



National Transportation Safety Board

Washington, D.C. 20594

September 5, 2000

Mr. Ed Voorhis, Petitioner
Aircraft Accident
Quincy, Illinois
November 19, 1996
File No. 1930, Accident No. DCA97MA009A/B

RESPONSE TO PETITION FOR RECONSIDERATION

In accordance with 49 *Code of Federal Regulations* (CFR) Section 845.41, the National Transportation Safety Board has reviewed the May 6, 1998, petition for reconsideration and modification of its findings and probable cause in the runway collision accident involving United Express flight 5925, a Beechcraft 1900C, N87GL, and a Beechcraft King Air A90, N1127D, at Quincy Municipal Airport, Quincy, Illinois, on November 19, 1996. On the basis of this review, the Safety Board has denied the petition to amend findings 6, 7, 13, 14, 19, and 20. The Board, however, has deleted findings 16 through 18 and has amended part of the probable cause statement based on its reevaluation of the factual evidence in this accident. In addition, the Board has amended finding 15, even though that finding was not specifically challenged by the petitioner.

Background Information

On November 19, 1996, about 1701 central standard time, United Express flight 5925, a Beechcraft 1900C, N87GL, and a Beechcraft King Air A90, N1127D, collided at Quincy Municipal Airport, Quincy, Illinois. The Beech 1900C was in its landing roll on runway 13, and the King Air A90 was in its takeoff roll on runway 4. The collision occurred at the intersection of the two runways. The 2 flight crewmembers and all 10 passengers aboard the 1900C were killed, and the 2 occupants aboard the King Air A90 were killed. A Piper Cherokee, N7646J, with a pilot and passenger aboard, was taxiing to runway 4 behind the King Air A90.

On July 1, 1997, the Safety Board 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 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 pilot's misunderstanding of the transmission as an 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 firefighting services, and the failure of the air stair door on the Beech 1900C to open.¹

Raytheon Aircraft Company, which acquired Beech Aircraft Corporation in February 1980, was a party to the Safety Board's investigation in accordance with 49 CFR Section 831.12. In support of its petition, Raytheon provided affidavits from company employees and consultants retained by the company to assist in the investigation of the accident. The petition states that "important new evidence has been discovered which deserves the Board's evaluation. The Affidavits...identify in detail this new evidence and discuss its impact on the Board's findings." In particular, the petitioner challenges nine of the Board's findings (6, 7, 13, 14, and 16 through 20) and urges the Board to adopt the following revised probable cause:

...(1) the failure of both flight crews to effectively monitor the traffic advisory frequency and to properly scan for traffic was a probable cause of the collision; and (2) the severity of the impact from the collision and the intensity of the immediately resulting fire caused the deaths. Neither the airstair door nor the availability of airport rescue and fire fighting services played a role in the cause of death.

The Safety Board's response follows the petition's format.

Finding 6

The Safety Board concluded that

Given the Beech 1900C flight crew's frequent radio broadcasts of the airplane's position during the approach, and the lack of any prohibition on straight-in approaches to uncontrolled airports, the flight crew's decision to fly a straight-in approach to runway 13 was not inappropriate.

Raytheon's petition stated that

...the crew violated FAR [Federal Aviation Regulation] 91.117(a) by operating in excess of 250 KIAS [knots indicated airspeed] below 10,000 feet MSL [mean sea level]. They also chose the non active runway and admittedly "fudged in there a little" to complete their approach before the departure of the King Air. These actions by the 1900 crew were inappropriate; it appears the 1900 crew was operating in a hurry-up mode and cutting corners on prudent traffic pattern procedures.

¹ For more information, see National Transportation Safety Board. 1997. *Runway Collision, United Express Flight 5925 and Beechcraft King Air A90, Quincy Municipal Airport, Quincy, Illinois, November 19, 1996*. Aircraft Accident Report NTSB/AAR-97/04. Washington, DC.

The Federal Aviation Administration (FAA) encourages pilots, through Advisory Circular (AC) 90-66A, "Recommended Standard Traffic Patterns and Practices for Aeronautical Operations at Airports Without Control Towers," to use the standard traffic pattern, rather than a straight-in approach, for uncontrolled airports (such as Quincy Municipal Airport). However, AC 90-66A recognizes that some pilots may choose to execute a straight-in approach and therefore urges that all pilots operating in the traffic pattern be alert to aircraft executing such an approach.

The petitioner does not offer any contrary evidence toward the prohibition of a straight-in approach. Although the petitioner presents information suggesting that the 1900C flight crew erred in other respects, these issues are not relevant to the finding. Therefore, the Safety Board has denied the petitioner's request to modify finding 6.

Finding 7

The Safety Board concluded that

The flight crew of flight 5925 made appropriate efforts to coordinate the approach and landing through radio communications and visual monitoring; however, they mistook the Cherokee pilot's transmission (that he was holding for departure on runway 4) as a response from the King Air to their request for the King Air's intentions and therefore mistakenly believed that the King Air was not planning to take off until after flight 5925 had cleared the runway.

Raytheon's petition stated that

The conspicuity tests performed by RAC [Raytheon Aircraft Company]...clearly establish that the King Air was in the field of view of the 1900 flight crew for more than the last minute of flight, including the King Air's entire ground roll. Therefore, the 1900 flight crew's visual monitoring efforts were anything but appropriate.

The petitioner's challenge of this finding focused solely on visual monitoring. The Safety Board notes that the petitioner did not challenge the parts of the finding regarding the 1900C flight crew's radio communications and the radio transmission from the pilot of the Piper Cherokee.²

The Safety Board recognizes that, in this case, the "see and be seen" concept of traffic separation was unsuccessful. The Board also recognizes that the flight crew of each airplane had an opportunity to see the other airplane during the last minute of flight. However, the petitioner ignores the appropriate efforts of the 1900C flight crew to coordinate the approach and landing

² The Safety Board notes that the petitioner also did not challenge finding 11, which stated that "the Cherokee pilot's transmission in response to flight 5925's request was unnecessary and inappropriate and, combined with the lack of any correction to the flight crew's misunderstanding, misled the flight crew into believing that it had been communicating with the King Air, and that the King Air would continue holding."

through radio communications, in accordance with the FAA's *Aeronautical Information Manual* (AIM), paragraph 4-1-9, and AC 90-66A. Specifically, the cockpit voice recorder indicated that the 1900C flight crew made radio transmissions about 30, 10, and 5 miles out and on short final. These transmissions included position location information and requests to be advised of any other traffic in the area.

According to 14 CFR Section 91.113, "Right-of-way rules," the landing airplane (the 1900C) had priority over the departing airplane (the King Air A90). Also, the 1900C flight crew's attention during the last minute of the final approach could reasonably be expected to focus on runway alignment and the descending flightpath into the touchdown zone. In addition, air traffic control transcripts indicated that the King Air A90 flight crew failed to announce its takeoff intentions on the common traffic advisory frequency, which was required by the AIM, paragraph 4-1-9.³

Because the 1900C pilots mistakenly believed that they had received assurance from the King Air A90 pilots that the airplane would hold on the runway, the 1900C pilots may have been less concerned about continuing to watch the King Air A90 during their landing. However, the evidence gathered during this investigation continues to support that the 1900C flight crew made appropriate efforts to coordinate the approach. Therefore, the Safety Board has denied the petitioner's request to modify finding 7.

Finding 13

The Safety Board concluded that

The impact forces were at a survivable level for the occupants of both airplanes.

Raytheon's petition stated that

...the 1900's peak deceleration [was shown] to be in excess of 19G's and the King Air's more than 30G's, resulting in a severe (not mild) impact.

The autopsy results determined that the cause of death for the occupants of both airplanes was either "carbon monoxide intoxication from inhalation of smoke and soot" from the postimpact fire or "inhalation of products of combustion." Also, two on-scene witnesses indicated that they heard sounds of life from within the 1900C cabin and that the captain had spoken with them from the cockpit.

According to the autopsy results, the occupants of both airplanes did not sustain blunt force trauma injuries that would have impeded their mobility or ability to evacuate. The bodies of the King Air A90's occupants were found behind their seats, and the body of the 1900C first

³ The Safety Board notes that the petitioner did not challenge finding 8, which stated that "the failure of the King Air pilot to announce over a common traffic advisory frequency his intention to take off created a potential for collision between the two airplanes."

officer was found between the air stair (main boarding) door and the forward right overwing exit. The bodies of seven passengers were found forward of row 4, and the bodies of three passengers were found near rows 7 and 8.⁴ (The body of the 1900C captain was found in the cockpit area.)

The petitioner stated that finding 13 was reached without an impact analysis. However, no analysis of the severity of this accident was required to support the Safety Board's conclusion that the impact forces were survivable. The Board based its conclusion on autopsy findings, body locations, and eyewitness accounts, which clearly indicated that the 1900C occupants were alive and mobile after the collision. The petitioner offered the Board no reason to alter this finding. Therefore, the Board has denied the petitioner's request to modify finding 13.

Finding 14

The Safety Board concluded that

The speed with which the fire enveloped the King Air and the intensity of the fire precluded survivability for the occupants of the King Air.

Raytheon's petition stated that

...this conclusion applies equally to the 1900's passengers. The 1900 passengers and co-pilot were subjected to severe fire conditions both inside the cabin at the moment of impact and externally.

The Safety Board formed its conclusion based on the position of the King Air A90 cockpit/fuselage within the pool fire in the final wreckage scene. The Board determined that the King Air A90 occupants initially attempted to escape but were overcome by the effects of the fire before reaching an exit. The Board did not make a similar conclusion for the 1900C because it did not have sufficient evidence to determine the amount of time that was available for the occupants to have escaped the airplane in the presence of smoke and soot from the fire.

Because the petitioner offered a different conclusion from the same evidence, the Safety Board considered it appropriate to seek outside assistance to review the survivability issue and ensure that no relevant forensic evidence was overlooked. Thus, the Board requested that the Assistant Medical Examiner at the Armed Forces Institute of Pathology (AFIP) conduct a review of the survivability and crash forces of this accident. In a July 15, 1999, letter, the medical examiner stated the following:

Many documents were submitted by Raytheon Aircraft supporting the hypothesis that the [1900C] aircraft interior was ignited by burning fuel vapor at the time of the initial impact and was totally involved by fire almost immediately with all

⁴ The forward section of the airplane included rows 1 through 5, and the aft section included rows 6 through 9. According to the load manifest, at least four passengers were seated in rows 6 through 9, and at least five passengers were seated in rows 1 through 5. The 10th passenger was not listed on the manifest.

occupants, except the pilot, dead within the first 30 seconds after the initial impact. An alternate hypothesis is that there was minimal or no interior fire associated with the initial fire-ball of burning fuel and the occupants' fatal injuries were associated with the pool fire which ultimately ignited the interior. The alternate hypothesis would allow some occupants to survive 120 seconds or more after the impact.

The hypotheses represent extreme limits of the occupant survival time in this mishap. The actual fire dynamics are within the spectrum defined by the two hypotheses. Occupant survival time ranged from 30 to more than 120 seconds. I am not aware of any scientific means to define exactly when the occupants were incapacitated or when they died. The following observations suggest that the survivability impact of the pool fire was more important than the initial external fire ball.

- a. The pilot was alive and conscious at least 120 seconds after the impact. The pilot had a source of fresh air and was partially separated from the main cabin. Despite these special circumstances, it is very difficult to imagine a single individual remaining alive and alert for over 2 minutes when all other occupants were dead within the first 30 seconds [according to Raytheon's hypothesis].
- b. The fire and toxicological modeling studies are consistent with death within 20 to 30 seconds after full involvement of the cabin interior by fire. Unfortunately this is a final common pathway and does not distinguish whether the cabin fire was primarily from entry of the initial fireball or from burn-through by the pool fire.
- c. The wreckage and kinematics analyses indicate that there were openings in the fuselage exposed to the fuel droplet cloud and fireball associated with initial impact. It is possible that this burning cloud entered and rapidly consumed the cabin and its occupants. It is also possible that very little, if any, of the burning fuel cloud entered the cabin, despite significant defects in the fuselage of the B1900. Post-impact movement of the airplanes away from the fuel cloud, temporary occlusion of fuselage defects during the crash sequence, lack of significant cabin ventilation, and relative positive pressure in the cabin at the time of impact could limit initial entry of burning fuel.
- d. Data cited by Raytheon consultants suggests fuselage burn-through within approximately 30 seconds of exposure to a fully developed fire. Since the entire left side of the fuselage was intact when the first witnesses arrived approximately 2 minutes after the crash, it seems unlikely that a significant fire had been burning inside the cabin since initial impact.

The locations of the remains of the B1900 occupants suggest that at least some of [the] passengers moved out of their seats and forward in the aircraft after the crash. Only three of the twelve occupants were found behind the wings while achieving proper weight and balance would require seating of five to six passengers aft of the center of gravity. Despite some movement after the crash, there is no evidence of any effective escape attempts on the part of any of the occupants. The left over-wing exit and the main door were the only viable exit routes due to the pool fire on the right side of the aircraft. The B1900 occupants had opened neither exit. This suggests that the relatively uninjured occupants were incapacitated by the post-crash fire before they could open the window or door.

The hypothesis presented by the AFIP Assistant Medical Examiner supports the Safety Board's decision not to include the 1900C as part of this conclusion. Specifically, the Board found that the fire did not initially preclude survivability for the 1900C occupants because the first officer and the passengers were able to move from their seats and on-scene witnesses heard sounds of life inside the cabin and spoke with the captain. The petitioner did not offer any new evidence to support modifying the Board's conclusion. Therefore, the Board has denied the petitioner's request to modify finding 14.

Finding 16

The Safety Board concluded 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.

Raytheon's petition stated that

...the internal operability of the 1900 airstair door is irrelevant in light of the fact that the King Air engine penetrated the 1900 fuselage opposite that door disrupting the floor and immediately depositing fuel and fire in that area. In addition, the kinematics of the door, on scene witness statements, and the remains of the airstair door itself, do not support a finding that the door was jammed.

As previously stated, the autopsy results indicated that the 1900C occupants did not sustain blunt force trauma injuries that would have impeded their mobility or ability to evacuate. Thus, it is possible that the occupants were in the cabin for a period of time sufficient to have opened an available exit. However, the investigation determined that the air stair door, which was located on the left side of the airplane, and the left overwing exit hatch were not opened in an escape attempt. (On-scene witnesses indicated that, when they approached the airplanes after the accident, the right side of the 1900C was engulfed in fire.)

The 1900C captain told the two potential rescuers outside of the airplane (one of which was a 1900C-qualified United Express pilot) to “get the door open,” but neither was able to open the door. Also, the first potential rescuer found the air stair door handle in the 6 o’clock (unlocked) position. This finding, along with the location of the first officer’s body, suggested that the first officer was following company evacuation procedures and tried to open the air stair door but was unable to do so. The Safety Board does not have specific evidence to indicate why the air stair door was not opened because most of the door and its frame were destroyed by fire.

The Safety Board does not agree with Raytheon’s statement that “the internal operability of the 1900 airstair door is irrelevant in light of the fact that the King Air engine penetrated the 1900 fuselage opposite that door disrupting the floor and immediately depositing fuel and fire in that area.” The internal operability of the air stair door is extremely relevant because the impact forces were survivable and the air stair door was accessible despite the fire on the right side of the airplane. The 1900C flight crew and passengers should have been able to get out of the airplane using the air stair door, yet they did not open the door to escape the airplane. Also, the two potential rescuers could not open the door from the outside. The first potential rescuer stated that he found the handle in the 6 o’clock position, pulled on the handle, and turned it up. The second potential rescuer (a United Express 1900C pilot, who was familiar with the operation of the door) stated that he intervened and then depressed the release button above the door handle while rotating the handle downward from the 3 o’clock to the 6 o’clock position but was also unable to open the door.⁵ Nonetheless, the Board reevaluated the factual evidence from this accident and could not determine the most likely reason that the air stair door was not opened.⁶ Therefore, the Board has granted the petitioner’s request to modify finding 16 by deleting it from the findings list and amending the corresponding text in the accident report.

The Safety Board notes that the petitioner did not challenge finding 15, which states that “the occupants of the Beech 1900C did not escape because the air stair door could not be opened and the left overwing exit hatch was not opened.” However, because the reevaluation of the factual evidence from this accident could not determine the specific reason that the air stair door or the left overwing exit hatch were not opened, the Board has revised finding 15 and the corresponding text in the accident report to indicate that the air stair door and the left overwing exit hatch were not opened for undetermined reasons.

⁵ The Beechcraft 1900C maintenance manual stated that “when unlocking the door from the outside or inside, the release button adjacent to the door handle must be held depressed before the handle can be rotated to unlock the door.”

⁶ The Safety Board’s final report on this accident indicated that “according to Raytheon, the introduction of as little as 1/4 inch of slack in the [door control] cable could prevent the cams from fully rotating.” However, the Board’s reevaluation did not determine that the slack in the cable was the reason that the air stair door was not opened. Other possible reasons include a right wing low attitude, which shifted the door’s center of gravity inward and increased the force necessary to open the door, and damage to the door.

Finding 17

The Safety Board concluded 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.

Raytheon's petition stated that

...although FAA regulatory clarity might be helpful, current testing of the fuselage to ultimate shear and bending loads are adequate and appropriate.

The 1900C was certificated by the FAA as having met the freedom from jamming requirements. However, the Safety Board's investigation did not find clear written guidance from the FAA indicating how a manufacturer should demonstrate compliance with the freedom from jamming requirements. Specifically, there appeared to be no clear guidance specifying the degree of fuselage deformation contemplated by the applicable regulations in 14 CFR Part 23 and the meaning of "reasonably free" from jamming. This finding provided the basis for Safety Recommendation A-97-104, which recommended that the FAA "establish clear and specific methods for showing compliance with the freedom from jamming certification requirements."

In its June 23, 1998, letter to the Safety Board, the FAA stated that it received proposed text from Raytheon for a new airworthiness standard for a fuselage door per 14 CFR Section 23.783(c)(5). The proposed text stated the following:

The door and emergency exit should be free from jamming and operate properly after fuselage deformation resulting from the ultimate load factors of 14 CFR 23.561(b)(2) and the requirements of 14 CFR 23.307(a). It should also be demonstrated by tests that each door and emergency exit can be opened after exposure to each critical loading condition. Those conditions should include at least the following: the ultimate static tests loads that result from 14 CFR 23.321 through 14 CFR 23.341, and 14 CFR 23.365(a)(b); or ultimate landing design load requirements of 14 CFR 23.365(a)(c), and 14 CFR 23.471 through 14 CFR 23.485, provided they are equal to or exceed the ultimate load requirements of 14 CFR 23.561(b)(2).

The FAA indicated that it reviewed Raytheon's proposed text and determined that it would provide no new substantial airworthiness standards beyond those contained in existing guidance (AC 25.783-1). However, the FAA stated that Raytheon's proposal did provide "excellent policy material." The FAA reported that it would convert the text into policy guidance for use by aircraft certification offices in future certification projects. The FAA also indicated that this information would appear as guidance information in the forthcoming *Systems Guide for Certification of Part 23 Airplanes*.

In its September 5, 2000, response, the Safety Board stated that it had reevaluated the factual information regarding the inability of the flight crew and passengers of the 1900C to exit the airplane after the collision with the King Air A90. Because the Board was unable to determine the circumstances that prevented the occupants from evacuating the airplane (even with the efforts of two potential rescuers to open the door) and the investigation did not identify any specific evidence that the door jammed, the Board classified Safety Recommendation A-97-104 “Closed—Reconsidered.”

The Safety Board’s reevaluation of the factual evidence from this accident did not conclusively determine that the air stair door had jammed. Therefore, the Board has granted the petitioner’s request to modify finding 17 by deleting it from the findings list and amending the corresponding text in the accident report.

Finding 18

The Safety Board concluded that

The FAA’s freedom from jamming certification standards may be inadequate.

Raytheon’s petition stated that

...the known severity of this accident, including impact forces of 169,385 pounds acting over a period of only approximately 0.115 seconds, is equivalent to a passenger bus traveling at 60 mph and being struck at a right angle by a UPS [United Parcel Service] truck traveling 70 mph. No transportation vehicle is designed to withstand such loads.

On June 25, 1998 (almost 1 year after the accident report was adopted), the Safety Board issued a study, titled “Momentum Reconstruction and Door Tests,” to determine, among other things, the physics of the collision. The Board’s study determined that the damage from the nose of the King Air A90 and the damage to the 1900C in the front part of the fuselage were not equivalent to a right angle impact at 60 mph. The study also determined that the main impact of this accident lasted as long as 0.133 second. These findings do not support the claims made by Raytheon regarding the severity of this accident. In addition, forensic evidence indicated that the impact forces in this accident were survivable, and eyewitnesses stated that the occupants of the 1900C did, in fact, survive the collision.

Finding 18 resulted in the issuance of Safety Recommendation A-97-105, which asked the FAA to “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.” In its June 23, 1998, letter to the Safety Board, the FAA stated that it was not feasible to show freedom from jamming for the door of the 1900C because of the impact forces that were present in this accident.

