated with fatigue. According to the pilot's wife, he slept normally in the days before the accident but awoke earlier than his usual time of 0800 on the day of the accident. The detection of lorazepam in the pilot's urine indicates that he ingested the medication in the previous days or weeks. However, the absence of the medication in his blood indicates that he was not impaired by the medication at the time of the accident. Nevertheless, his potentially recent use of the medication suggests that he may have had some difficulty sleeping. Based on his early wake-up time, the time of day that the accident occurred, and the possibility that he had difficulty sleeping recently, he was most likely not at his peak alertness at the time of the accident. However, the Safety Board could not determine the extent to which this may have affected his performance.

The King Air pilot might have been in a hurry to get home after a long day of flying potential purchasers of the King Air on a demonstration flight to Tulsa. After the King Air pilot returned to Quincy, two of the passengers said that he seemed to be "in a hurry" or "anxious to get home."

A combination of these factors (preoccupation with providing instruction to the pilot/passenger, careless habits, possible fatigue, and rushing) could explain why the King Air pilot did not properly scan for traffic.

The pilot/passenger was a ground instructor with Flight Safety International and had instructed commuter pilots on proper procedures at uncontrolled airports. She would have known the importance of scanning for traffic before taking off. The fact that she did not do so in this case suggests that she may have been preoccupied with the instruction, focusing solely on the cockpit instruments, and she may have assumed that the pilot had already scanned for traffic before taking off.

³The Safety Board concluded that the occupants of the King Air did not hear several transmissions from flight 5925 on the CTAF and that it is likely that either the King Air occupants did not properly configure the radio receiver switches to the CTAF, or that they were preoccupied, distracted, or inattentive.

The Safety Board concludes that the occupants of the King Air were inattentive to or distracted from their duty to "see and avoid" other traffic. In light of the circumstances of this accident, the Safety Board believes that the FAA should reiterate to flight instructors the importance of emphasizing careful scanning techniques during pilot training and biennial flight reviews.

Beech 1900C's Air Stair Door

A fixed-base operator (FBO) pilot and a United Express pilot tried to open the door from the outside after the collision. The FBO pilot said that he found the exterior air stair door handle in the 6 o'clock (unlocked) position. He stated that he tried to pull on the door and move the handle in all directions in an attempt to open the door. Although he recollected that he was unable to rotate the handle any farther than the 5 o'clock position, he probably rotated the handle to the 3 o'clock (locked) position, where the United Express pilot subsequently found it. Because he did not understand how the door handle worked,⁴ and he had initially been unable to open the door with the handle in the 6 o'clock (unlocked) position, it is understandable why the FBO pilot would have attempted to open the door by rotating the handle to a different position. The United Express pilot pushed the button and rotated the handle back to the unlocked position but was also unable to open the door. The FBO pilot then made another unsuccessful attempt to open the door and probably rotated the handle back to the locked position.

All six of the air stair's cam locks were recovered from the wreckage and were determined to be in locked positions. The exterior door handle lock plate was also found in the locked position.

If the impact caused deformation of the door and/or the fuselage that prevented one or more of the cam locks from moving, it would not have been possible for the exterior door control handle to be moved from the closed position to the open position as easily as it was described to have been done by the United Express pilot who tried to open the air stair door from the outside.

However, if the impact caused deformation of the door/frame system that introduced slack into the cable system, the exterior handle could have been moved from the closed to the open position, but the cable would not necessarily simultaneously rotate all the cam locks to the completely open position. This would explain why the FBO pilot found the door handle in the unlocked position when he first arrived but could not open the door. According to Raytheon, the introduction of as little as ¼ inch of slack in the cable could prevent the cams from fully rotating.

⁴According to the manufacturer, to unlock the air stair door from the outside, a release button above the door handle must be depressed while the handle is simultaneously rotated downward

The Safety Board concludes that the most likely reason that the air stair door could not be opened is that the accident caused deformation of the door/frame system and created slack in the door control cable. The Safety Board is concerned that the design and testing of the door did not account for minimal permanent deformation that could introduce slack into the door control system and ultimately disable the door. Therefore, the Safety Board believes that the FAA should evaluate the propensity of the Beech 1900C door/frame system to jam when it sustains minimal permanent door deformation and, based on the results of that evaluation, require appropriate design changes.

The Safety Board is further concerned that even though the impact forces from the accident were so mild that both airplanes came to rest on their landing gear and the occupants of the Beech 1900C sustained little or no injuries as a result, those same forces were apparently sufficient to cause the Beech 1900C's air stair door to jam, preventing the occupants from using it to escape. Because the airplane was certificated by the FAA as having met the freedom from jamming requirements, the Safety Board attempted to analyze the adequacy of those requirements.