In its September 5, 2000, response, the Safety Board stated that its reevaluation of the factual evidence in this accident continued to support that the impact forces from the accident were survivable and that the 1900C occupants should have been able to open the air stair door and escape from the airplane. The Board remained concerned that, in this survivable accident, none of the 1900C occupants survived; all succumbed to smoke inhalation and thermal injuries because they were unable to exit the airplane. However, the Board was unable to determine the circumstances that prevented the occupants from evacuating the airplane (even with the efforts of two potential rescuers to open the door). Because the investigation did not identify any specific evidence to indicate that the air stair door had jammed, the Board classified Safety Recommendation A-97-105 “Closed—Reconsidered.”

The Safety Board’s reevaluation of the factual evidence from this accident did not conclusively determine that the air stair door had jammed. Therefore, the Board has granted the petitioner’s request to modify finding 18 by deleting it from the findings list and amending the corresponding text in the accident report.

Finding 19

The Safety Board concluded that

Formal training for maintenance personnel in specific tasks they are assigned to accomplish is critical for the proper, sustained operation of aircraft.

Raytheon’s petition stated that

...nothing in the record reflects any maintenance discrepancy in the 1900 external door prior to this accident. Without a maintenance discrepancy, additional formal training of maintenance personnel is unnecessary.

As part of its investigation, the Safety Board considered whether a Great Lakes Aviation mechanic improperly routed the air stair door’s cable, which could have led to a binding or loosening of the cable over time and might have prevented the door from operating properly. Although, in this case, no evidence indicated that the cable was misrouted, the Board believed that it would be beneficial to safety to issue Safety Recommendation A-97-106, which asked the FAA to “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.”

In its June 23, 1998, letter to the Safety Board, the FAA indicated that it reviewed the guidance available to principal maintenance inspectors (PMI) to use in ensuring that maintenance personnel are properly trained in accomplishing assigned maintenance tasks. Specifically, the FAA reviewed FAA Order 8300.10, “Airworthiness Inspector’s Handbook,” and determined that the guidance available to PMIs was adequate. The FAA stated that, on November 17, 1997, it sent a letter to all PMIs to reinforce the importance of proper maintenance training. Because the

FAA's actions satisfied the intent of Safety Recommendation A-97-106, it was classified "Closed—Acceptable Action" on October 6, 1998.

The petitioner indicated that, before this accident, there was no maintenance discrepancy concerning the air stair door. However, this statement, regardless of its validity, is not relevant to the conclusion and resulting safety recommendation. Therefore, the Safety Board has denied the petitioner's request to modify finding 19.

Finding 20

The Safety Board concluded that

If on-airport aircraft rescue and firefighting equipment protection had been required for this operation at Quincy Airport, lives might have been saved.

Raytheon's petition stated that

...the presence of such equipment would have been no assistance to the passengers and co-pilot of the 1900 due to: (1) the intense fire inside the 1900 fuselage, which ignited immediately upon impact; and (2) the large external pool fire. Rescue and fire fighting equipment could not have reached the accident site in time to save these people.

The investigation determined that on-airport aircraft rescue and firefighting (ARFF) services would have been able to reach the accident scene in no more than 1 minute (in contrast to the 14-minute response time from the Quincy Fire Department).⁷ Thus, ARFF personnel might have been able to extinguish or control the fire, thereby extending the survival time for at least some of the 1900C occupants. Because the impact of the collision did not result in blunt force trauma injuries to the occupants, some might have had time to escape.

The petitioner's response did not acknowledge the possibility that the captain might have survived if rescue personnel had arrived sooner. As stated previously, the captain was observed by witnesses to have survived for some time (estimated to be 120 seconds), and she was sufficiently coherent to tell potential rescuers to open the door. Also, the AFIP Assistant Medical Examiner determined that the captain "had a source of fresh air and was partially separated from the main cabin."

In addition, the AFIP Assistant Medical Examiner stated that "since the entire left side of the [1900C] fuselage was intact when the first witnesses arrived approximately 2 minutes after the crash, it seems unlikely that a significant fire had been burning inside the cabin since initial

⁷ Title 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. However, this requirement only applies when the airport is serving air carrier aircraft with a seating capacity of more than 30 passengers. Although Quincy Municipal Airport had an ARFF truck, it was not staffed at the time of the accident because no air carrier aircraft with more than 30 passenger seats were taking off or landing. The 1900C had 19 passenger seats.

impact.” As a result, the Safety Board continues to believe that on-airport ARFF equipment would have reached the accident site in time to save the lives of at least some of those aboard the 1900C. Therefore, the Board has denied the petitioner’s request to modify finding 20.

Probable Cause Statement

As previously indicated, the Safety Board 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 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 pilot’s misunderstanding of the transmission as an 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 services, and the failure of the air stair door on the Beech 1900C to open.

Raytheon’s petition stated that

...(1) the failure of both flight crews to effectively monitor the traffic advisory frequency and to properly scan for traffic was a probable cause of the collision; and (2) the severity of the impact from the collision and the intensity of the immediately resulting fire caused the deaths. Neither the airstair door nor the availability of airport rescue and fire fighting services played a role in the cause of death.

The Safety Board continues to believe that the 1900C flight crew made appropriate efforts to coordinate the approach and landing (see the discussion of finding 7). The Board also continues to believe that that the King Air A90 pilots’ failure to announce the airplane’s takeoff over the common traffic advisory frequency and yield to the landing airplane (which had the right of way) led to the accident.

The petitioner claimed that the cause of death for the occupants of both airplanes was the severity of the impact from the collision and the fire that resulted immediately afterward. Although the petitioner presented impact analysis data to support his claim regarding the severity of the impact, the Safety Board’s determination of the survivability of the accident was not dependent on a determination of the specific levels of force within each airplane. Regarding the immediate intensity of the cabin fire, the petitioner stated that survival time in the 1900C cabin was less than 30 seconds because the King Air A90 penetrated the cabin and immediately deposited fuel and fire in that area. However, the AFIP Assistant Medical Examiner offered the possibility that the 1900C occupants’ deaths were associated with the pool fire that ultimately

ignited the interior but could have allowed some occupants to survive 120 seconds or more after the impact (see the discussion of finding 14).

The petitioner suggested that the air stair door did not play a role in the cause of death for the 1900C occupants. The impact forces of the collision were survivable, and evidence indicated that the 1900C occupants were able to move inside the cabin after the accident. However, the air stair door was not opened in any escape attempt, and the door could not be opened from the outside of the airplane by the two potential rescuers. Raytheon presented evidence to indicate that an air stair door could be opened with slack in the door cable, but this evidence does not change the fact that the 1900C occupants succumbed to inhalation and thermal injuries because they did not escape from the airplane using the two available exits—one of which was the air stair door.

The petitioner also stated that the lack of on-airport ARFF services did not play a role in the cause of death. Because the captain of the 1900C likely survived for at least 120 seconds after the accident (according to eyewitness estimates) and had a source of fresh air, the Safety Board continues to believe that her life could have been saved by the presence of on-airport ARFF equipment, which would have been able to reach the accident scene in 60 seconds or less. The Board cannot precisely determine when the 1900C first officer and passengers were incapacitated to the point that they could not escape or when they died. However, the Board continues to believe that at least some of the remaining occupants might have been saved by the presence and use of ARFF equipment.

After evaluating the evidence provided by the petitioner, the Safety Board has determined that none of this evidence is sufficient to support a change to the original probable cause for this accident. However, because its reevaluation of the factual information in this accident did not identify any specific evidence to indicate that the air stair door had jammed (even with the efforts of two potential rescuers to open the door), the Board has modified the probable cause language to indicate that “the failure of the air stair door on the Beech 1900C to be opened” was a contributing factor to the severity of the accident and the loss of life.

Conclusion

After review of the evidence submitted by Raytheon, the Safety Board has found no basis to grant any modification to findings 6, 7, 13, 14, 19, and 20. The Board, however, has taken the following actions for findings 15 through 18, the corresponding accident report text, and the probable cause statement:

Finding 15

In the findings list and the accident report text (Section 2.5, “Survival Aspects,” on page 48, sixth paragraph), replaced “the occupants of the Beech 1900C did not escape because the air stair door could not be opened and the left overwing exit hatch was not opened” with “the occupants of the Beech 1900C did not escape because the air stair door and the left overwing exit hatch were not opened for undetermined reasons.”

Finding 16

In the findings list, deleted “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.” Renumbered the remaining findings accordingly.

In the accident report text (Section 2.5.1, “Air Stair Door,” on page 49, fifth paragraph), deleted “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.”

In the accident report text (Section 2.5.1, “Air Stair Door,” on page 49, sixth paragraph), replaced “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” with “the Safety Board is further concerned that, even though the impact forces from the accident were such that both airplanes came to rest on their landing gear and the occupants of the Beech 1900C did not sustain blunt force trauma injuries as a result, the door was not opened by any of the occupants for undetermined reasons.”

Finding 17

In the findings list, deleted “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.” Renumbered the remaining findings accordingly.

In the accident report text (Section 2.5.1, “Air Stair Door,” on page 50, second complete paragraph), deleted “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.”

Finding 18

In the findings list, deleted “the FAA’s freedom from jamming certification standards may be inadequate.” Renumbered the remaining findings accordingly.

In the accident report text (Section 2.5.1, “Air Stair Door,” on page 50, third complete paragraph), deleted “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 standards may be inadequate."

Probable Cause

Replaced "contributing to the severity of the accident and the loss of life were the lack of adequate aircraft rescue and firefighting services, and the failure of the air stair door on the Beech 1900C to open" with "contributing to the severity of the accident and the loss of life were the lack of adequate aircraft rescue and firefighting services and the failure of the air stair door on the Beech 1900C to be opened."

Revised Briefs of Accident are enclosed.

Members HAMMERSCHMIDT, BLACK, GOGLIA, and CARMODY concurred in this petition for reconsideration. Chairman HALL did not participate.

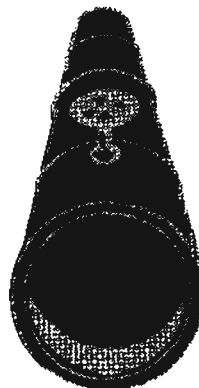
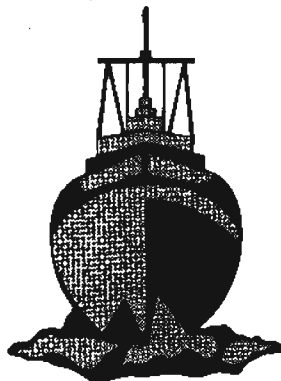
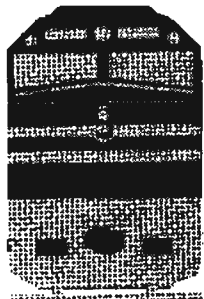
Enclosures

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

RUNWAY COLLISION
UNITED EXPRESS FLIGHT 5925
AND BEECHCRAFT KING AIR A90
QUINCY MUNICIPAL AIRPORT
QUINCY, ILLINOIS
NOVEMBER 19, 1996



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**NATIONAL TRANSPORTATION
SAFETY BOARD
WASHINGTON, D.C. 20594**

AIRCRAFT ACCIDENT REPORT

RUNWAY COLLISION

**UNITED EXPRESS FLIGHT 5925
AND BEECHCRAFT KING AIR A90
QUINCY MUNICIPAL AIRPORT
QUINCY, ILLINOIS
NOVEMBER 19, 1996**

**Adopted: July 1, 1997
Notation 6793C**

Abstract: This report explains the accident involving United Express flight 5925, a Beechcraft 1900C, and a Beechcraft King Air A90 that collided at the intersection of runway 13 and runway 04 at Quincy Municipal Airport, near Quincy, Illinois, on November 19, 1996. Safety issues in the report include the importance of emphasizing careful scanning techniques during flight training, Beech 1900C certification standards and compliance with requirements on door jamming, the certification of small airports used by scheduled commuter airlines, and aircraft rescue and fire fighting protection on scheduled commuter aircraft having 10 seats or more. Safety recommendations concerning these issues were made to the Federal Aviation Administration.

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EXECUTIVE SUMMARY

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. 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 14 Code of Federal Regulations Part 135. The flight was operated by Great Lakes Aviation, Ltd., doing business as United Express. The King Air was operating under 14 Code of Federal Regulations Part 91.

The National Transportation Safety Board determines 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 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 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 services, and the failure of the air stair door on the Beech 1900C to open.

Safety issues discussed in the report include the importance of emphasizing careful scanning techniques during flight training, Beech 1900C certification standards and compliance with requirements on door jamming, the certification of small airports used by scheduled commuter airlines, and aircraft rescue and fire fighting protection on scheduled commuter aircraft having 10 seats or more. Safety recommendations concerning these issues were made to the Federal Aviation Administration.

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594**

**AIRCRAFT ACCIDENT REPORT
RUNWAY COLLISION
UNITED EXPRESS FLIGHT 5925
AND BEECHCRAFT KING AIR A90
QUINCY MUNICIPAL AIRPORT
QUINCY, ILLINOIS
NOVEMBER 19, 1996**

1. FACTUAL INFORMATION

1.1 History of Flight

On November 19, 1996, at 1701 central standard time,¹ 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. 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.

On the day of the accident, the flightcrew of United Express flight 5925 checked in for duty at Quincy Municipal Airport at 0415 for a 1-day trip, which was to consist of 8 legs for a total of 5.36 flight hours. According to company records, the flightcrew performed routine preflight duties and departed the gate at 0512 for the first leg to Burlington, Iowa. After the fifth leg (Bloomington, Indiana, to Terre Haute), a mechanical problem required the flightcrew to ferry the airplane to O'Hare, where the flightcrew changed to the accident airplane, N87GL, for the remaining legs to Burlington and Quincy.

At 1500, the flightcrew departed O'Hare in N87GL as United Express flight 5925.² The flight departed 2 hours and 45 minutes late because of the earlier maintenance problem at Terre Haute. According to flightcrew-reported times, the airplane landed at Burlington at 1625 and departed at 1637 as combined flights 5925/5926 to Quincy.³

¹All times are central standard time, based on a 24-hour clock, unless otherwise noted.

²The flight operated under a code-sharing agreement with United Airlines but used the call sign "Lakes Air 251."

³Flight 5926 was scheduled to operate from Quincy by way of Burlington to O'Hare. Because of flight 5925's late departure from O'Hare, the decision was made to eliminate the Burlington

According to the cockpit voice recorder (CVR), at 1652:07, a female voice identified as the captain⁴ of flight 5925 stated on the Quincy common traffic advisory frequency (CTAF)⁵ that the airplane was about 30 miles north of the airport and that they would be landing on runway 13; she also asked that “any traffic in the area please advise.” (See appendix B for a complete transcript of the CVR recording.) No replies were received to this request.

At 1655:19, a female voice, identified as one of the occupants in the King Air, announced, “Quincy traffic, King Air one one two seven Delta’s taxiing out...takeoff on runway four, Quincy.” At 1655:40, the CVR recorded the voice of the male pilot of a Piper Cherokee,⁶ which was taxiing behind the King Air, announcing, “Quincy traffic, Cherokee seven six four six Juliet back-taxi...taxiing to runway four, Quincy.” At 1655:48, the captain of flight 5925 commented to the first officer, “They’re both using [runway] four.” The captain then asked, “you’re planning on one three still, right?” The first officer replied, “yeah, unless it doesn’t look good then we’ll just do a downwind for four but...right now plan one three.”

At 1656:56, the captain of flight 5925 announced over the CTAF, “Quincy area traffic, Lakes Air two fifty one is a Beech airliner currently ten miles to the north of the field. We’ll be inbound to enter on a left base for runway one three at Quincy any other traffic please advise.” There was no response.⁷

At 1659:03, the female occupant of the King Air announced, “Quincy traffic, King Air one one two seven Delta holding short of runway four. Be ...takin’ the runway for departure and heading...southeast, Quincy.” At 1659:19, the captain of flight 5925 commented, “she’s takin’ runway four right now?” The first officer replied, “yeah.” According to the Cherokee pilot, the King Air pulled up far enough on runway 04 to allow the Cherokee access to runway 36, and when the King Air went into position on runway 04, he taxied the Cherokee into the runup area short of the runway.

At 1659:29, the captain of flight 5925 announced, “Quincy area traffic, Lakes Air two fifty one is a Beech airliner currently...just about to turn, about a six mile final for

stop of flight 5926. Therefore, passengers scheduled on flight 5926 from Burlington to O’Hare were included on flight 5925 to Quincy from where they would have taken flight 5926.

⁴Company personnel who listened to the CVR recording reported that all of the communications were being made by the captain. Company practice is for the pilot not flying to handle radio communications.

⁵CTAF is a radio frequency designated for use by pilots operating near uncontrolled airports. Pilots use this frequency to broadcast their positions or intended flight activities or ground operations.

⁶The pilot of the Cherokee received his private pilot’s license in February 1996, and had 80 hours of flight time in the Cherokee. His passenger had received a private pilot’s license about 2 weeks before the accident and had 44 hours of flight time.

⁷In a postaccident interview, the Cherokee pilot indicated that when he heard this broadcast, he saw the airplane. He also said that he remembered seeing lights on each wing of the airplane on its final approach.

runway...one three, more like a five mile final for runway one three at Quincy.”⁸ At 1700:16, the captain of flight 5925 reported that the airplane was “on short final for runway one three” and asked, “the aircraft gonna hold in position on runway four or you guys gonna take off?”

The King Air did not respond to this request. However, at 1700:28, the pilot of the Cherokee stated, “seven six four six Juliet...holding...for departure on runway four.” The CVR then recorded an interruption in this transmission by a mechanical “two hundred” alert announcement from the ground proximity warning system (GPWS)⁹ in the Beech 1900C. The CVR then recorded the last part of the transmission from the Cherokee as “* on the uh, King Air.”¹⁰ At 1700:37, the captain of flight 5925 replied, “OK, we’ll get through your intersection in just a second sir * we appreciate that.”¹¹

According to the Cherokee pilot and his passenger, as well as a pilot who saw the approach and landing of flight 5925 as he was driving to the airport, flight 5925 had its landing lights on. The passenger in the Cherokee said the airplane made a normal landing on runway 13.

Time and distance data from an Aircraft Performance and Visibility Study conducted by the Safety Board indicated that the King Air began its takeoff roll about 13 seconds before flight 5925 touched down on the runway at 1700:59. According to the occupants of the Cherokee, the King Air had been in position on the runway for about 1 minute before beginning the takeoff roll. The Cherokee pilot stated that he heard no takeoff announcement from the King Air over the CTAF, and none was recorded on the Beech 1900C CVR.¹²

⁸The Cherokee pilot indicated that he remembered hearing a call from the captain of flight 5925 while he was waiting in the runway area. However, he recalled her saying that the airplane was 2 miles out on final.

⁹The GPWS provides cautions, alerts, and warnings that indicate potentially hazardous proximity to terrain. Callouts include “five hundred,” “two hundred,” and “minimums” above the terrain. These callouts refer to feet above the terrain.

¹⁰The asterisk from the CVR recordings found in this report indicates an unintelligible word. According to the CVR transcript, this was the Cherokee pilot’s second radio call on the CTAF. In a postaccident interview, the Cherokee pilot indicated that his recollection was that his second radio call before departing Quincy followed a transmission that included the words “King Air...taxiing and holding.” He stated that he did not hear the whole transmission but that at the time, he thought it came from the King Air, and he thought that the King Air pilot might have been talking to him. He said that after he asked his passenger whether he understood the transmission, and his passenger said that he did not, he transmitted “King Air this is Cherokee 7646J...I am right behind you and am holding for your departure.”

¹¹The Cherokee pilot indicated that he did not recall hearing any transmission concerning an intersection.

¹²A pilot waiting inside the FBO said he thought he remembered hearing a male voice “stepping on” (transmitting at the same time as) a female voice shortly before the accident. None of the other witnesses who were listening to the CTAF at the time reported hearing such a “stepped on” transmission.

At 1701, during flight 5925's landing rollout, the airplane collided with the King Air at the intersection of runways 13 and 04. (See diagrams of accident site in figures 1 and 3 and photographs of accident site in figures 2a and 2b.) Rescuers reported that they heard signs of life when they first reached the Beech 1900C, but they were unsuccessful in their attempts to open the air stair door.

The Cherokee pilot later indicated that he did not know the two runways intersected. The passenger in the Cherokee said he was watching the two airplanes, but he thought they would miss each other.

The collision occurred in visual meteorological conditions about 15 minutes after sunset at 39° and 56 minutes north latitude, and 91° and 11 minutes west longitude.

1.2 Injuries to Persons

<u>Injuries</u>	<u>Flightcrew</u>	<u>Cabin Crew</u>	<u>Passengers</u>	<u>Other</u>	<u>Total</u>
Fatal	4	0	10	0	14
Serious	0	0	0	0	0
Minor	0	0	0	0	0
None	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	4	0	10	0	14

1.3 Damage to Airplane

Both aircraft were destroyed by the impact and postcrash fire. The estimated value of the Beech 1900C was \$3 million. The estimated value of the King Air was \$225,000.

1.4 Other Damage

The cost of repairs to the runway, runway light and turf, and environmental decontamination of the area was \$1,898.88.

1.5 Personnel Information

1.5.1 Flight 5925 Flightcrew

1.5.1.1 Captain Information

The captain, age 30, held an airline transport pilot (ATP) certificate, airplane multiengine land, and was type rated in the Beech 1900. She held a first-class medical certificate, with no limitations, dated September 26, 1996. She was hired by Great Lakes Aviation on September 23, 1993, as a first officer, and she upgraded to captain on February 13, 1996. At the time of the accident, the captain had accumulated about 4,000 hours of flight time, of which 700 hours were as pilot-in-command of the Beech 1900. Her last proficiency check

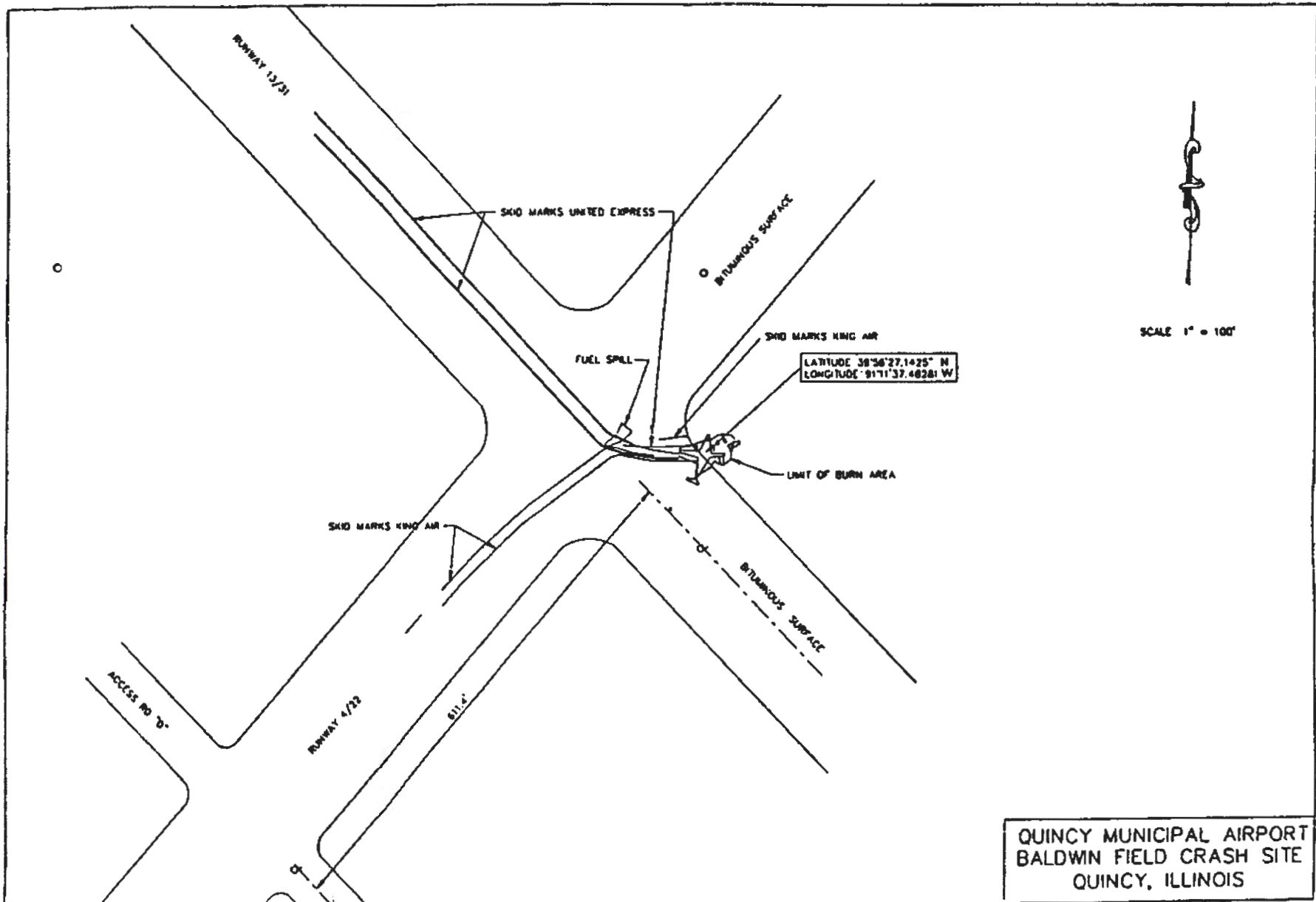


Figure 1.—Diagram of accident site.



2a. View looking aft of the Beech 1900C



2b. View (looking forward) of the King Air wreckage

Figures 2a and 2b.—Photographs of accident site.

was in September 1996, and her last line check was in February 1996. Her total flying time in the 30 and 90 days before the accident was 91 hours and 235 hours, respectively. A review of Federal Aviation Administration (FAA) records revealed no prior accidents/incidents or enforcement actions.

1.5.1.2 First Officer Information

The first officer, age 24, held a commercial pilot certificate with instrument ratings for single-engine and multiengine airplanes. He held a first-class medical certificate, with no limitations, dated June 18, 1996. According to his family, he had been hired and furloughed by another commuter airline before he was hired by Great Lakes Aviation on September 27, 1995, as a first officer. At the time of the accident, the first officer had accumulated about 1,950 hours of flight time, of which 800 hours were as second-in-command of the Beech 1900. His last proficiency check was in September 1996. His total flying time in the 30 and 90 days before the accident was 103 hours and 223 hours, respectively. A review of FAA records revealed no prior accidents/incidents or enforcement actions.

1.5.2 King Air Occupants

1.5.2.1 King Air Pilot-in-Command

The pilot of the King Air, age 63, was a retired Trans World Airlines (TWA) captain. He was employed by TWA from 1965 until 1992, and was also a pilot in the U.S. Air Force Reserves. From 1993 until the time of the accident, he was a part-time flight instructor at the Scott Air Force Base Aero Club, Belleville, Illinois. In addition, he flew part-time as an on-demand, air taxi pilot for Prestige Air, Cape Girardeau, Missouri, and did some commercial flying in a Beechcraft Baron BE-58P, based at Spirit of St. Louis Airport, Chesterfield, Missouri.

The pilot held an ATP certificate, with ratings for airplane multiengine land, and commercial privileges for airplane single-engine land and sea. He was type rated in the B-377, B-707, B-720, B-747, DC-9, L-382, L-1011, and N-B25. He also held a flight engineer certificate for turbojet and reciprocating engine-powered airplanes. In addition, he was a certified flight instructor for single-engine and multiengine airplanes with instrument ratings.¹³ He held a first-class medical certificate, dated June 11, 1996, with the restriction that he wear corrective lenses. He was seen wearing glasses when he boarded the airplane before the accident. According to the FAA, he had a waiver allowing him to use the tranquilizer/sedative, Ativan, (a benzodiazepine that is generically known as lorazepam), so long as he used it no more than 2 to 4 times per month for sleep, and not within 18 hours of flying.

¹³A logbook entry dated January 20, 1996, revealed that he received a multiengine instructor endorsement from the female occupant on the accident flight.

The pilot had a total of 25,647.8 hours of flight time at the time of the accident, of which 22 hours were in the accident airplane. His last Part 135 instrument proficiency check was in July 1996. His logbook indicated that he was current in accordance with 14 CFR Part 91.

The pilot had been involved in a gear-up landing incident in a Cessna 172RG on May 26, 1996, while giving instruction to a student commercial pilot. As a result of that incident, the FAA initiated an enforcement action against him, but subsequently allowed him to take remedial training in place of the enforcement action. That training had not been completed at the time of this accident. The FAA inspector who investigated the gear-up incident said in a written statement to the Safety Board that the pilot “expressed an extremely negative attitude toward the FAA’s questioning him about this landing. His statements were to the effect that he was a retired U.S. Air Force Colonel with almost 30,000 hour[s] of flying time and that landing gear up did not mean anything.”

Safety Board investigators interviewed several pilots who had received flight instruction from the King Air pilot, including the student who was involved in the gear-up landing. This student indicated that in his opinion, a shortcoming of the instructor was that he “seemed to be in a hurry when time was a factor,” and the student sometimes felt that the instructor was rushing him. Two of the passengers who had flown with the King Air pilot just before the accident¹⁴ commented that he seemed “to be in a hurry” or “anxious to get home” when he left them after the return flight to Quincy.

TWA records indicated that on October 7, 1991, the pilot was transferred from the status of captain to that of flight engineer. A TWA instructor involved in that action told Safety Board investigators that the transfer was made because of flying deficiencies observed in the pilot’s training, which resulted in a failed proficiency check and a failed special line check.

According to the pilot’s wife, he slept normally in the days before the accident but awoke “at an early hour” to fly on the day of the accident. She said that she expected him to return home that evening about 1745.

1.5.2.2 King Air Pilot/Passenger

The pilot-rated passenger, age 34, was employed by Flight Safety International Airline Center, St. Louis, Missouri, as a ground instructor. She primarily taught orientation and indoctrination classes to airline customers. She was also a part-time flight instructor at the Scott Air Force Base Aero Club, Belleville, Illinois.

She held a commercial pilot certificate with ratings for airplane single-engine land and sea, airplane multiengine land, instrument airplane. She also held a certified flight instructor certificate for airplane single-engine and multiengine, instrument airplane; and a ground

¹⁴On the day of the accident, beginning about 0830, the King Air occupants flew four prospective buyers of the King Air on a demonstration flight from Quincy to Tulsa, Oklahoma, and back to Quincy.

instructor certificate, with an advanced and instrument rating. Her first-class medical certificate was issued on July 1, 1996, with no restrictions. Her logbook indicated that she had a total of 1,462.2 flying hours, and her last proficiency check was on June 28, 1996.

According to an acquaintance, who was also a flight instructor at Scott Air Force Base Aero Club, the accident flight was the first time the pilot/passenger had flown in a King Air. This flight instructor, and a passenger who had flown on the King Air before the accident, stated that the pilot/passenger came along on the flight to increase her multiengine time. A student pilot from the Scott Air Force Base Aero Club indicated that he understood the pilot had instructed the pilot/passenger in multiengine airplanes, and had provided opportunities for her and another flight instructor at the Aero Club to fly them. The pilot/passenger's former husband said that she wanted to become a commercial pilot with a commuter airline, and that she was attempting to build her flying hours toward obtaining an ATP rating.

One of the passengers on the King Air's earlier flight to Tulsa and back noted that both the pilot and pilot/passenger had their hands on the controls when they left Tulsa,¹⁵ and another passenger indicated that the pilot and the pilot/passenger appeared to have "an excellent teacher/student relationship with [the pilot] as the teacher." A third passenger stated that "[the pilot] seemed to be telling [the pilot/passenger] how to fly the plane when we were in flight."

1.6 Airplane Information

1.6.1 Beech 1900C

The accident airplane, N87GL, was owned by Raytheon Aircraft Credit Association and was leased to Great Lakes Aviation on December 28, 1989. The airplane, which contained 19 passenger seats, was manufactured by Beech Aircraft (now Raytheon Aircraft Company) and received its airworthiness certificate on December 20, 1989. The airplane was powered by two Pratt & Whitney (P&W) Model PT6A-65B turbopropeller engines. The two Model HC-B4MP-3A engine propellers were manufactured by Hartzell. The airplane had four emergency exits (viewed from the aft looking forward): the forward air stair door on the left, which is the main boarding door, the overwing hatch on the left, and two overwing hatches on the right.

At the time of the accident, the airframe had 18,446 hours total time and 26,797 total cycles. The left engine had 16,821.2 hours total time and 18,701 total cycles. The right engine had 14,534.8 hours total time and 19,291 total cycles. No noteworthy discrepancies were found in the airplane's maintenance logs.

According to maintenance records, on April 27, 1996, Great Lakes performed a detailed inspection (including opening) of the air stair door, the overwing exits, and the cargo

¹⁵One of the passengers said that the pilot/passenger did some of the flying and that around 50 feet above ground level (agl), she returned control to the pilot.

door. No discrepancies were noted. The air stair door was replaced by Great Lakes on September 25, 1996, at its maintenance base in Spencer, Iowa, because of rivets pulling through the door near the hinge attach areas. The records indicated that the door annunciator light (FWD DOOR), which alerts the flightcrew of a possible unlocked door, had illuminated on October 1, 1996, October 10, 1996, and on November 7, 1996. Great Lakes maintenance personnel reportedly fixed the illumination problem by adjusting the door's microswitches.

According to Great Lakes, 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 was replaced by its maintenance personnel. The person who inspected the door was a certified airframe and powerplant mechanic¹⁶ 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.

1.6.1.1 Beech 1900C Emergency Exit Door Certification – Freedom from Jamming

The Beech 1900C received its initial type certification on November 22, 1983. According to the FAA, the Beechcraft 1900C was type certificated under Part 23, Amendment 23-9, effective June 17, 1970, and Special Federal Aviation Regulation (SFAR) 41C, effective September 13, 1982. According to the FAA, the emergency exits also complied with 14 CFR 23.807, Amendment 23-7, effective September 14, 1969.

According to the FAA, the Beech 1900C was type certificated pursuant to a delegated option authorization (DOA), a process under which a type certificate is issued based in part on the manufacturer's self-certification that all applicable regulations have been met. (See 14 CFR Part 21, Subpart J).¹⁷ However, the FAA may choose to participate in and make specific

¹⁶A mechanic who has been issued an airframe and powerplant certificate by the FAA under 14 CFR Part 65.

¹⁷14 CFR 21.253 states that to obtain a type certificate for a new product under the DOA, the manufacturer must submit to the FAA:

- (1) An application for a type certificate...;
- (2) A statement listing the airworthiness requirements...that the manufacturer considers applicable;
- (3) After determining that the type design meets the applicable requirements, a statement certifying that this determination has been made;
- (4) After placing the required technical data and type inspection report in the technical data file required by 21.293(a)(1)(i), a statement certifying that this has been done;
- (5) A proposed type certificate data sheet; and

findings of compliance with regard to certain regulatory requirements. As discussed below, in certifying the Beech 1900C, the FAA observed testing and made a specific finding of compliance with regard to the freedom from jamming certification requirement.

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.”¹⁸ (See *53 Federal Register* 30802, 30807, August 15, 1988).

Safety Board investigators reviewed the Beech Model 1900/1900C Engineering Structural Test reports, issued on September 3 and November 3, 1983, which detailed testing that Beechcraft used for the type certification of the 1900C airplane. According to the reports, fuselage static tests were conducted at Beech Aircraft in Wichita, Kansas, between December 14, 1982, and September 6, 1983, as part of the overall structural static test certification program for the Beech Model 1900C forward fuselage and standard version 1900 fuselage. According to

-
- (6) An Aircraft Flight Manual (if required) or a summary of required operating limitations and other information necessary for safe operation of the product.

Section 21.257 provides:

An applicant is entitled to a type certificate for a product manufactured under a DOA if the Administrator finds that the product meets the applicable airworthiness, noise, fuel venting, and exhaust emission requirements (including applicable acoustical change or emissions change requirements in the case of changes in type design).

¹⁸Emergency 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.

Raytheon officials, Beech personnel at that time asked the FAA's Aircraft Certification Office (ACO) in Wichita for guidance on how to show compliance with the freedom from jamming requirements of SFAR 41, paragraph 5 (e)(c).

According to Raytheon, the ACO did not provide Beech with specific test criteria, but indicated that compliance could be shown by demonstrating that the doors were free from jamming after undergoing the tests that were already established as part of the Beech structural static test certification program. Under that program, side loads were applied during the side shear and side bending torque tests. (Other tests involved up bending and up shear; down bending and down shear; shear between spars; side shear between spars; and ultimate fuselage pressure.) According to Beech's test data, 2,970 pounds of static side pressure were applied for 3 seconds at 90° at fuselage station 30.13, and water line 34.48, near the right and left sides of the nose gear. The tests measured 194,592 inch pounds of torque and 430,264 inch pounds of bending moment at fuselage station 175.0 with the following results: a 3.70-inch crack in the lower aft corner of the air stair frame at fuselage station 175; buckling of the aft lower corner of the right-hand nose door, door frame, and floor frame at fuselage station [1]82;¹⁹ wrinkling of the fuselage skin at fuselage station 290; loosening of the sealer, the forward spar; and the shearing of two raised rivet heads at the forward spar.

In a letter to Beech dated April 25, 1983,²⁰ the FAA indicated that "Beech must show that application of the inertia loads in FAR 23.561 to the stair/door combination, while closed, will not prevent subsequent opening of the door." The FAA also asked that Beech "provide...any information or data which you consider appropriate" to assure that a landing with both main gears collapsed and the airplane resting on its nose gear and aft fuselage would not result in an "unsafe feature."²¹

After the completion of fuselage static tests which included the side shear and side bending torque tests described above (but did not simulate loads resulting from a landing with both main gears collapsed and the airplane resting on its nose gear and aft fuselage), FAA representatives visited the Beech test facility and witnessed the opening of the forward air stair door and overwing emergency hatches on the two test fuselages (a 1900 and a 1900C). The doors opened without jamming or structural failure.

¹⁹According to Raytheon, the test data entry for fuselage station 182 was written in error. The right-hand nose door on the Beech 1900C is located at fuselage station 82 rather than 182.

²⁰The letter primarily addressed Beech's proposed methods for showing compliance with SFAR 41, paragraph 5(e)(g), relating to design of the stair installed on the door, and did not specifically refer to the freedom from jamming requirement in paragraph 5(e)(c). However, Beech's correspondence to the FAA discussing its proposed means for showing compliance, to which the FAA's April 25 letter responded, also referenced the freedom from jamming requirement in paragraph 5(e)(c).

²¹In an earlier letter, Beech had indicated that in this emergency landing configuration (both main gear collapsed and nose gear extended) it "would definitely expect at least nonpermanent fuselage deformation." In an internal memorandum dated April 20, 1983, the FAA Aircraft Certification Division indicated concern that such deformation might result in door jamming, and recommended that the ACO "investigate the condition...and assure that no unsafe condition will result."

In a letter to Beech Aircraft Corporation dated September 12, 1983, the ACO stated that the findings from this demonstration showed compliance with SFAR 41, section 5(e)(c). It further stated that, based on the results of an “unofficial static test conducted at Beech on January 25, 1983,...[which] show the entry door to be reasonably free from jamming when the fuselage is loaded corresponding to the most critical condition of landing gear collapse (both mains collapsed),” the ACO “is satisfied that no unsafe condition is identified with regard to entry door jamming.”

After the Beech 1900C had been certificated, the FAA set forth guidance in Advisory Circular (AC) 25.783-1 (dated December 10, 1986) for complying with the door design standards in 14 CFR 25.783. In 1988, in connection with its promulgation of section 23.783(c)(5), the FAA indicated that the guidance in AC 25.783-1 for complying with the freedom from jamming requirement of 25.783 could also be used to demonstrate compliance with what the FAA referred to as the “substantively equivalent” freedom from jamming requirements of 23.783.²² Specifically, the AC states the following:

8. Door Jam Condition.

An external door, exit, or hatch which may be used for emergency exit in a crash should be designed to allow for fuselage distortion likely to result from a minor crash. This is usually achieved by allowing sufficient clearance between the door and surrounding fuselage support structure to accommodate likely distortions. Also, the possibility of distortion in the door cutout should be minimized by designing the door cutout frame with more strength than that of the surrounding structure.

1.6.2 King Air A90

The King Air A90 was manufactured by Beech Aircraft on January 16, 1967. The airplane was powered by two P&W Model PT6A-20 turbine engines. The two Model HC B3TN-3B engine propellers were manufactured by Hartzell. The airplane had two exits (viewed from the aft looking forward): the air stair door in the aft cabin on the left, and the overwing emergency exit on the right.

The airplane’s maintenance records revealed 11,391.8 total flight hours. A 150-hour primary inspection was made on July 15, 1996, and the total airframe time was noted as 11,359.4 hours at that time. On that date, the left engine had accumulated 9,278.4 hours total time and 2,809.9 hours since the engine was overhauled in March 1978; and the right engine had 9,368.3 hours total time and 2,932.7 hours since that engine was overhauled in March 1978. The engine cycles were not recorded in the maintenance records.

²²53 *Federal Register* 30802, 30807 (August 15, 1988).

The examination of the airframe logbooks did not reveal any abnormalities or entries concerning the airplane's communication equipment. However, the last transponder and pitot static inspections reflected in the airplane maintenance records were on July 1, 1992. Such inspections are required every 2 years under 14 CFR Parts 91.411 and .413.²³

1.7 Meteorological Information

An FAA contract weather observing station is located at the Quincy Municipal Airport. Weather observations are made each hour by contract weather observers employed by Midwest Weather. An automated weather observing system at the airport automatically generates visibility, pressure, ceiling, wind, temperature, and dew point values. The surface weather observations are recorded by the weather observers and transmitted on the voice channel of the local nondirectional beacon.

The following surface weather observation for Quincy was provided on the day of the accident at 1650:

Winds 060° at 10 knots; visibility 12 miles; ceiling 13,000 feet broken, 15,000 feet broken, 20,000 feet overcast; temperature 2° C; dew point -3° C; altimeter setting 30.00 inches of Hg.