Regulatory requirements pertaining to door jamming applicable to the certification of the Beech 1900C were set forth in 23.807(b)(4), which stated that each emergency exit must "[h]ave reasonable provisions against jamming by fuselage deformation;" and SFAR 41, subsection 5(e)(c), which stated that "[e]ach external door must be reasonably free from jamming as a result of fuselage deformation in a minor crash." Subsequent to the Beech 1900C's certification, the FAA promulgated a similar requirement in section 23.783(c)(5), stating that each external passenger or crew door "must be reasonably free from jamming as a result of fuselage deformation in an emergency landing."⁵ (See 53 *Federal Register* 30802, 30807, August 15, 1988).

Although the requirement that doors be reasonably free from jamming as a result of fuselage deformation is stated in at least three applicable regulations relevant to certification

⁵Emergency landing conditions are set forth in 14 CFR 23.561(b), which requires, in part, that the airplane structure be designed to protect each occupant during emergency landing conditions when "proper use is made of the seats, safety belts, and shoulder harnesses provided for in the design" and,

- (2) The occupant experiences the static inertia loads corresponding to the following ultimate load factors -
 - (i) Upward, 3.0 G for normal, utility, and commuter category airplanes,...
 - (ii) Forward, 9.0 G;
 - (iii) Sideward, 1.5 G; and
 - (iv) Downward, 6.0 G when certification to the emergency exit provisions of 23.807(d)(4) is requested; and
- (3) The items of mass within the cabin, that could injure an occupant, experience the static inertia loads corresponding to the following ultimate load factors -
 - (i) Upward, 3.0 G;
 - (ii) Forward, 18.0 G; and
 - (iii) Sideward, 4.5 G.

under 14 CFR Part 23,⁶ two of which existed at the time the Beech 1900C was certificated, there is apparently no clear guidance indicating how a manufacturer should demonstrate compliance with these requirements. Specifically, there appears to be no clear written guidance from the FAA specifying the degree of fuselage deformation contemplated by those regulations, or explaining what is meant by "reasonably free" from jamming. Although Beech requested and received FAA approval of the specific tests it used to show compliance and conducted additional "unofficial" tests to demonstrate freedom from jamming in a particular accident configuration over which the FAA had expressed concern (both main gears collapsed), there is apparently no specific written FAA standard against which a manufacturer's compliance is to be measured.

The Safety Board concludes that the methods for showing compliance with the FAA's certification requirement that external doors be reasonably free from jamming as a result of fuselage deformation are not clearly defined. Therefore, the Safety Board believes that the FAA should establish clear and specific methods for showing compliance with the freedom from jamming certification requirements.

Further, because the air stair door on the accident airplane jammed as a result of an impact that caused little or no injury to the occupants of the airplane, the Safety Board concludes that the FAA's freedom from jamming certification process may be inadequate. Therefore, the Safety Board believes that the FAA should consider the circumstances of this accident when developing methods for showing compliance with freedom from jamming requirements, and determine whether it is feasible to require that doors be shown to be free from jamming after an impact of similar severity.

Maintenance Practices

According to Great Lakes Aviation, its maintenance department stocked about four air stair door shells to support its fleet of 44 Beech 1900s. As air stair doors were needed, maintenance personnel placed the rollers, locking mechanisms, and stops in the door shell, then secured the door to the airplane, trimming the sheet metal around the door to ensure a proper fit. The company's records revealed that the air stair door on the accident airplane was replaced by its maintenance personnel. The person who inspected the door was a certified airframe and powerplant mechanic⁷ who had attended formal Beech 1900 training. The mechanic who had assembled the locking mechanism in the door shell was a certified mechanic who had not attended any formal Beech 1900 training. A review of the inspection checklist for the air stair door did not indicate that there had been any internal inspection of the door for the proper installation of the cable, routing, or other anomalies associated with internal locking mechanisms.

⁶Similar requirements also appear several times in Part 25.

⁷A mechanic who has been issued an airframe and powerplant certificate by the FAA under 14 CFR Part

In light of Great Lakes Aviation's maintenance practices for the air stair door, the Safety Board considered the possibility that a mechanic improperly routed the door's cable, a situation that might not have been evident immediately after installation, which could have led to a binding or loosening of the cable over long periods of use. Such a condition might have prevented the door from operating properly after the collision. However, the Safety Board was unable to find any evidence that the cable was misrouted.