After seeing the smoke and flames from the accident, the surface weather observer made the following special surface weather observation for Quincy at 1709:

Winds 070° at 9 knots; visibility 12 miles; few clouds near the surface, ceiling 14,000 feet broken, 20,000 feet overcast; temperature 2° C; dew point -3° C; altimeter setting 29.99 inches of Hg.; smoke near the ground; aircraft mishap.

The weather observer stated that at the time of the accident, all weather equipment was operating satisfactorily, and the visibility was uniform.

1.8 Aids to Navigation

There were no known difficulties with aids to navigation.

1.9 Communications

On the King Air's earlier flight from Tulsa to Quincy, the ground controller at Tulsa reportedly commented about the quality of one of the King Air's radios, and the clearance delivery controller was unable to receive transmissions made by the pilot/passenger. However,

²³The mechanic who performed the last annual inspection on the airplane reported that he had placed a piece of paper in the logbook indicating that the pitot-static system had recently been inspected. No such piece of paper was found in the airplane's records recovered at the crash site.

communications with the air traffic controllers at the Kansas City air route traffic control center (ARTCC), who were responsible for aircraft in the Quincy area, did not indicate any difficulties with radio communications. The ARTCC was in contact with the King Air from about 1443 to 1620.

One of the airplane's passengers on the previous flight for the prospective buyers of the airplane stated that he recalled the pilot and pilot/passenger had exchanged headsets at one point because of difficulty hearing out of one of them. Another passenger recalled that the pilot and pilot/passenger had exchanged microphones because the pilot/passenger's microphone would not transmit. This passenger also remembered the King Air pilot saying that the airplane was in "great shape," and that the only thing the airplane needed was "a small piece of avionics."

1.10 Airport Information

Quincy Municipal Airport is an uncontrolled airport owned and operated by the City of Quincy, Illinois, which is located about 10 miles away from the airport. The airport has an elevation of 769 feet mean sea level, and it has three runways: 18/36, which is concrete, 5,397 feet long, and 150 feet wide; 13/31, which is asphalt, grooved, 5,398 feet long, and 150 feet wide; and 04/22, which is asphalt, grooved, 7,097 feet long, and 150 feet wide. (See figure 3, Airport Diagram.) Runway 18/36 is equipped with low intensity runway lights; runway 13/31 with medium intensity runway edge lights; and runway 04/22 with high intensity runway lights.

The airport holds an FAA-issued limited airport operating certificate.²⁴ Although a 500-gallon capacity airport aircraft rescue and fire fighting (ARFF) truck was located at the airport, full-time ARFF services were not present or required at the time of the accident. (See section 1.15.6, "Emergency Response," for more information on ARFF services.)

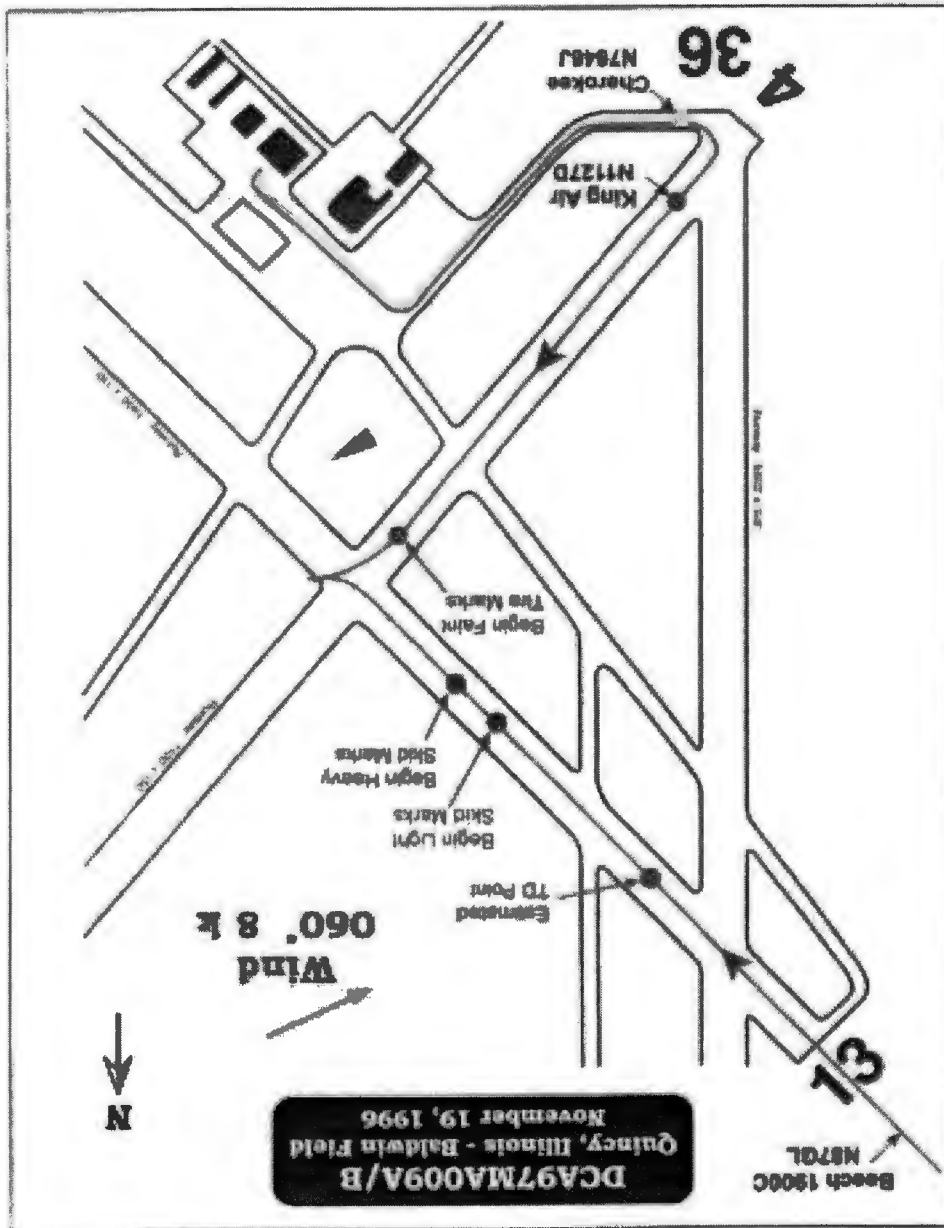
1.11 Flight Recorders

The Beech 1900C was not equipped with a flight data recorder (FDR), nor was it required to be. It was equipped with a Fairchild Model A100A CVR. The King Air was not equipped with either an FDR or a CVR, nor was it required to be.

The Beech 1900C CVR included a "G switch," which was designed to activate and stop the CVR recording if the aircraft experienced forces of at least 2.5 G along its longitudinal axis or lateral axis. The CVR recording stopped about the time of the impact.

²⁴Under 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.

Figure 3.—Airport diagram.



The Beech 1900C's CVR recording of the outgoing radio transmissions was faint and of poor quality.²⁵ As a result, the Board had difficulty determining the content of all transmissions. The quality of the recorded voice communications between the flightcrew members became noticeably poorer during radio transmissions; at other times, they were generally adequate for readout.

The Safety Board addressed this issue in a May 22, 1997, recommendation letter to the FAA. The letter noted that in the past 2 years, the Safety Board has investigated five other accidents/incidents involving Beech 1900 airplanes in which the CVR poorly recorded the incoming or outgoing radio transmissions.²⁶ Four of these occurrences did not involve serious injuries or fatalities, and the poor quality of the recordings was not a factor in the Board's determination of the circumstances surrounding the occurrences. The investigations revealed that the problem originated in the isolation amplifiers installed in the airplanes rather than in the actual CVR units.

The recommendation letter further noted that Raytheon had modified the audio amplifier to correct the circuitry problem on later-model airplanes. However, more than 250 Beech 1900 airplanes are in service, and more than 170 of them may not have had the audio amplifier modified. The company told Safety Board investigators that it plans to make a retrofit kit available to the owners of these airplanes.

Accordingly, in its May 22, 1997, letter to the FAA, the Safety Board issued Safety Recommendation A-97-36, which asked the FAA to do the following:

Promptly require the inspection of the CVR and associated equipment on all Beech 1900 aircraft and ensure that operators take corrective action to repair deficient CVR systems so that the intelligibility of recorded communications, including radio transmissions to and from the airplane, is as high as practicable.

The Safety Board has not yet received a response to this recommendation.

²⁵The Safety Board generally uses the following criteria to assess the quality of a CVR recording: a "poor" recording is one in which a transcription is nearly impossible given that a large portion of the recording is unintelligible; a "fair" recording is one in which a transcription is possible, but the recording is difficult to understand; a "good" recording is one in which a few words are unintelligible; and an "excellent" recording is very clear and easily understood.

²⁶See Safety Board accident briefs FTW95FA004, Denver, Colorado, October 1, 1994; FTW96FA198, Denver, Colorado, May 2, 1996 (preliminary report); NYC97FA045, Bangor, Maine, January 10, 1997 (preliminary report); and incident briefs FTW97IA003, Pueblo, Colorado, October 3, 1996 (preliminary report); and CHI95IA066, Williston, North Dakota, January 12, 1995.

1.12 Wreckage and Impact Information

Both airplanes came to rest with their wings interlocked, along the east edge of runway 13, approximately 110 feet east of where the skid marks converged near the intersection of runways 04 and 13. According to witnesses, both airplanes came to rest on their landing gear after the impact.

1.12.1 Beech 1900C Wreckage Information

The Beech 1900C's continuous tire skid marks were 475 feet long leading up to the point where they converged with the scuff marks made by the King Air's tires. The majority of the airplane's upper fuselage, including the cockpit area and both wings, was destroyed by fire.

The nose of the fuselage was intact, but it had separated at the forward cockpit area and was resting on its right side with the nose gear extended. The right side of the nose section was compressed inward about 10 inches, and blue paint transfer was found along the right side of the nose assembly that matched the color of the paint trim on the King Air. The tail assembly remained intact and was resting on the left horizontal stabilizer.

The engine and propeller assembly remained attached to the left wing. All four right engine propeller blades had fractured at the blade root and had separated from the hub. One of the propeller blades was found along the east edge of runway 04 at the intersection with runway 13. The blade's leading edge had blue paint transfer that matched the color of the paint trim on the King Air. The leading edge of another torn propeller blade exhibited white paint transfer that matched the color of paint on the King Air's fuselage and wing surface. Examination of the control cables to the fuel controls of both engines revealed positions consistent with normal engine shutdown.

The forward air stair door was destroyed by fire. The door latches, latch mounts, control cable, and control handle assemblies were recovered from the wreckage. Examination of the latches revealed that they were all partially or fully latched.

1.12.2 King Air A90 Wreckage Information

The King Air's tire scuff marks veered continually to the right on runway 04 for about 260 feet before they converged with the skid marks from the Beech 1900C. A dark area with an odor consistent with that of jet fuel was found on the runway near the converging skid marks. The grass next to the airplane wreckage was burned and dark and also had an odor consistent with jet fuel.

Except for the outboard sections of the right wing and the right horizontal stabilizer, the King Air was consumed by the postcrash fire. No evidence of the main cabin door or the emergency exit hatch could be found. The nose gear was folded forward in the down-and-locked position. The radome and a small section of the airplane's left wing leading edge were found on the runway next to the wreckage. The radome was torn and exhibited chipped paint

and abrasive marks on its exterior, and the section of the left wing's leading edge showed black paint transfer that matched the color of paint on the Beech 1900C's propellers. Examination of the control cables to the fuel controls of both engines revealed positions consistent with normal engine shutdown. The cockpit-mounted radio controls were consumed by the postcrash fire. The nose-mounted communication radio units were found crushed and partially burned. No information about the radio's functioning or its settings at the time of the accident could be obtained from the wreckage.

1.13 Medical and Pathological Information

Autopsies were performed on the occupants of both airplanes. According to the Coroner, Adams County, Illinois, the cause of death for 10 occupants was "carbon monoxide intoxication from inhalation of smoke and soot." The cause of death for four occupants was "inhalation of products of combustion."

Toxicological tests were conducted on fluid and tissue samples of all four pilots. Tests conducted on urine samples for benzodiazepines, alcohol, and other drugs were negative for all of them except the King Air pilot. Lorazepam (a benzodiazepine)²⁷ was detected in the King Air pilot's urine sample, but it was not detected in his blood or liver fluid samples.

1.14 Fire

At the accident site, investigators observed that the grass was burned for approximately 10 feet beyond the perimeter of the wreckage, and that fuel had saturated the grass for about 40 feet beyond the perimeter. A 5- by 8-foot area of fuel residue was observed on the runway area where the aircraft skid marks converged.

1.15 Survival Aspects

The bodies of the King Air pilot and pilot/passenger were found behind the seats in the cockpit.

The bodies of seven of the passengers on the Beech 1900C were found forward of row 4, and the bodies of three passengers were found near rows 7 and 8. The captain's body was found in the cockpit area, and the first officer's body was found between the air stair door and the forward right overwing exit.²⁸

²⁷As indicated in section 1.5.2.1, the King Air pilot had a waiver from the FAA allowing him to use this tranquilizer/sedative.

²⁸Great Lakes Aviation told Safety Board investigators that passengers aboard flight 5925 were given seat assignments but was unable to provide the Safety Board with a record of those seat assignments. The company's load manifest divided the cabin into forward and aft sections. The forward section included seat rows 1 through 5, and the aft section included rows 6 through 9. According to the load manifest, at least four passengers were seated in rows 6 through 9 and at least 5 passengers were seated in rows 1 through 5. The 10th passenger was not listed on the load manifest.

1.15.1 Rescue Attempts

A pilot employed by the airport's fixed-base operator (FBO) and two Beech 1900C-qualified United Express pilots who had been waiting for flight 5925 to arrive were the first people to reach the accident scene. One of the United Express pilots remained some distance from the airplanes while the other United Express pilot and the FBO pilot approached the airplanes. They saw that the King Air and the right side of the Beech 1900C were engulfed in fire. The United Express pilot said that he opened the left aft cargo door of the Beech 1900C and black smoke poured out. The FBO pilot said that he could not see the interior of the cabin through the passenger windows because the cabin appeared to be filled with dark smoke. They then ran to the forward left side of the Beech 1900C fuselage where the FBO pilot said he saw the captain's head and arm protruding from her window on the left. She asked them to "get the door open."

The FBO pilot stated that he found the forward air stair door handle in the 6 o'clock (unlocked) position.²⁹ He said that he attempted unsuccessfully to open the door by moving the handle in all directions and pulling on the door. He said that he did not see any instructions for opening the door, but he was able to rotate the handle upward to the 5 o'clock position but no further. The United Express pilot stated that he then intervened because he believed that the FBO pilot probably did not know how to open the door. The United Express pilot stated that he depressed the button above the handle while rotating the handle from the 3 o'clock position downward to the unlocked position. He stated that the handle felt "normal" as he rotated it. However, he was unable to open the door. The FBO pilot then tried again to open the door by rotating the handle upward, but he was again unsuccessful.

According 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 following instructions for operating the air stair door were printed on a small placard, with black letters 2/10-inch high on a white background, that was located aft and slightly lower than the door handle on the exterior of the airplane: "PUSH BUTTON AND TURN HANDLE TO OPEN." No further instructions were posted on the exterior of the airplane. The button above the handle was black, and it was located on a background color scheme of medium-hued blue. The button was not outlined. The FBO pilot said that he did not know that the proper procedure for opening the door involved depressing the button above the handle while simultaneously turning the handle.

On January 3, 1997, the Safety Board issued urgent Safety Recommendation A-97-1, which asked the FAA to do the following:

²⁹According to the manufacturer, when the handle is in the 6 o'clock position, the door is unlocked, and when it is in the 3 o'clock position, it is locked.

Immediately issue a telegraphic [Airworthiness Directive] (AD) directing all Beechcraft 1900 operators to (1) conspicuously identify the external air stair exit door button with highly visible markings, (2) indicate that the button must be depressed while the handle is rotated, and (3) include an arrow to show the direction that the handle must be moved to open the door.

In February 1997, Raytheon Aircraft Company issued Service Bulletin (SB) No. 2741 requiring, within the next 200 flight hours, new exterior operating instruction placards for the air stair and cargo doors for the Beech 1900 and 1900C and new exterior operating instruction placards for the air stair, cargo, and emergency exits for the 1900D.

On February 24, 1997, the FAA responded to Safety Recommendation A-97-1, stating that it had issued Priority Letter AD 97-04-02, which refers to Raytheon's SB No. 2741, to require the installation of new exterior operating instructions, markings, and placards for the air stair door, cargo door and emergency exits. Based on the FAA's action, the Safety Board classified Safety Recommendation A-97-1 "Closed—Acceptable Action" on April 25, 1997.

1.15.2 Passenger Briefing

At 1638:12, the CVR recorded a flightcrew-activated, prerecorded passenger briefing as flight 5925 departed Burlington for Quincy. The prerecorded briefing stated the following, in part:

Please remove the passenger briefing card located in the seat pocket in front of you. We suggest that you follow along as we explain the location and operation of the aircraft's safety equipment.

Passengers seated in 4C, 6A, or 6C should review the information card explaining exit row seating requirements. If you feel you would be unable to carry out these instructions or wish to be re-seated, please notify a crewmember.

There are four exits aboard this aircraft. There are three clearly marked overwing exits, two over the right wing and one over the left wing. To open, pull down on the handle and pull the exit inward. The main cabin door through which you entered is also an emergency exit. To open, push the button next to the handle then rotate the handle counter-clockwise and push the door open.

1.15.3 Beech 1900C Exits

1.15.3.1 Air Stair Door

The Beechcraft 1900 maintenance manual describes the operation of the air stair exit door as follows:

The air stair door has six cam locks positioned around the exterior of the door, with three cams on each side. A continuous cable connects the exterior and interior door handle assemblies and the six cams. During operation of either door handle, the cable rotates each cam approximately 150° to lock or unlock the air stair door. The air stair door weighs 58 pounds, and the center of gravity for the door is 3 inches inside the hinge line.

Whether unlocking the door from the outside or inside, the release button adjacent to the door handle must be held depressed before the handle can be rotated to unlock the door. The release button acts as a safety device to help prevent accidental opening of the door.

See figure 4 for a diagram of the Beech 1900/1900C air stair door and latching mechanism.

According to representatives of Raytheon, if there is more than ¼ inch of slack in the cable, the cam locks may not fully rotate when the handle is rotated.

The air stair door parts from the accident airplane were examined at the Safety Board's Materials Laboratory on January 30, 1997. The findings of the examination were as follows:

1. All cams were either fully or partially latched;
2. The exterior door handle was frozen in the latched position with aluminum melted around it;
3. The position of the interior door handle assembly could not be determined because there was no frame of reference to compare it to surrounding structure;
4. The door control cable was attached at both handle assemblies and was fractured at both turnbuckles. The metallurgical examination of the turnbuckle fracture surfaces revealed a topography typical of copper alloys subject to static failure influenced by high temperatures and steady state strain rates.

Beechcraft
1900/1900C AIRLINER
MAINTENANCE MANUAL

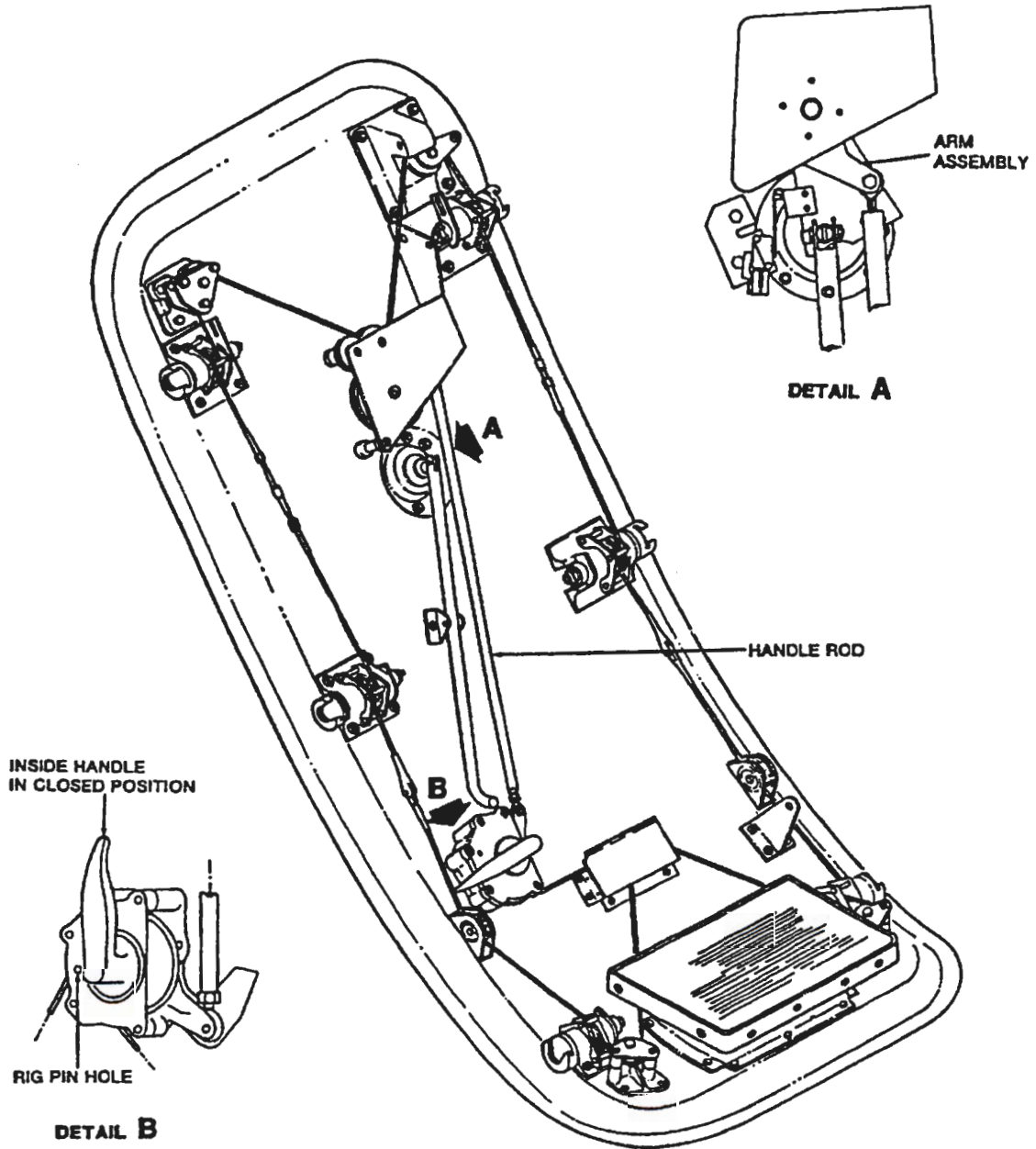


Figure 4.—Beech 1900/1900C air stair door and latching mechanism.

1.15.3.2 Overwing Exit Hatches

Two overwing exit hatches are located on the right side and one on the left side of the Beech 1900C passenger cabin. From the inside, the doors are released with a pull-down handle, placarded "EXIT - PULL." From the outside, the doors are released with a flush-mounted, pull-out handle. The exit hatches are nonhinged, plug-type doors that completely remove from the fuselage frame into the cabin when the latches are released. (See figure 5.) Windows at the overwing exits have a placard with instructions to "push seat backs to clear exit."

During the investigation, Safety Board investigators opened a Beech 1900C overwing exit while two persons were in the seats next to the hatch. An investigator was able to pull the exit into the cabin even though the seats were occupied and the seat backs were not pushed forward to clear the exit.

During wreckage recovery, the overwing exit hatch release latches and turnbuckles were examined. No conclusion could be drawn regarding their positions before the postcrash fire because the release latch secured to the airframe could have fallen from its latched position when the surrounding structure burned away.

1.15.4 Pilot Evacuation Procedures and Training

Great Lakes Aviation's General Operating Manual, Volume 3, Chapter 7, dated August 25, 1994, includes a section for "Unplanned Immediate Action." The instructions call for immediate action when an obvious emergency has occurred. Crewmembers are instructed to shout "Unfasten Seat Belts and Get Out" when the airplane has come to a complete stop. The manual indicates that a "crewmember will then open a usable exit (main cabin door) and direct opening of other exits." The manual includes the following instructions for an unusable exit:

Do not waste time at an exit that will not open and is not going to get anyone out. Assign an able-bodied person (ABP) to redirect everyone to an appropriate alternate exit. With the ABP redirecting by saying "go that way," it is easier for you to direct passengers toward you by using the verbal command, "come this way" to the alternate exit.

The manual instructs the first officer to leave the airplane as quickly as possible, preferably through one of the forward exits. It also states that the first officer should be one of the first out and should ensure that all usable exits have been opened.

The most recent emergency training of the captain of flight 5925 was completed during her captain upgrade training on February 5, 1996. It included ground evacuation and drills on emergency exits.

The first officer's most recent emergency training and emergency drills were completed on August 6, 1996.

Beechcraft
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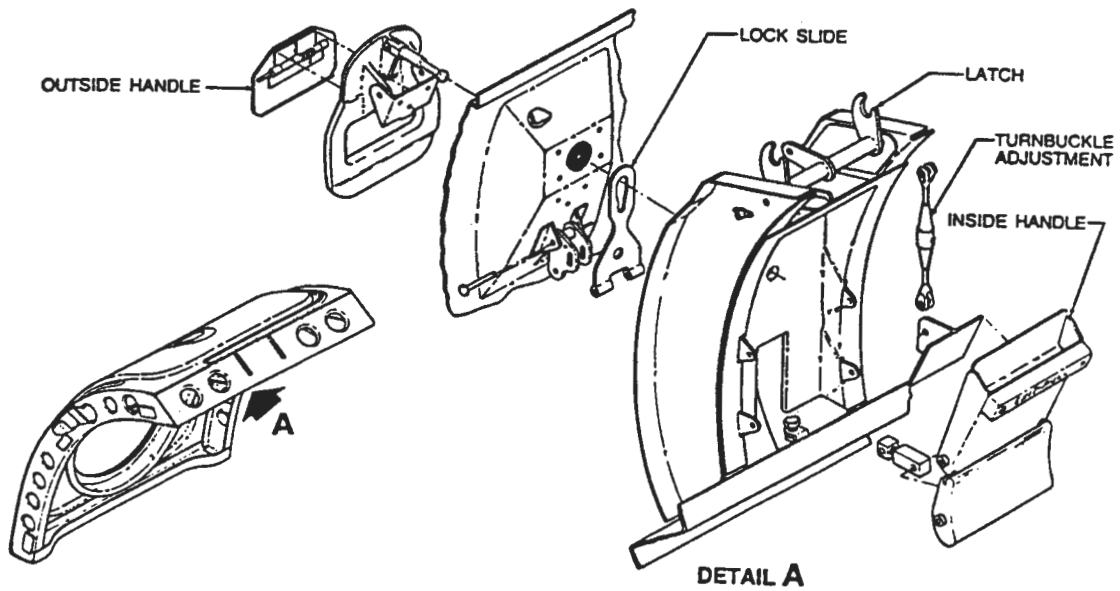


Figure 5.—Diagram of overwing exit hatch.

1.15.5 Previous Safety Board Recommendations on Emergency Exits

The Safety Board has issued two previous safety recommendations related to the external operation of emergency exits.

Safety Recommendation A-81-28 was issued to the FAA on March 20, 1981, following a series of Piper PA-28 accidents in which repeated attempts to open cabin doors and break windows to rescue surviving occupants were unsuccessful. The safety recommendation urged the FAA to do the following:

Amend 14 CFR 23.783, 14 CFR 23.807(b)(3), and 14 CFR Part 91 to require external doors and emergency exits of aircraft to be conspicuously marked on the outside with directions for opening the door.

Based on the Safety Board's later recommendation of A-82-94 (discussed below) and on the FAA's airworthiness review of 14 CFR 23, which included the issue of external markings of exits openable from the outside, on June 12, 1984, the Safety Board classified Safety Recommendation A-81-28 "Closed—Superseded."

On March 27, 1980, a Beechcraft 200, Super King Air, crashed and burned in a field near Parker, Colorado. The pilot and four of the eight passengers survived the crash, but they died from smoke or fire-related injuries because they were unable to escape through the emergency exits. On August 20, 1982, the Safety Board issued Safety Recommendation A-82-94, which asked the FAA to do the following:

Issue an [AD] directing all operators of airplanes equipped with emergency exits openable from the outside to mark the exits and their means of operation on the airplane fuselage in the manner described by 14 CFR 25.811(f)(1), (2), and (3) irrespective of the rules under which the aircraft are being operated.

In a letter to the FAA, dated May 22, 1984, the Safety Board classified Safety Recommendation A-82-94 "Closed—Acceptable Alternate Action," after the FAA issued AC 23.807-3, "Emergency Exits Openable from Outside for Small Airplanes," on January 20, 1984.

AC 23.807-3 recommended that "all manufacturers, operators and owners of small airplanes, with emergency exits openable from the outside of the airplane, add external markings to these exits." The AC gave guidance for methods to improve the visibility and identity of exits; and recommended that a decal be installed on the outside of the emergency exit or on the outside of the airplane next to the exit showing how to open the emergency exit, including special instructions, if applicable. Four methods to visually identify the exit were suggested: (1) outline the exit with a band of such color contrast as to be readily distinguishable from the surrounding fuselage surface, (2) mark the corners of the emergency exit in a conspicuous manner, (3) outline the emergency exit handle with a band of contrasting color, and (4) mark the emergency exit with any other conspicuous visual identification scheme.

At the time of this accident, United Express Beech 1900 exits were not marked using any of the methods suggested in AC 23.807-3.

On December 20, 1995, the FAA issued regulations requiring commuter operators that conduct scheduled passenger-carrying operations in airplanes with 10 to 30 seats to comply by March 20, 1997, with the requirements for exterior exit markings outlined in 14 CFR Part 121.310 (g), which states the following, in part:

Exterior exit markings. Each passenger emergency exit and the means of opening that exit from the outside must be marked on the outside of the airplane. There must be a 2-inch colored band outlining each passenger emergency exit on the side of the fuselage. Each outside marking, including the band, must be readily distinguishable from the surrounding fuselage area by contrast in color....

United Express is now in compliance with the new requirement.

1.15.6 Emergency Response

The Quincy Fire Department's (QFD) 911 dispatch records showed that the initial notification of the airplane crash was received at 1701, and that units, consisting of two engines, seven firefighters, and two other vehicles, were dispatched to the scene at 1702. At 1714,³⁰ after traveling a distance of about 10 miles, the first units arrived at the scene and observed that both airplanes were engulfed in flames. The firefighters from the two engines used 1¾-inch hose lines to extinguish the fire with water, and other firefighters activated the Quincy Airport 500-gallon ARFF truck. Shortly after the QFD units arrived, units from the Central Adams County Fire Department arrived and supplied additional water for the ARFF truck. The incident commander reported that the fire was under control within 10 minutes after the QFD's arrival and that only spot fires remained.

The Quincy Airport has an ARFF truck, which is staffed by QFD firefighters 15 minutes before and 15 minutes after the arrival and/or departure of an air carrier aircraft with more than 30 passenger seats.³¹ The truck at the airport was not staffed at the time of the accident because no air carrier aircraft with more than 30 passenger seats were landing or taking off. According to the fire chief, after the accident, the QFD and the City of Quincy began to investigate ways to staff the ARFF truck at the airport during periods beyond that required by the FAA.

³⁰The time reference is according to the QFD incident commander's report supplement.

³¹14 CFR Part 139.3 defines air carrier operations as "the takeoff or landing of an air carrier aircraft [with a seating capacity of more than 30 passengers] and includes the period of time from 15 minutes before and until 15 minutes after the takeoff or landing."

1.15.7 Commuter Airline Study

In November 1994, the Safety Board issued a safety study entitled *Commuter Airline Safety*³² that states the following, in part:

The National Transportation Safety Board has had a longstanding interest in commuter airline safety and has issued safety recommendations in the past seeking various actions by government and industry to address needed safety improvements. The recommendations followed the Board's 1972 study of air taxi safety, its 1980 study of commuter airline safety, and investigations of accidents involving commuter airline operations. In response to the recommendations and through other initiatives taken by government and industry, regulatory revisions and other actions have resulted in a greatly improved safety record for scheduled Part 135 airlines: the accident rate per 100,000 departures in 1993 was one-fourth the accident rate observed in 1980.

Included in this safety study were two airport-related safety recommendations addressed to the FAA to enhance the level of safety at airports served by commuter airlines:

Seek[] legislative action within 6 months to include in the Airport Certification Program all airports served by air carriers that provide scheduled passenger service. (A-94-203)

Revis[e] and expand[] 14 CFR 135, following enactment of the legislative action described in Safety Recommendation A-94-203, to permit scheduled passenger operation only at airports certificated under the standards contained in Part 139, "Certifications and Operations: Land Airports Serving Certain Air Carriers." (A-94-204)

In its February 23, 1995, response to the Safety Board, the FAA stated that it was "undertaking a process which will lead to a legislative proposal to amend 14 CFR Part 139 to include airports servicing scheduled aircraft with more than 10 passenger seats."

In its April 7, 1995, reply to the FAA, the Safety Board stated that although it was:

pleased that the FAA has initiated a request for legislative activity to revise the airport certification standards, the Board is concerned that the proposal is restricted to airports servicing aircraft with 10 or more passenger seats. Recommendations A-94-203 and -204 did not specify a minimum number of passenger seats for which Part 139 certification should be required, and reflect the Board's strong belief that Part 139

³²See NTSB/SS-94/02.

certification provides a safety standard that should be applied to all scheduled passenger operations, regardless of aircraft size. However, the Board also recognizes that eliminating the passenger seat restriction may have the greatest economic impact on small airports located in remote communities that rely heavily on small aircraft operations for basic necessities. If the FAA has determined that the airport improvements required under Part 139 represent an excessive economic hardship on airports receiving scheduled service in aircraft with fewer than 10 seats, the Board would like to review the analysis that supports this position. Pending review of that information, the Board classifies Safety Recommendations A-94-203 and -204 “Open—Acceptable Response.”

In its May 6, 1997, response to the Safety Board concerning Safety Recommendations A-94-203 and -204, the FAA stated:

The Federal Aviation Reauthorization Act of 1996 provides requirements for the Federal Aviation Administration (FAA) to issue airport operating certificates for airports that (1) serve an air carrier operating aircraft designed for at least 31 passenger seats, (2) are not located in the State of Alaska and serve any scheduled passenger operation of an air carrier operating aircraft designed for more than 9 passenger seats but less than 31 passenger seats, and (3) the Administrator determines a certificate is required. The Aviation Rulemaking Advisory Committee (ARAC) developed recommendations on what requirements should be applicable to the certification of airports that serve scheduled air carrier aircraft with 10 to 30 seats. The FAA is preparing a notice of proposed rulemaking to revise 14 CFR Part 139. The FAA proposal will include a revision to 14 CFR Part 121 to reflect the revisions to 14 CFR Part 139.

In February 1997, an Aviation Rulemaking Advisory Committee (ARAC) addressed the issue of establishing standards for smaller, currently noncertificated airports that receive commuter airline service in aircraft having 10 or more seats. It recommended the following, in part, to the FAA:³³

more emphasis on education directed at accident prevention rather than accident mitigation and upon developing a comprehensive plan for responding to an emergency and for ensuring airfield safety. The Working Group majority clearly feels that the limited funds available to these small airports would be better spent on accident prevention rather than on accident mitigation.

³³ARAC Executive Summary, dated December 30, 1996.

A minority position was taken by the Air Line Pilots Association members of the group, mostly with regard to [advocating] ARFF equipment and personnel available on or adjacent [to] the airport in order to meet a 3-minute response time.

The FAA is currently reviewing the ARAC recommendations, and the Safety Board is currently reviewing the FAA's letter of May 6, 1997. The Safety Board has not received any communication from the FAA concerning its intentions with regard to certification of airports serving smaller air carrier aircraft.

In December 1996, the FAA reported that at that time 70 airports in the contiguous states, 150 airports in Alaska, 2 in American Samoa, and 2 in Hawaii were not certificated under Title 14 CFR Part 139 but were served by commuter airlines.

1.16 Tests and Research

1.16.1 Takeoff Distance and Accelerate and Stop Distance for King Air A90

Based on the weather at the time of the accident and the estimated weight of the King Air A90 (8,117 pounds), and manufacturer's airplane performance data, the normal takeoff distance³⁴ for the airplane was calculated to be about 1,500 feet. The King Air's main gear tires left 260 feet of scuff marks (consistent with hard turning) immediately preceding the impact point at the intersection. Assuming, as reported by the Cherokee pilot, that the King Air was positioned on runway 04 so that enough clearance remained behind him for the Cherokee to have access to runway 36, the distance from the King Air to the intersection of runway 04 and 13 was approximately 1,900 feet.

1.16.2 Visibility Tests and Study

Safety Board investigators performed tests at the accident site to determine the line of sight visibility and conspicuity of the Beech 1900C in sunset/dusk conditions. The Safety Board also conducted a photographic visibility study to determine the locations of the airplanes as they would have appeared in the pilots' fields of vision.

1.16.2.1 Conspicuity/Visibility Tests

On November 22, 1996, between 1637 and 1708, at dusk in weather conditions similar to those at the time of the accident, and with the sunset behind them, two investigators positioned themselves in an airport service truck in the runup area at the approach end of runway 04 facing the direction of the King Air's takeoff roll. At 1648, they observed an airplane (a King

³⁴A normal takeoff is defined as one using takeoff power, flaps up, and a level, dry surface. The normal takeoff procedure is to accelerate with both engines at takeoff power to 101 knots CAS, take off, retract the landing gear, and climb at 101 knots CAS. Takeoff distance is defined as that necessary to clear a 50-foot obstacle.

Air C90) fly overhead, make a downwind entry, and land on runway 13. The strobe and landing lights of the airplane were observed to be conspicuous during the sequence, and there were no obstructions to visibility. At 1645, they observed another airplane (a Cessna Conquest) and, at 1653, another (a Dassault Falcon) taxi out and take off on runway 13. The strobe lights of both these airplanes appeared to be conspicuous during taxi, and the strobe and landing lights appeared to be conspicuous during takeoff. No obstructions to visibility were observed.

Additional visibility tests involving a Beech 1900 were conducted on November 22, 1996, between 1800 and 1930. The Beech 1900, carrying two test pilots and an investigator seated in the jumpseat, took off, performed a left pattern, and landed on runway 13, while another investigator observed from the left seat of a King Air B90 positioned on runway 04 in the approximate takeoff position of the accident airplane. During the Beech 1900's landing sequence on final approach and touchdown, the investigator in the King Air observed obstructions to his direct view of the Beech 1900 caused by the rear side window post in the King Air for most of the landing sequence on short final. In a second and third test, an investigator observer sat in the right seat (second test) and then in the left seat (third test) of the King Air B90, which was positioned about 100 feet forward of its previous position on the runway, and a test pilot sat in the remaining seat. When the Beech 1900 was about 200 feet agl on final approach, the test pilot began a fast taxi along the runway toward the accident site. In both tests, the Beech 1900 appeared close to the King Air captain's forward window post. No surface obstructions to visibility were observed in either test.

1.16.2.2 Photographic Visibility Study

Photographs provided by the manufacturer representing the view from within the cockpits of both aircraft are shown as figures 6 through 9. Two superimposed photographs represent the visual image for each eye and show the aircraft windshield visibility angles. The camera used for these photographs is located at the captain's³⁵ cockpit eye zero reference point, and the photographs are a panorama of what the pilot would see as the head was rotated. The photographs do not account for any movement of the torso, or head movement forward, backward, up or down. Because the cockpit is symmetrical, the captain's view of the first officer's side window is the same as the first officer's side view of the captain's side window, but on opposite sides of their respective fields of view.

As shown in figure 6, the Safety Board's study using its VIZPC computer program indicated that the view of the King Air from the Beech 1900C captain's position would have been partially obstructed by the center post and windshield wipers during the airplane's final approach and would have been totally obscured by the center post for 6 seconds, starting about 17:00:43. Approximately 10 seconds before touchdown,³⁶ at 1700:49, until the time of the

³⁵For the purposes of this study, the captain's eye position refers to the view from the left seat position, and the first officer's eye position refers to the view from the right seat position.

³⁶Although a precise touchdown point and impact speed could not be determined, a touchdown at 1,000 feet, with typical braking for 5.5 seconds and hard skidding braking for 4.5 seconds.

collision, the captain would have had a partially obscured view of the King Air through the first officer's front windshield.

As shown in figure 7, the view from the Beech 1900C first officer's position would have been partially obstructed by the first officer's side posts for nearly 30 seconds before touchdown until impact, including 6 seconds starting at 17:00:42 when the first officer's view of the King Air would have been totally obstructed by the front windshield side post.

The VIZPC study also indicates that while the King Air was stationary near the end of runway 04, the left seat occupant's³⁷ view of the Beech 1900C would have been unobstructed at nearly 72° to the left, as viewed through the side window of the King Air. (See figure 8). About 17:00:40, 4 seconds before the King Air began its takeoff roll, the view of the Beech 1900C from the left seat occupant's position would have become partially obstructed at nearly 68° to the left, and fully obstructed at 17:00:54, about 55° to the left, when the King Air would have been accelerating during the roll; this time is immediately before the touchdown of the Beech 1900C. The view of the Beech 1900C from the left seat occupant's position would have been fully obstructed from 17:00:54 until impact at 17:01:09, except for 2 seconds at 17:01:02 when the view would have been partially obstructed.

As shown in figure 9, the King Air right seat occupant's view of the Beech 1900C would have been partially obstructed by the left seat occupant's side posts until just before the start of the King Air's takeoff roll. At 17:00:39, the Beech 1900C would have emerged into clear view in the left front windshield. It was noted that when the right seat occupant's view would have been obstructed, the left seat occupant's view would have been clear, and vice versa. At the start of engine throttle back by the King Air pilot, the Beech 1900C would have been about 50° to the left of the King Air. This position would have been fully obstructed from the King Air left seat occupant's position, but in clear view from the right seat occupant's position.