The Safety Board concludes that formal training for maintenance personnel in specific tasks they are assigned to accomplish is critical for the proper, sustained operation of aircraft. Therefore, the Safety Board believes that the FAA should review and improve, as necessary, guidance for principal maintenance inspectors to use in ensuring that maintenance personnel are properly trained in accomplishing the maintenance tasks that they are assigned.

Airport ARFF Protection

Quincy Municipal Airport holds an FAA-issued limited airport operating certificate.⁸ Although a 500-gallon capacity airport ARFF truck was located at the airport, full-time ARFF services were not present or required at the time of the accident.

The Quincy Fire Department was 10 miles away from the accident site, and it took about 14 minutes for its fire fighting units to arrive. In contrast, 14 CFR Part 139 requires that a certificated airport be capable of an immediate response time of 3 minutes by an on-site ARFF truck equipped with extrication tools and carrying extinguishing agent and properly trained firefighters. However, this requirement applies only when the airport is serving air carrier aircraft with a seating capacity of more than 30 passengers.

Witnesses observed that the fire was burning on the right side of the Beech 1900C, about 1,800 feet from the airport's ARFF truck. If properly staffed, that truck should have been able to reach the accident site in no more than 1 minute. Fire fighters might then have been able to extinguish or control the fire, thereby extending the survival time for at least some of the occupants of the Beech 1900C. Those occupants might then have had time to escape through the overwing exit hatch. Accordingly, the Safety Board concludes that if on-airport ARFF protection had been required for this operation at Quincy Airport, lives might have been saved.

Therefore, the Safety Board reiterates Safety Recommendation A-94-204, which urges the FAA to permit scheduled passenger operation only at airports certificated under the standards contained in Part 139, "Certification and Operations: Land Airports Serving Certain Air Carriers."

The Safety Board also concludes that although some communities may lack adequate funds to provide ARFF protection for small airports served by commuter airlines, commuter

⁸Under 14 CFR Part 139, a limited airport operating certificate is issued to an airport serving *unscheduled* (but not scheduled) operations of air carrier aircraft with a seating capacity of more than 30 passengers

airline passengers deserve the same degree of protection from postcrash fires as air carrier passengers on aircraft with more than 30 passenger seats. Accordingly, the Safety Board believes that the FAA should develop ways to fund airports that are served by scheduled passenger operations on aircraft having 10 or more passenger seats, and require these airports to ensure that ARFF units with trained personnel are available during commuter flight operations and are capable of timely response.

Further, in an effort to inform commuter airline passengers about airports that do not have ARFF capabilities, the Safety Board believes that the FAA should add to the Safety Information Section of the FAA's Internet Home Page a list of airports that have scheduled air service but do not have ARFF capabilities.

Therefore, as a result of the investigation of this accident, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Reiterate to flight instructors the importance of emphasizing careful scanning techniques during pilot training and biennial flight reviews. (A-97-102)

Evaluate the propensity of the Beech 1900C door/frame system to jam when it sustains minimal permanent door deformation and, based on the results of that evaluation, require appropriate design changes. (A-97-103)

Establish clear and specific methods for showing compliance with the freedom from jamming certification requirements. (A-97-104)

Consider the circumstances of the November 19, 1996, Quincy, Illinois, accident when developing methods for showing compliance with freedom from jamming requirements, and determine whether it is feasible to require that doors be shown to be free from jamming after an impact of similar severity. (A-97-105)

Review and improve, as necessary, guidance for principal maintenance inspectors to use in ensuring that maintenance personnel are properly trained in accomplishing the maintenance tasks that they are assigned. (A-97-106)

Develop ways to fund airports that are served by scheduled passenger operations on aircraft having 10 or more passenger seats, and require these airports to ensure that aircraft rescue and fire fighting units with trained personnel are available during commuter flight operations and are capable of timely response. (A-97-107)

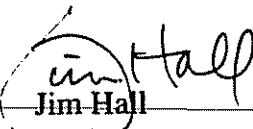
Add to the Safety Information Section of the FAA's Internet Home Page a list of airports that have scheduled air service but do not have aircraft rescue and fire fighting capabilities. (A-97-108)

In addition, the Safety Board reiterates Safety Recommendation A-94-204 to the FAA:

Permit scheduled passenger operation only at airports certificated under the standards contained in Part 139, "Certification and Operations: Land Airports Serving Certain Air Carriers."

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations.

By:


Jim Hall
Chairman