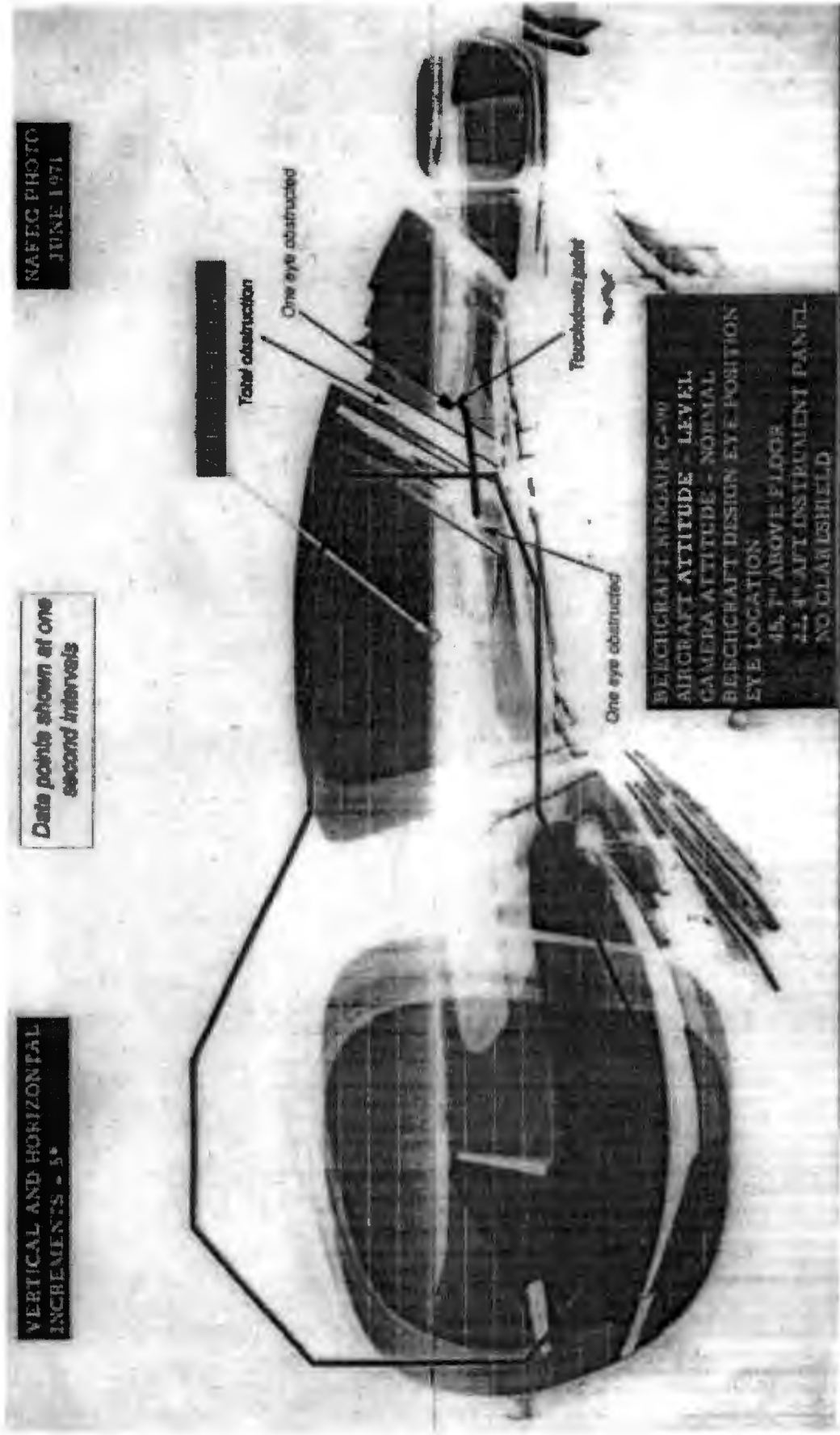
1.17 Organizational and Management Information

1.17.1 Great Lakes Aviation, Ltd.

Founded in 1977, Great Lakes Aviation is a regional airline that holds a commuter air carrier operating certificate issued by the FAA under 14 CFR Part 135. It operates under the following marketing identities: United Express, under a cooperative marketing agreement with United Airlines, Inc.; Midway Connection, under a cooperative marketing agreement with Midway Airlines, Inc.; Great Lakes Airlines; and Arizona Airways Express.

consistent with the CVR recording, could result in the collision occurring where it did, with residual speed and sufficient momentum to carry the airplane to its final resting point.

³⁷Traditionally, the flying pilot would be in the left seat and the passenger in the right seat. However, because the bodies of the King Air pilot and pilot/passenger were found out of their seats, the Safety Board was unable to determine which seats the pilot and pilot/passenger occupied.



NAFEC PHOTO
JUNE 1971

Data points shown at one
second intervals

Total obstruction

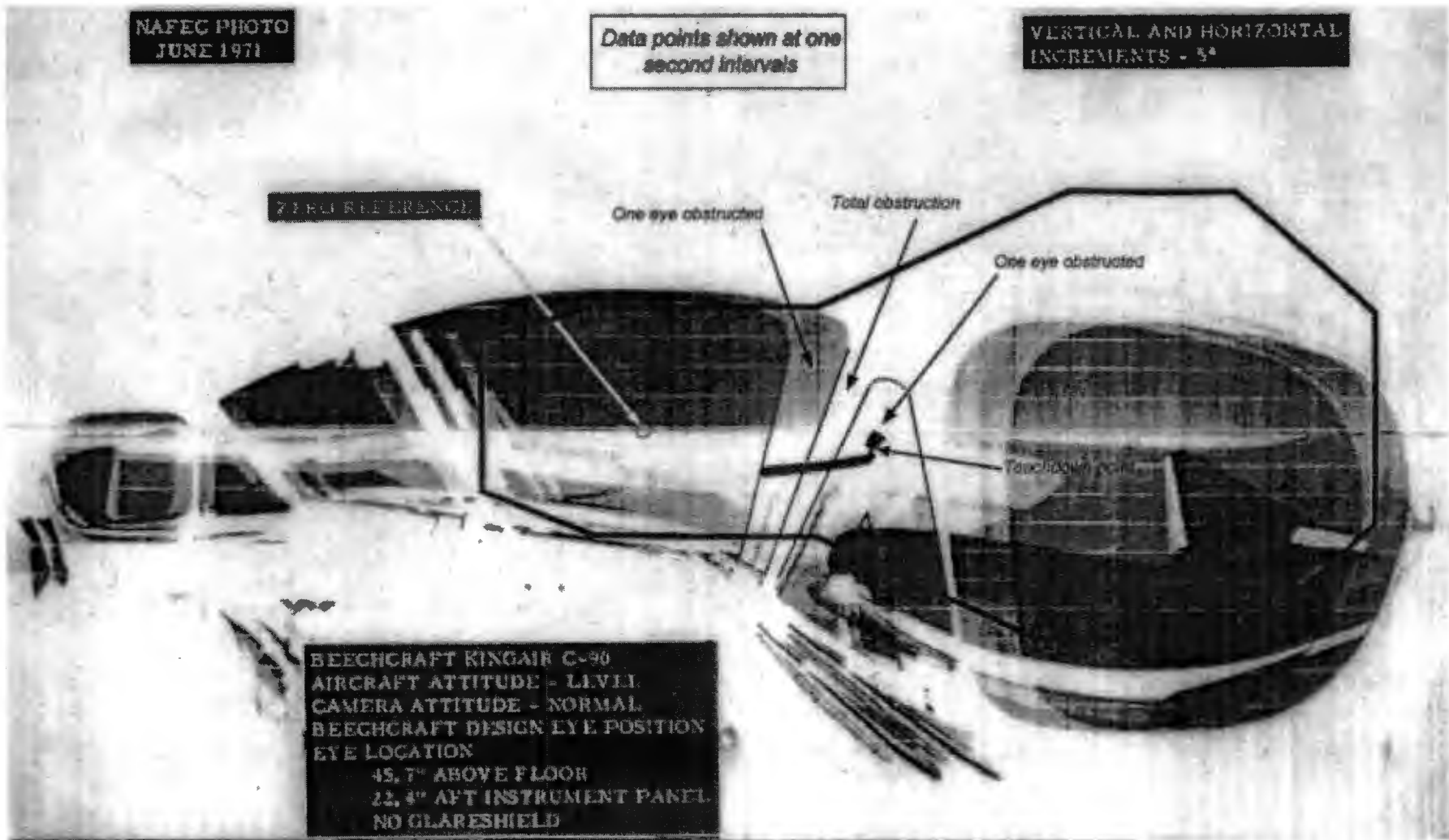
One eye obstructed

One eye obstructed

Touchdown point

BEECHCRAFT KINGAIR C-90
 AIRCRAFT ATTITUDE - LEVEL
 CAMERA ATTITUDE - NORMAL
 BEECHCRAFT DESIGN EYE POSITION
 EYE LOCATION
 45. 3" ABOVE FLOOR
 42. 3" AFT INSTRUMENT PANEL
 NO GLARISHIELD

Figure 6.—Beech 1900C captain's view of King Air.



NAFEC PHOTO
JUNE 1971

Data points shown at one
second intervals

VERTICAL AND HORIZONTAL
INCREMENTS - 5°

ZERO REFERENCE

One eye obstructed

Total obstruction

One eye obstructed

Touchdown point

BEECHCRAFT KINGAIR C-90
AIRCRAFT ATTITUDE - LEVEL
CAMERA ATTITUDE - NORMAL
BEECHCRAFT DESIGN EYE POSITION
EYE LOCATION
45, 7" ABOVE FLOOR
22, 4" AFT INSTRUMENT PANEL
NO GLARESHIELD

Figure 7.—Beech 1900C first officer's view of King Air.

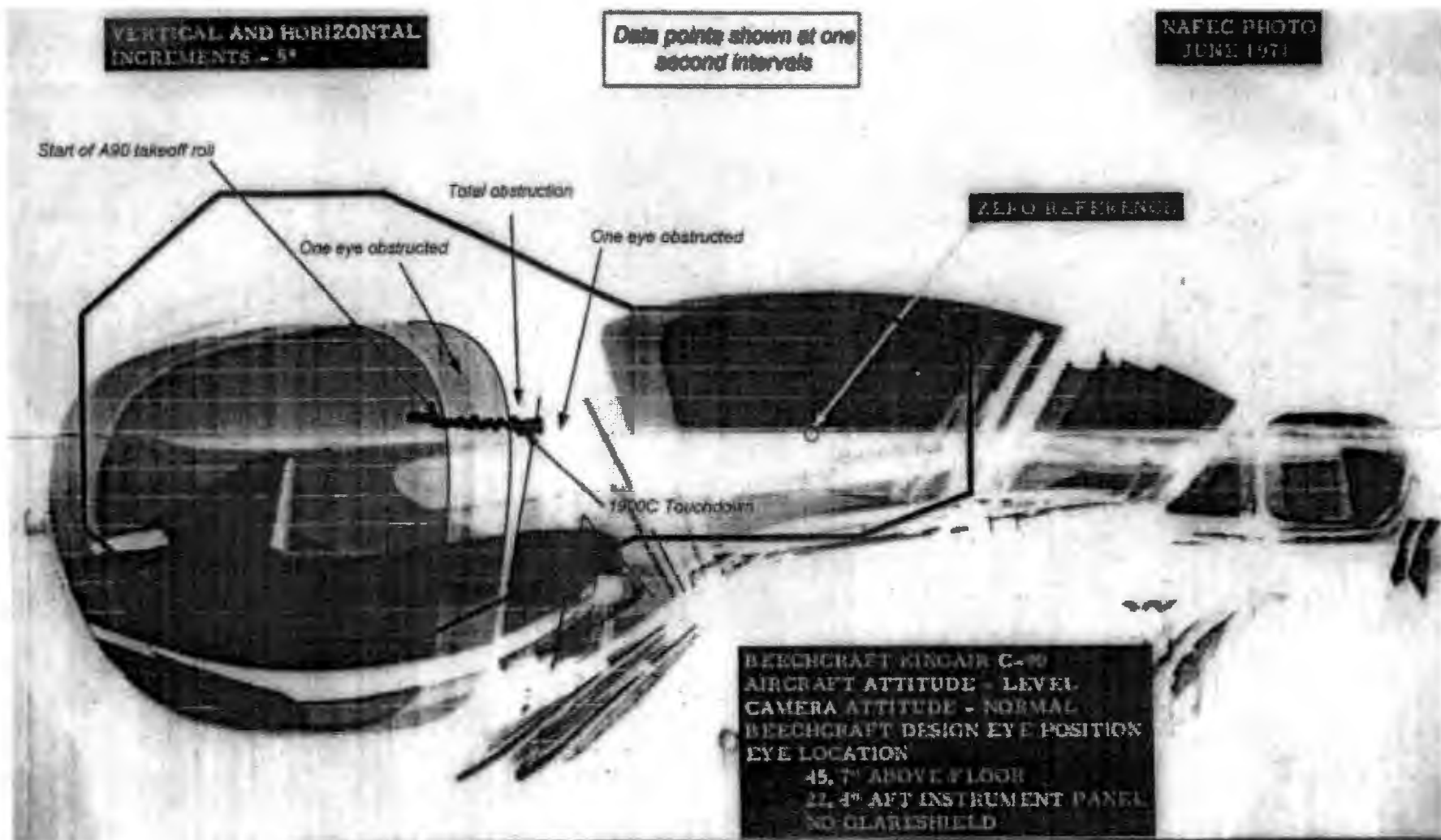
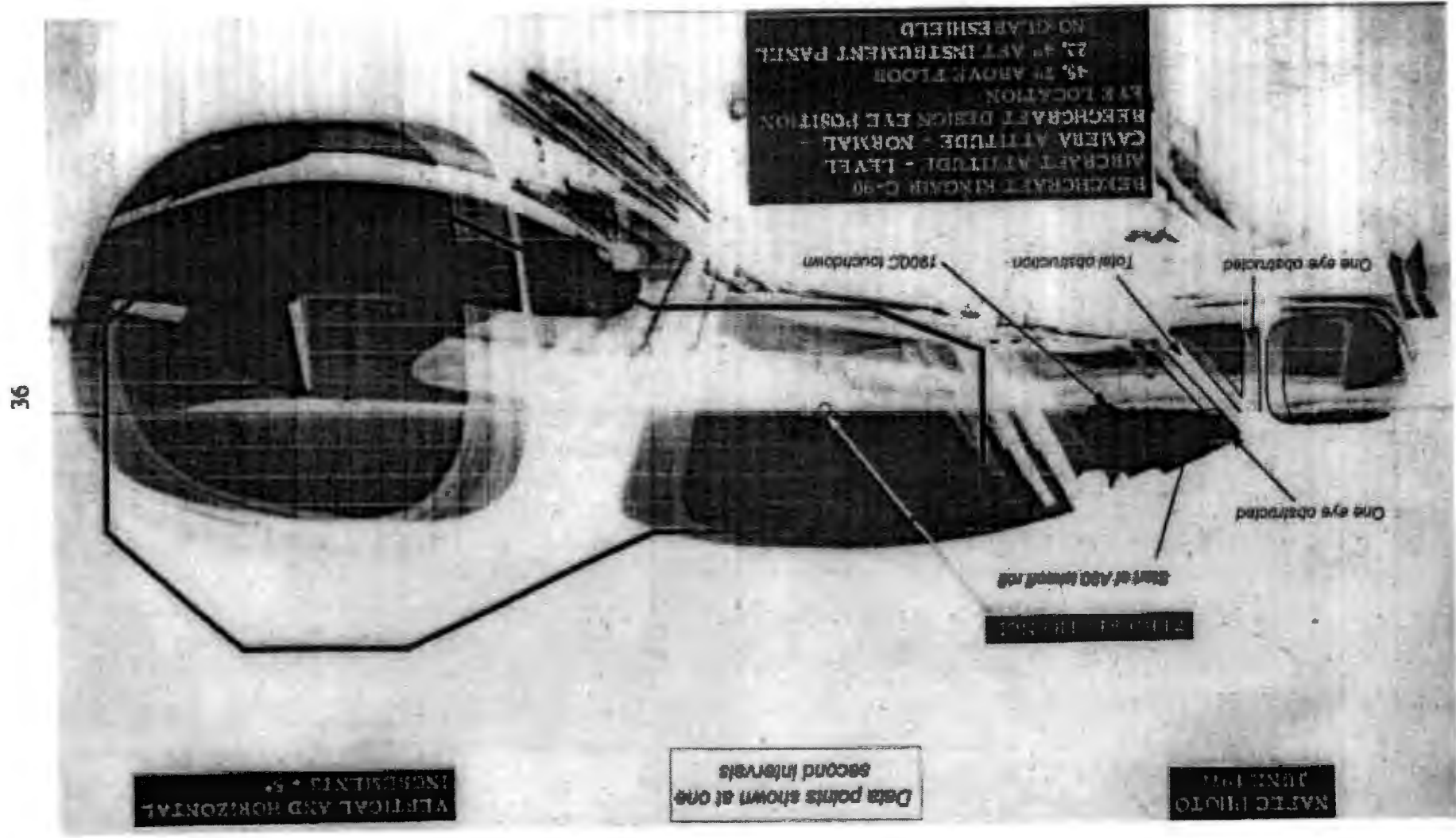


Figure 8.—King Air left seat occupant's view of Beech 1900C.

Figure 9.—King Air right seat occupant's view of Beech 1900C.



At the time of the accident, the company employed more than 1,200 employees, including 382 pilots. According to company documents, the airline operated a combined fleet of 44 Beechcraft 1900s and 12 Embraer EMB-120s and provided scheduled service to 87 destinations in 20 states and Mexico.

Crew resource management (CRM) training consisted of an initial 12 hours for newly hired pilots and 2 hours for recurrent CRM training. The company reported that traffic pattern procedures for uncontrolled airports are reviewed during both initial and recurrent training.

The FAA principal operations inspector for Great Lakes stated that her relationship with the company was good and that she was unaware of any complaints by pilots. She stated that a National Aviation Safety Inspection Program review of the company was conducted in June 1995 and that there were no major findings. She noted that when she had conducted type rating check rides en route to Quincy, company pilots had used appropriate calls and procedures for landing, and that the carrier served a high number of uncontrolled airports. She stated that she had personally observed a recurrent training class that addressed the issues of uncontrolled airports and procedures.

Great Lakes Aviation voluntarily suspended flight operations on May 16, 1997, after the FAA identified discrepancies in the airline's maintenance operations. According to the FAA, the suspension was unrelated to this accident. On June 23, 1997, the company resumed limited service; and, according to the FAA, as of July 1, 1997, it was operating 18 of its airplanes on 18 routes into 26 cities.

1.18 Additional Information

1.18.1 Operating Procedures at Uncontrolled Airports

Guidance Regarding Radio Communications

Paragraph 4-1-9, a. 1., of the Aeronautical Information Manual (AIM) states the following:

There is no substitute for alertness while in the vicinity of an [uncontrolled] airport. It is essential that pilots be alert and look for other traffic and exchange traffic information when approaching or departing an airport without an operating control tower. This is of particular importance since other aircraft may not have communication capability or, in some cases, pilots may not communicate their presence or intentions when operating into or out of such airports. To achieve the greatest degree of safety, it is essential that all radio-equipped aircraft transmit/receive on a common frequency identified for the purpose of airport advisories.

Paragraph 4-1-9, c. 1., of the AIM, also states that at uncontrolled airports:

[p]ilots of inbound traffic should monitor and communicate as appropriate on the designated CTAF from 10 miles to landing. Pilots of departing aircraft should monitor/communicate on the appropriate frequency from start-up, during taxi, and until 10 miles from the airport unless the FARs or local procedures require otherwise.

Table 4-1-1 of the AIM, "Summary of Recommended Communication Procedures," specifies the following recommended broadcasts:

for outbound aircraft - before taxiing, and before taxiing on the runway for departure;

for inbound aircraft - 10 miles out, entering downwind, base, final, and leaving the runway.

In addition, the AIM provides general guidance regarding proper radio communication phraseology and techniques. Paragraph 4-2-4, "Aircraft Call Signs," states, "[c]ivil aircraft pilots should state the aircraft type, model or manufacturer's name followed by the digits/letters of the registration number. When the aircraft manufacturer's name or model is stated, the prefix "N" is dropped; e.g., Aztec Two Four Six Four Alpha."

Guidance Regarding Traffic Patterns

AC 90-66A, "Recommended Standard Traffic Patterns and Practices for Aeronautical Operations at Airports Without Operating Control Towers," describes regulatory requirements and recommended operating procedures at airports without control towers.

AC 90-66A states the following, in part:

7. General Operating Practices.

b. The use of any traffic pattern procedure does not alter the responsibility of each pilot to see and avoid other aircraft. Pilots are encouraged to participate in "Operation Lights On," which is a voluntary pilot safety program described in the AIM designed to enhance the "see and avoid" requirement.

e. The FAA encourages pilots to use the standard traffic pattern. However, for those pilots who choose to execute a straight-in approach, maneuvering for and execution of the approach should be completed so as not to disrupt the flow of arriving and departing traffic. Therefore, pilots operating in the traffic pattern should be alert at all times to aircraft executing straight-in approaches.

In addition, Title 14, CFR Part 91, Subpart B - Flight Rules, section 91.113, states the following, in part:

91.113 Right-of-way rules: Except water operations.

(b) General. When weather conditions permit, regardless of whether an operation is conducted under instrument flight rules or visual flight rules, vigilance shall be maintained by each person operating an aircraft so as to see and avoid other aircraft....

(g) Landing. Aircraft, while on final approach to land or while landing, have the right-of-way over other aircraft in flight or operating on the surface....

Guidance Regarding Scanning for Other Traffic

AC 90-48C, "Pilots' Role in Collision Avoidance," describes how to scan for traffic and states the following, in part:

Pilots are reminded of the requirement to move one's head in order to search around the physical obstructions, such as door and window posts. The doorpost can cover a considerable amount of sky, but a small head movement may uncover an area which might be concealing a threat....

Prior to taxiing onto a runway or landing area for takeoff, scan the approach areas for possible landing traffic by maneuvering the aircraft to provide a clear view of such areas....

AC 90-42F, "Traffic Advisory Practices at Airports Without Operating Control Towers," contains the same guidance provided in the AIM and states, in part, "Departing aircraft should always be alert for arrival aircraft that are [coming from the] opposite direction."

As a result of this accident and at the request of the FAA, which asked for help in reinforcing pilot education, the Air Safety Foundation of the Aircraft Owners and Pilots Association distributed a poster to more than 5,000 FBOs and flight schools about uncontrolled airport operations. The poster includes the message, "Don't let a collision ruin your day—REACT." REACT is an acronym for Radio, Eyes, Announce, Courtesy, and Traffic pattern. The poster also includes this list:

- Radio - Listen for traffic and form a mental picture of the position and movement of all aircraft;
- Eyes - Look for all traffic—including no-radio aircraft—and turn on landing lights when within 10 miles of the airport to make it easier to be seen;

- Announce - Broadcast position on taking the active runway and on pattern entry, crosswind, downwind, base, and final;
- Courtesy - Be courteous in the pattern. Discuss conflicts on the ground, not on the radio;
- Traffic Pattern - Fly a standard traffic pattern at the recommended altitude.

In addition, the Foundation published a “Safety Advisor” booklet on uncontrolled airport operations, is providing more information at Flight Instructor Refresher Clinics, and has published the pamphlet “Pilot Operations at Nontowered Airports” and other safety articles on the Internet (<http://www.aopa.org>).³⁸

1.18.2 Previous Safety Board Recommendation on Scanning Techniques

In its report adopted on September 13, 1993, concerning the midair collision of a Mitsubishi MU-2B-60 and a Piper PA-32-301 in Greenwood, Indiana, on September 11, 1992,³⁹ the Safety Board issued Safety Recommendation A-93-130, which asked the FAA to do the following:

Inform flight instructors about the necessity for emphasizing scanning techniques during training and biennial flight reviews.

On January 24, 1994, the FAA responded to the Safety Board stating that scanning techniques would be emphasized in the FAA’s flight instructor refresher clinics and designated pilot examiner standardization courses. On April 1, 1994, the Safety Board classified Safety Recommendation A-93-130 “Closed—Acceptable Action.”

1.18.3 Postaccident Actions by the FAA

As a result of this accident, the FAA prepared a report, dated January 3, 1997, entitled “Comparison of Accidents and Incidents Between Towered and Nontowered Airports.” The report, which evaluated accidents involving at least one Part 121 or scheduled Part 135 operation at airports receiving commercial airline service, found that for the years between 1983 and 1996, the number of airport accidents (occurring within a 5 mile radius of the airport) declined for both types of airports. Also, using the same timeframe, the accident rate per 100,000 operations for towered airports indicated a downward trend. The report stated that an accident

³⁸For more detailed information on AOPA’s actions since the accident, see the February 1997 issue of *AOPA Pilot*.

³⁹See Aircraft Accident Report, “Midair Collision, Mitsubishi MU-2B-60, N74FB, and Piper PA-32-301, N82419, Greenwood Municipal Airport, Greenwood, Indiana, September 11, 1992” (NTSB/AAR-93/05)

rate for nontowered airports was not calculated because “activity data for nontowered airports are unreliable.”

According to the report:

Accidents involving high-speed runway collisions in which at least one of the aircraft were engaged in commercial service are extremely rare events. Only two such accidents occurred during the last five full year period, and those accidents occurred at airports with an operating tower. The data does not indicate that the recommended practices, procedures and services currently being used to prevent aircraft collisions in the airport environment are systematically inadequate.

In addition, on December 2, 1996, the FAA issued a letter to all pilots referring to this accident. The letter encouraged pilots to review the AIM relating to operations at uncontrolled airports and cited the three ACs discussed in section 1.18.1. The letter also stated the following, in part:

As pilots you have been trained to “see and avoid,” and there is no need to remind you of that duty. We need to take stock of our traffic scanning and radio communications techniques, particularly when operating at nontowered airports. Transmitting on UNICOM or on the Common Traffic Advisory Frequency while operating at nontowered airports—particularly during busy periods of operation or during early morning or dusk—can mean the difference between a safe operation and an accident or incident. For aircraft without radios, of course, a pilot’s scanning technique at nontowered airports is a necessity and his or her best insurance against involvement in a collision on the ground or in the air.

2. ANALYSIS

2.1 General

The pilots of flight 5925 were properly certificated, trained, and qualified for their duties in accordance with 14 CFR Parts 61 and 135 and company requirements.

The pilot of the King Air was properly certificated under 14 CFR Part 61.

The Beech 1900C was equipped and maintained in accordance with applicable rules and directives.

No records were found to indicate that the King Air had undergone the required transponder and pitot static inspections within the past 2 years. Other than this possible maintenance deficiency, which was not a factor in the accident, the King Air was maintained in accordance with applicable rules and directives.

Weather was not a factor in the accident.

2.2 United Express Flightcrew Performance

The Safety Board analyzed the flightcrew's use of a straight-in approach to runway 13, radio communications, and post-touchdown actions, to determine whether they were factors in the accident.

The flightcrew of flight 5925 made a straight-in approach, rather than using the standard traffic pattern as recommended in AC 90-66A and the AIM for uncontrolled airports. Although the FAA encourages pilots to use the standard traffic pattern, it recognizes in AC 90-66A that some pilots may choose to execute a straight-in approach, and therefore urges all pilots operating in the pattern to be alert to such approaches.

Although the wind direction and speed did not favor the use of either runway in this case, the flightcrew of 5925 probably chose the straight-in approach to runway 13 rather than a downwind or base leg entry to runway 04 to save time because they had been delayed previously and because it was easier to accomplish than maneuvering in a pattern.

The Beech 1900C was visible to other airport traffic during its approach. Witnesses, including the occupants of the Cherokee taxiing behind the King Air, said that they could see the airplane and that it had its landing lights on. Further, the Beech 1900C flightcrew discussed the fact that two airplanes were planning to take off on runway 04, and they had an alternate plan to use runway 04 if necessary. The captain's request at 10 miles out for other traffic to "please advise" gave them sufficient time to revert to this alternate plan if needed. The pilots observed when the King Air entered runway 04, and later attempted to ensure that runway 13 would remain clear for their landing by asking whether the airplane on the runway (i.e., the King Air) intended to hold or take off.

The Safety Board concludes that given the Beech 1900 flightcrew's frequent radio broadcasts of the airplane's position during the approach, and the lack of any prohibition on straight-in approaches to uncontrolled airports, the flightcrew's decision to fly a straight-in approach to runway 13 was not inappropriate.

The flightcrew made radio transmissions about 30 miles out, at 1652:07, ("any traffic in the area please advise"); 10 miles out, at 1656:56, ("we'll be inbound to enter on a left base for runway one three at Quincy any other traffic please advise"); 5 miles out, at 1659:29, ("just about to turn, about a six mile final for runway...one three, more like a five mile final for runway one three at Quincy;"); and on short final, at 1700:16, ("aircraft gonna hold in position on runway four or you guys gonna take off?") Although these callouts did not exactly match those recommended in the AIM and AC 90-42F, they were appropriate for the straight-in approach being flown.⁴⁰ Even though under 14 CFR Part 91.113, flight 5925, as a landing aircraft, had the right of way over aircraft on the surface, the captain took the precaution of asking whether the airplane on the runway was going to hold or take off. It would have been prudent for the captain to refer specifically to the "King Air," to leave no doubt about which airplane she was addressing; however, her transmission was sufficiently specific that she could reasonably expect to be understood.

The Cherokee pilot's transmission, at 1700:28, ("seven six four six Juliet uh, holding uh, for departure on runway four....* on the uh, King Air") immediately followed the captain's inquiry, and appeared to be in response to her question. The transmission was interrupted by the GPWS alarm in the Beech 1900C. Although it would have been prudent for the captain to ask that the transmission be repeated, her reply, at 1700:37, ("OK, we'll get through your intersection in just a second sir * we appreciate that") made it clear that she believed she was communicating with the airplane that was to take off next on the runway, and it would have been reasonable for her to expect a clarification if that was not the case.

Subtle cues indicated that the transmission did not come from the King Air. Specifically, the speaker gave a different "N" number, and the voice and gender of the speaker were different than heard in previous transmissions from the King Air. However, because the pilots were most likely preoccupied with landing the airplane, and because the speaker said "King Air" but did not say "Cherokee" and the pilots had no reason to expect a response from any aircraft other than the King Air, they probably did not notice or focus on those cues. Having received what they believed was an assurance from the airplane on the runway that it was going to hold, the pilots may have become less concerned about continuing to watch the King Air during their landing.

The airplane touched down at 1700:59. The captain was recorded as calling for "Max reverse" at 1701:01; expletives from the flightcrew were also recorded beginning at

⁴⁰Recommended broadcasts in AIM and AC (10 miles out; entering downwind; base; and final) assume the inbound plane is flying a pattern approach. Because flight 5925 was flying a straight-in approach, it did not enter a downwind leg and, therefore, such a call would have been inappropriate.

1701:01, indicating that the flightcrew saw the King Air at that time. Skid marks indicate that they applied maximum braking beginning 3 seconds later until the time of impact at 1701:09.

The Safety Board concludes that the flightcrew of flight 5925 made appropriate efforts to coordinate the approach and landing through radio communications and visual monitoring; however, they mistook the Cherokee pilot's transmission (that he was holding for departure on runway 04) as a response from the King Air to their request for the King Air's intentions, and therefore mistakenly believed that the King Air was not planning to take off until after flight 5925 had cleared the runway.

2.3 King Air Pilot and Pilot/Passenger Performance

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 ATP 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,⁴¹ suggesting that they may have been preoccupied with instructional activities inside the cockpit.

Although he had been sitting on runway 04 for about 1 minute, the King Air pilot began the takeoff without making a takeoff announcement over the CTAF.⁴² Because of the delay between the announcement from the King Air that the King Air was taking the runway and the commencement of its takeoff roll, an additional takeoff announcement would have been

⁴¹Witnesses said they heard the King Air throttle back just before the collision.

⁴²A pilot inside the FBO stated that shortly before the accident, he thought he heard a male pilot transmitting at the same time as a female pilot, timed so that the female pilot would not have known her transmission had been "stepped on." The Safety Board considered whether this could indicate that the King Air pilot made a takeoff announcement simultaneously with the Beech 1900C captain's request (at 1700:16) for the intentions of the airplane holding on runway 04, and that the announcement was therefore not recorded on the Beech 1900C's CVR. However, this potential scenario was contradicted by the recollections of an employee of the FBO who also heard the CTAF transmissions. The employee remembered the entire content of the Beech 1900C captain's transmission, which indicates it was not overridden by another transmission. Further, the Cherokee pilot stated that all the transmissions from both the Beech 1900C and the King Air were in female voices. Therefore, it is likely that the pilot was mistaken in his belief that he heard a "stepped on" transmission.

prudent, and would have been consistent with common and expected practice at uncontrolled airports. Such an announcement would have afforded the Beech 1900C flightcrew the opportunity to take evasive action. Because no pilot would take off knowing that another airplane was about to land on an intersecting runway, the occupants of the King Air must have been unaware at the time they began their takeoff roll that an airplane was about to land. The Safety Board concludes that the failure of the King Air pilot to announce over the CTAF his intention to take off created a potential for a collision between the two airplanes.

Had the occupants of the King Air been monitoring the CTAF, they should have heard the four announcements from flight 5925 indicating that the airplane was inbound to Quincy and was planning to land on runway 13. Also, they would most likely have answered the question that was directed at them, or corrected the misunderstanding resulting from the Cherokee pilot's transmission. Therefore, the Safety Board concludes that the occupants of the King Air did not hear the transmissions from flight 5925 on the CTAF.

The Safety Board considered whether their failure to hear the transmissions made over the CTAF could have been a result of mechanical radio problems. On the previous flight, Tulsa ground control indicated a problem receiving outgoing transmissions from the airplane. Although a passenger recalled the pilots exchanging headsets, indicating that one of the headsets might have had some trouble receiving incoming transmissions, subsequent communications with the Kansas City ARTCC did not indicate that the pilot of the King Air, who was then handling the radios, had any trouble receiving incoming transmissions. The Safety Board could not determine from the wreckage whether the radio equipment was working properly. However, problems with outgoing transmissions would not have affected the occupants' ability to hear incoming transmissions over the CTAF. And if there had been previous problems with incoming transmissions, they apparently affected only one of the headsets and would not have prevented both occupants from hearing incoming transmissions on the CTAF.

The Safety Board also considered whether the occupants might have unintentionally set the radio controls so they could transmit but not receive over the CTAF; or that they might have tuned the receiver to a different frequency (such as the first anticipated air traffic control frequency), or turned the volume down. However, because of the extensive fire damage, the settings on the radios at the time of the accident could not be determined.

The Safety Board concludes 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.

Witnesses 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.

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 the CTAF, 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 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 TWA pilot, the pilot 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.

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.

2.4 Cherokee Pilot Performance

The Cherokee pilot had accumulated only 80 hours of flight time, and his radio communications reflected his inexperience. In his first communication, a taxi announcement at 1655:40, “Quincy traffic, Cherokee seven six four six Juliet back-taxi uh, taxiing to runway four, Quincy,” he used the term “back-taxi” inappropriately. The term refers to taxiing on a runway opposite the traffic flow. Further, at 1700:16, he responded to the transmission from the captain of flight 5925, which was clearly not directed at his airplane. He then failed to correct the resulting misunderstanding.

The Cherokee pilot’s response to flight 5925’s question (directed to the airplane “in position on runway four”) was unnecessary and inappropriate because he was not the first in line for takeoff. If he did not understand the transmission and thought a pilot from the King Air was talking to him,⁴³ which they would have had no apparent reason to do, he should have asked for clarification before answering. In any event, even if the Cherokee pilot did not know he was responding to the Beech 1900C flightcrew’s request, he should have realized that his transmission could be misinterpreted or could create confusion.

In addition, the Cherokee pilot’s transmission created the potential for confusion and misunderstanding because he failed to precede his N number with his airplane model (“Cherokee”), as recommended in the AIM. He should have been alerted by flight 5925’s response that such a misunderstanding had occurred. But he then reinforced the misunderstanding by not correcting it.

The Safety Board concludes that the Cherokee pilot’s transmission in response to flight 5925’s request was unnecessary and inappropriate and, combined with the lack of any correction to the flightcrew’s misunderstanding, misled the flightcrew into believing that it had been communicating with the King Air, and that the King Air would continue holding.

⁴³After the accident, the Cherokee pilot claimed that he responded to a transmission because he thought the King Air pilot was talking to him. However, because the Cherokee pilot’s recollection was not consistent with the sequence of events as recorded on the Beech 1900’s CVR, it was not clear whether this explanation related to his transmission following flight 5925’s question, or his earlier broadcast at 1655:40 (“Quincy traffic, Cherokee seven six four six Juliet back-taxi uh, taxiing to runway four, Quincy”), which followed the King Air’s broadcast that he was taxiing to runway four.

Both the Cherokee pilot and the passenger saw the two airplanes converging. The Cherokee pilot had the opportunity to alert the pilots in the Beech 1900C to the situation, and it would have been prudent for him to do so. It should have been apparent from the Beech 1900C's approach path, which would have been about a 90-degree angle to runway 04, that the runways intersected. Nonetheless, the Cherokee pilot stated that he did not realize the runways intersected. The Cherokee passenger said that he thought the airplanes would miss each other. The Safety Board concludes that because of the Cherokee pilot's inexperience, he probably did not realize that a collision between the two airplanes was imminent, and therefore he did not broadcast a warning.

2.5 Survival Aspects

The autopsy reports revealed that the occupants of both airplanes died of carbon monoxide intoxication from the inhalation of smoke and soot from the postimpact fire or inhalation of products of combustion. They did not sustain blunt force trauma injuries that would have impeded their mobility or ability to evacuate.

The bodies of the King Air's occupants were found behind the seats in the cockpit, indicating that they were overcome by the effects of the fire before reaching an exit.

Witnesses who ran to the scene immediately after the collision stated that they heard sounds of life from within the cabin of the Beech 1900C and that the captain talked to them from the cockpit.

Because Great Lakes Aviation was unable to provide the Safety Board with a record of passenger seat assignments, the Safety Board was unable to determine the distance or direction that the passengers on the Beech 1900C moved from their seats toward an exit. The Safety Board could not determine the time that was available for the occupants of that airplane to have escaped in the presence of the smoke and soot of the fire.

The body of flight 5925's first officer was found between the air stair door and the forward right overwing exit. The exterior air stair door handle was in the unlocked position when the first people reached the accident scene, suggesting that the first officer followed company evacuation procedures and initially tried to open the air stair door but was unable to do so. Because the right overwing exits were near the fire on the right side of the cabin, he most likely proceeded toward the left overwing exit but was overcome by the effects of the smoke and fire before he could reach it. The rescuers did not observe any smoke coming from the left overwing exit, indicating that it was not opened.

The Safety Board concludes that the impact forces were at a survivable level for the occupants of both airplanes. The Safety Board further concludes that the speed with which the fire enveloped the King Air and the intensity of the fire precluded survivability for the occupants of the King Air; however, the occupants of the Beech 1900C did not escape because the air stair door could not be opened and the left overwing exit hatch was not opened.

2.5.1 Air Stair Door

The FBO pilot 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, 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.

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.

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 under 14 CFR Part 23,⁴⁴ 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.

In addition, 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.

⁴⁴Similar requirements also appear several times in Part 25.

2.5.2 Emergency Response

The Quincy Fire Department was 10 miles away, 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 do the following:

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 concludes that although some communities may lack adequate funds to provide ARFF protection for small airports served by commuter airlines, commuter 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 aircraft rescue and fire fighting capabilities.

3. CONCLUSIONS

3.1 Findings

1. The pilots of flight 5925 were properly certificated, trained, and qualified for their duties in accordance with 14 Code of Federal Regulations Parts 61 and 135 and company requirements.
2. The pilot of the King Air was properly certificated under 14 Code of Federal Regulations Part 61.
3. The Beech 1900C was equipped and maintained in accordance with applicable rules and directives.
4. No records were found to indicate that the King Air had undergone the required transponder and pitot static inspections within the past 2 years. Other than this possible maintenance deficiency, which was not a factor in the accident, the King Air was maintained in accordance with applicable rules and directives.
5. Weather was not a factor in the accident.
6. Given the Beech 1900C flightcrew's frequent radio broadcasts of the airplane's position during the approach, and the lack of any prohibition on straight-in approaches to uncontrolled airports, the flightcrew's decision to fly a straight-in approach to runway 13 was not inappropriate.
7. The flightcrew of flight 5925 made appropriate efforts to coordinate the approach and landing through radio communications and visual monitoring; however, they mistook the Cherokee pilot's transmission (that he was holding for departure on runway 04) as a response from the King Air to their request for the King Air's intentions, and therefore mistakenly believed that the King Air was not planning to take off until after flight 5925 had cleared the runway.
8. The failure of the King Air pilot to announce over the common traffic advisory frequency his intention to take off created a potential for collision between the two airplanes.
9. The occupants of the King Air did not hear the transmissions from flight 5925 on the common traffic advisory frequency; it is likely that either the King Air occupants did not properly configure the radio receiver switches to the common traffic advisory frequency, or that they were preoccupied, distracted, or inattentive.

10. The occupants of the King Air were inattentive to or distracted from their duty to “see and avoid” other traffic.
11. The Cherokee pilot’s transmission in response to flight 5925’s request was unnecessary and inappropriate and, combined with the lack of any correction to the flightcrew’s misunderstanding, misled the flightcrew into believing that it had been communicating with the King Air, and that the King Air would continue holding.
12. Because of the Cherokee pilot’s inexperience, he probably did not realize that a collision between the two airplanes was imminent, and therefore he did not broadcast a warning.
13. The impact forces were at a survivable level for the occupants of both airplanes.
14. The speed with which the fire enveloped the King Air and the intensity of the fire precluded survivability for the occupants of the King Air.
15. The occupants of the Beech 1900C did not escape because the air stair door could not be opened and the left overwing exit hatch was not opened.
16. 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.
17. 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.
18. The FAA’s freedom from jamming certification standards may be inadequate.
19. Formal training for maintenance personnel in specific tasks they are assigned to accomplish is critical for the proper, sustained operation of aircraft.
20. If on-airport aircraft rescue and fire fighting equipment protection had been required for this operation at Quincy Airport, lives might have been saved.
21. Although some communities may lack adequate funds to provide aircraft rescue and fire fighting protection for small airports served by

commuter airlines, commuter airline passengers deserve the same degree of protection from postcrash fires as air carrier passengers on aircraft with more than 30 passenger seats.

3.2 Probable Cause

The National Transportation Safety Board determines 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 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 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 services, and the failure of the air stair door on the Beech 1900C to open.

4. RECOMMENDATIONS

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

--to 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)

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

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

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

James E. Hall
Chairman

Robert T. Francis II
Vice Chairman

John Hammerschmidt
Member

John J. Goglia
Member

George W. Black, Jr.
Member

July 1, 1997

5. APPENDIXES

APPENDIX A—INVESTIGATION AND HEARING

1. Investigation

The National Transportation Safety Board was notified of the accident about 1830 on November 19, 1996. An investigative team was dispatched shortly thereafter, arriving at Quincy early the next morning. Investigative specialists for meteorology, air traffic control, operations, airplane performance, structures, systems, human performance, survival factors, airports and powerplants gathered evidence at the scene for about 1 week. An investigative group for the cockpit voice recorder was also formed in Washington, D. C. Member Black was the Safety Board Member on scene.

Parties to the investigation included the Federal Aviation Administration, Raytheon Aircraft Company, Great Lakes Aviation, Ltd., United Technologies Pratt and Whitney, and the National Air Traffic Controllers Association.

2. Public Hearing

There was no public hearing conducted in conjunction with this investigation.

APPENDIX B—COCKPIT VOICE RECORDER TRANSCRIPT

LEGEND

HOT	Crewmember hot microphone voice or sound source
HOT-M	Aircraft mechanical voice heard on all channels
RDO	Radio transmission from accident aircraft
CAM	Cockpit area microphone voice or sound source
PA	Voice heard over aircraft public address system
PA4	Recorded passenger announcement over aircraft public address system
CTR1	Radio transmission from Chicago center controller
CTR2	Radio transmission from Kansas City center controller
1127D3	Radio transmission from King Air N1127D, male voice
1127D4	Radio transmission from King Air N1127D, female voice
7646J	Radio transmission from Cherokee N7646J
BRLOP	Radio transmission from Burlington operations
QCYOP5	Radio transmission from Quincy operations, female voice
QCYOP6	Radio transmission from Quincy operations, male voice
AWOS	Radio transmission from Quincy Automated Weather Observation System
-B	Sounds heard through both pilot's hot microphone systems
-1	Voice identified as Pilot-in-Command (PIC)
-2	Voice identified as Co-Pilot.
-?	Voice unidentified
*	Unintelligible word
@	Non pertinent word
#	Expletive
- - -	Break in continuity
()	Questionable insertion
[]	Editorial insertion
.....	Pause

Note 1: Times are expressed in central standard time (CST).

Note 2: Words shown with excess vowels, letters, or drawn out syllables are a phonetic representation of the words as spoken.

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

**TIME &
SOURCE**

CONTENT

**TIME &
SOURCE**

CONTENT

**START of RECORDING
START of TRANSCRIPT**

1620:21
CTR-1

Lakes Air two fifty one, right now you are three miles south of BURNS. maintain three thousand till established on the localizer. cleared ILS approach to Burlington airport.

1620:26
CAM

[sound similar to aircraft altitude alert signal]

1620:31
RDO-2

* two fifty one uh, three thousand till established, cleared ILS three six into Burlington.

1620:41
HOT-2

flaps?

1620:42
HOT-1

flaps * indicated takeoff.

1620:45
HOT-2

approach briefing?

1620:46
HOT-1

gonna be, that's complete.

1620:49
HOT-2

performance is one ten twenty five?

1620:51
HOT-1

reviewed.

1620:51
HOT-2

nav radios?

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1620:52 HOT-1	they're set.		
1620:53 HOT-2	** identified, interior lights?		
1620:57 HOT-1	aaare, comin' up.		
1620:59 HOT-2	flaps?		
1621:01 HOT-1	they're, ... takeoff.		
1621:02 CAM	[sound similar to aircraft altitude alert signal]		
1621:03 HOT-2	approach check list?		
1621:04 HOT-1	power back six hundred please.		
1621:05 HOT-1	it's complete.		
1621:12 HOT-1	call 'em established.		
		1621:14 RDO-2	two fifty one's established.
		1621:16 CTR-1	Lakes Air two fifty one roger. report cancellation IFR this frequency. if unable through Ft. Dodge radio. change to advisory is approved.

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1621:23 RDO-2	two fifty one's change to advisory.
		1621:26 RDO-?	[sound similar to someone keying microphone seven times]
1621:31 HOT-1	[sound similar to outer marker beacon signal]		
		1621:36 1127D-3	and Quincy traffic uh, King Air one one two seven Delta on a left base for runway four, Quincy.
1621:43 CAM	[sound similar to aircraft altitude alert signal]		
1621:48 HOT-2	I didn't get any marker beacons.		
1621:51 HOT-1	I got a low one. I think the volume might be way down.		
1621:57 HOT-1	[sound similar to engine ignition]		
1621:58 HOT-2	anyway, we're over the marker.		
1621:59 CAM	[sound similar to aircraft altitude alert signal]		
		1622:03 RDO-2	Burlington area traffic Lakes Air two fifty one is BURNS inbound three six ILS.

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1622:11 HOT-2	landing gear?		
1622:12 HOT-1	down, three green.		
1622:13 HOT-2	verified.		
1622:18 HOT-2	three thousand is the missed approach altitude.		
		1622:33 1127D-5	Quincy traffic, Baron, I mean King Air one one two seven Delta 'bout ready to turn final for runway four, Quincy.
1623:36 HOT-1	approach flaps please.		
1623:37 HOT-2	OK, check selected approach.		
1623:43 HOT-2	indicated approach, approach lights in sight, continue.		
1623:52 HOT-2	runway's in sight.		
1624:10 HOT-1	landing flaps.		
1624:11 HOT-2	speed checks, * to land.		

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1624:15 HOT-2	flaps are landing, yaw dampers off. three in the green. final checks are complete. runway's clear. ref's, one ten.	1624:22 RDO-2	Burlington area traffic, Lakes two fifty one short final three six, Burlington.
1624:36 CAM-3	two hundred.		
1624:42 HOT-2	plus five.		
1624:53 HOT-2	V ref.		
1625:00 CAM	[sound similar to aircraft touching down on runway]		
1625:02 HOT-2	reverse available.		
1625:09 CAM	[sound of increase in engine noise similar to engine reverse power being applied]	1625:53 RDO-2	Burlington area (traffic Lakes) two fifty one down and clear all runways, Burlington.
		1626:02 RDO-2	Chicago center Lakes two fifty one on the ground Burlington, cancel.
		1626:07 CTR-1	Lakes Air two fifty one, cancellation received.

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1626:10 RDO-2	two fifty one uh, we broke out about nine hundred AGL.
		1626:13 CTR-1	nine hundred AGL, thanks.
1626:21 HOT-1	afters please.		
1626:22 HOT-2	* lights are off, flaps up, trim's reset, radar, TCAS transponder standby auto feather's off anti-skid is not installed ice protection boards pressurization is depressurized after landing checklist complete.		
1626:33 HOT-1	OK, thank you. [several non pertinent comments between captain and co-pilot]		
1627:13 PA-2	ladies and gentlemen I'd like to welcome you to the Burlington airport for those of you getting off here in Burlington I'll have the door for you in just a minute call for your departure as you exit please check around your seat make sure you collect all your personal belongings you may have brought on board with you. please watch your head as you exit the exit is a little bit lower on the inside of the cabin. all your baggage will be inside the terminal. once again do apologize for the delay getting you into Burlington this afternoon, but uh, we do hope you have a real nice evening here in Burlington for those of you continuing on to Quincy we do ask that you remain on the aircraft with your seatbelts fastened thanks.		
1627:39 CAM	[sound similar to engines being shut off]		

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1627:45 CAM-1	mine looks clear I think, what about yours?		
1627:48 CAM-2	turn around and look at it I guess.		
1627:49 CAM-1	**.		
1627:49 CAM	[break in CVR recording similar to power being shut off]		

1636:21 CAM-1	avionics off inverters off, mode controllers off blowers are auto condition levers fuel cutoff prop area's been cleared battery voltage checks engine start.		
1636:29 HOT-1	[sound similar to engine ignition]		
1636:52 CAM	[sound similar to engine being started]		
1636:53 CAM	[sound similar to altitude alert signal]		

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1637:15 HOT-1	doors and windows are closed and locked. loads checked. panel lights are as required cabin lights are as required, cabin sign oops, wrong one isn't it. battery's on avionics are off inverters are off mode controllers off blowers are auto I knew which one I knew what I was doing. [sound of chuckle]		
1637:29 HOT-2	oh. [sound of chuckle]		
1637:30 HOT-1	I knew that the engine wasn't started. I just was saying the wrong checklist. [sound of chuckle]		
1637:35 HOT-2 *			
1637:36 HOT-1	Kate your engine's not going..... oh thank you..... battery's on avionics are off inverters are off mode controllers off blowers are auto, condition levers fuel cutoff prop area's been cleared battery voltage checks engine start.		
1637:51 CAM	[twin chime similar to no smoking/seatbelt sign being activated]		
1637:55 HOT-1	[sound similar to engine ignition]		
1637:56 CAM	[sound similar to altitude alert signal]		
1638:12 PA-4	Welcome aboard. Before we begin our flight, we would like to review some important safety features of our Beechcraft 1900 airliner. Please remove the passenger briefing card		

INTRA-COCKPIT COMMUNICATION

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located in the seat pocket in front of you. We suggest that you follow along as we explain the location and operation of the aircraft's safety equipment.

Passengers seated in 4C, 6A or 6C should review the information card explaining exit row seating requirements. If you feel you would be unable to carry out these instructions or wish to be resealed, please notify a crew member.

There are four exits aboard this aircraft. There are three clearly marked overwing exits, two over the right wing and one over the left wing. To open, pull down on the handle and pull the exit inward. The main cabin door through which you entered is also an emergency exit. To open, push the button next to the handle then rotate the handle counter-clockwise and push the door open.

This aircraft has two portable fire extinguishers. One located forward of the right front seat and the other located under the right seat in the cockpit. To operate the extinguisher, unlatch it from its bracket, pull the pin in the handle, point the nozzle at the base of the flames, and then squeeze the handle.

In the unlikely event of a water landing, each seat cushion can be used as a flotation device. Pull the seat cushion out, wrap your arms around the cushion and hold on to the straps.

Federal Aviation regulations require passenger compliance with the lighted passenger information signs and posted placards. Please observe the seat belt and no smoking signs on the overhead panels. To fasten your seatbelt, push the metal tab into the end of the metal buckle, then pull on the belt end to tighten. Release the seatbelt by lighting the buckle tab. For your safety keep seatbelts fastened for the takeoff and landing portions of the flight. Also, set backs and tray tables must be in the upright and

INTRA-COCKPIT COMMUNICATION**AIR-GROUND COMMUNICATION****TIME &
SOURCE****CONTENT****TIME &
SOURCE****CONTENT**

locked position during takeoff and landing. For your safety and comfort we require you to keep your seatbelt fastened for the entire flight.

Smoking is prohibited on this flight.

This aircraft is pressurized for your comfort. If the need for oxygen should arise, pull on the mask and pull over your nose and mouth and breathe normally. If you are traveling with small children, see to your needs first then assist the child. The crew will advise you when it is safe to discontinue use.

For takeoff and landing the Federal Regulations require the proper stowage of carry on baggage. Stow carry-on items under the seat in front of you or in the closet across from the main entrance door. The aisle must remain clear at all times.

Portable radios and electronic devices may interfere with communication and navigation equipment. Please refrain from using such devices during flight.

If anyone is having trouble with their seatbelt, please advise a crew member now. Thank you for your attention. Now we invite you to sit back, relax, and enjoy the flight.

1638:28
HOT-2

..... loads checked panel lights are off cabin lights cabin sign inverters on avionics on mode controllers on auto CVR GPWS checked, pressurization....

1638:36
HOT-B

[sound of tone]

1638:41
HOT-7

glide slope, pull up, pull up.

INTRA-COCKPIT COMMUNICATION**AIR-GROUND COMMUNICATION**

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1638:47 HOT-2	...fuel quantity flight and engine instruments checked, that checklist is complete.		
1638:48 HOT-1	brakes are set, airplane's yours.		
1638:52 HOT-2	umm, taxi checks.		
1638:53 HOT-1	brakes?		
1638:54 HOT-2	released checked.		
1638:55 HOT-1	area.		
1638:55 HOT-2	clear right and behind.		
1638:57 HOT-1	clear left.		
1638:58 HOT-1	passenger brief?		
1638:59 HOT-2	complete.		
1639:00 HOT-1	check list.		
1639:04 HOT-2	complete.		

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1639:10 RDO-1	Burlington area traffic, Lakes Air two fifty one is a Beech airliner taxiing out to runway three six for departure at Burlington.
1639:23 HOT-1	...nunciators?		
1639:25 HOT-2	considered.		
1639:26 HOT-1	engine instruments and loads.		
1639:30 HOT-2	* green and parallel.		
1639:33 HOT-1	flight instruments?		
1639:35 HOT-2	eleven four, thirteen six uh try to get the direct course of a hundred and eighty degrees off three six. three zero zero three for the meter.		
1639:47 HOT-1	and the flaps? oops, sorry auto-feather?		
1639:50 HOT-2	armed.		
1639:51 HOT-1	trim controls?		
1639:52 HOT-2	two zero zero set.		

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1639:54 HOT-1	flaps?		
1639:55 HOT-2	set checked takeoff.		
1639:56 HOT-1	flight controls.		
1639:58 HOT-2	free and correct.		
1640:00 HOT-1	and uh, performance is... seven and fourteen thirty three hundred pounds no other restrictions.		
1640:07 HOT-2	reviewed.		
1640:08 HOT-1	clearance?		
1640:11 HOT-2	we have to get.		
1640:12 HOT-1	and the takeoff departure briefing?		
1640:14 HOT-2	normal standard Great Lakes off three six. problems after V one, we'll try to keep it VFR and bring it back to Burlington if we can't we'll uh, ILS approach back to uh, three six.		
1640:37 HOT-1	ooh. risky.		

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1641:15 HOT-1	don't go missed.		
1641:33 HOT-2	they gotta be training.		
1641:37 HOT-2	they were up in Quincy yesterday training.... I thought he said that's BS. but he said that'd be us.		
1641:44 HOT-B	[sound of several chuckles]		
1641:48 HOT-2	risky.		
1641:50 HOT-1	oooh.		
		1641:53 RDO-1	good afternoon Chicago center, Lakes Air two fifty one on the ground at Burlington looking for clearance to Chic.. to uh, Quincy I'm sorry, and we're ready runway three six.
		1642:03 CTR-1	Lakes Air two fifty one roger, you're cleared from Burlington airport to Quincy airport via as filed. climb and maintain three thousand, squawk, six, five, zero six. contact Chicago center upon departure, this frequency, clearance void if not off by, two.. two.. five.. five.. time now two two four three and a half.

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1642:30 RDO-1	Lakes Air two fifty one we're cleared to Quincy as filed, three thousand, six five zero six on the squawk. void time two two five five. we'll call off with you ah, runway three six in just about thirty seconds.
		1642:41 CTR-1	roger.
1642:43 HOT-1	do you smell smoke?		
1642:50 HOT-1	I have the clearance.		
1642:52 HOT-2	* maintain three thousand.		
1642:55 HOT-1	uh.		
1642:59 HOT-2	***.		
1643:05 HOT-1	before takeoff checklist.		
1643:07 HOT-2	that's complete.		
1643:13 HOT-2	kinda smoke ya smell?		
1643:18 HOT-1	I don't know. maybe the lights or something. I don't see anything. ya got all your circuit breakers in?		

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1643:26 HOT-2	yeah.		
		1643:37 RDO-1	Burlington area traffic, Lakes Air two fifty one is a Beech airliner departing, runway three six. it'll be a departure from the area to the south. any other traffic in the Burlington area, please advise.
1643:54 HOT-2	line ups.		
1643:55 HOT-1	ice protection?		
1643:57 HOT-2	standard three boards.		
1644:01 HOT-1	and the external lights?		
1644:03 HOT-2	they're on.		
1644:05 HOT-1	anti-skid?		
1644:07 HOT-2	not installed.		
1644:09 HOT-1	check list, I'm sorry. environmental mode and bleeds environmental off and off , and your radar's on standby, TCAS is on, transponder's on alt, HSI/DG we're lookin' at about um, three fifty eight, that checks both sides. check list complete.		

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1644:24 CAM	[sound of increase in propeller RPM similar to engine take-off power being applied]		
1644:35 HOT-1	feathers lit.		
1644:38 HOT-2	that's affirm.		
1644:39 HOT-1	power's set.		
1644:44 HOT-1	eighty knots cross checks.		
1644:48 HOT-1	V one.		
1644:50 HOT-1	V two.		
1644:54 HOT-1	positive rate.		
1644:56 HOT-2	gear up.		
1645:01 HOT-1	gear's in transit, gear's up, lights are out.		
1645:05 HOT-1	four hundred.		
1645:06 HOT-2	flaps up. climb power climb check.		

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1645:18 CAM	[sound similar to decrease in propeller RPM]		
1645:23 HOT-1	gear is up, flaps are up, environmental mode and bleeds are on as required, your yaw damp's on,...		
1645:28 CAM	[sound similar to altitude alert signal]		
1645:29 HOT-1 climb power set, check complete, one to go.		
		1646:01 RDO-1	Burlington area traffic, Lakes Air, two fifty one is a Beech airliner just off runway, three six. we're in a left turn out, departing the area to the south at Burlington.
1646:25 HOT-1	wanna stay at four? we can stay below that high stuff. * sure, I s'pose six would probably do it too.... *** warm temperatures.		
1646:38 HOT-2	doesn't matter to me **.		
1646:44 CAM	[sound similar to altitude alert signal]		
1646:46 HOT-1	be nice if they didn't have to de-ice.		
		1647:05 RDO-1	Chicago center Lakes Air two fifty one level three thousand off Burlington.

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

**TIME &
SOURCE**

CONTENT

**TIME &
SOURCE**

CONTENT

1648:18
HOT-1 oops. ident. you just love to sit over there and laugh at me.

1647:31
RDO-1 Chicago, Lakes Air two fifty one level three thousand.

1647:51
AWOS-1 ... zero at eight , visibility one two, ceiling one three thousand broken, two zero thousand overcast, temperature three, dew point minus three, altimeter three zero zero zero.

1648:08
RDO-1 Chicago center, good afternoon. Lakes Air two fifty one level three thousand.

1648:13
CTR-1 Lakes Air two fifty one, ident.

1648:33
HOT-1 three one one zero. ** where they came up with that one?

1648:20
CTR-1 Lakes Air two fifty one, squawk three one one zero.

1648:28
RDO-1 three one one zero for Lakes Air um, two fifty one roger.

1648:48
CTR-1 Lakes Air two fifty one radar contact one zero miles south of the Burlington airport. climb and maintain eight thousand.

1648:56
RDO-1 Lakes Air two fifty one, wondering if we could get six as a final today.

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

**TIME &
SOURCE**

CONTENT

**TIME &
SOURCE**

CONTENT

1649:04
HOT-1 up to...

1648:59
CTR-1 sure Lakes Air two fifty one, amend the altitude climb maintain six thousand. that'll be the final.

1649:05
RDO-1 up to six thousand for Lakes Air two fifty one.

1649:11
AWOS-2 Quincy Muni Baldwin field, two one five zero Zulu, wind zero six zero at eight , visibility one two, ceiling one three thousand broken, two zero thousand overcast, temperature three..

1650:02
RDO-1 Burlington operations, fifty nine twenty five times.

1650:06
BRLOP this is Burlington, go ahead.

1650:07
RDO-1 we had two five, two seven, three seven, four zero. our Hobbs two three zero one point five. and see ya next time.

1650:19
BRLOP OK, see you later, thank you.

1650:30
RDO-1 Quincy operations, Lakes Air fifty nine twenty five, in range.

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INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

**TIME &
SOURCE**

CONTENT

**TIME &
SOURCE**

CONTENT

1651:33
HOT-2 what's the winds down there?

1650:40
QCYOP this is Quincy, go ahead.

1650:43
RDO-1 we'll see you at seven past. the next crew will have fifteen hundred on board.

1650:50
CTR-1 Lakes Air two fifty one have a good evening. contact Kansas City center one three five point five two.

1650:51
QCYOP see you at seven past.

1650:57
RDO-1 one thirty five fifty two for Lakes Air uh, two fifty one. good night.

1651:02
CTR-1 good night.

1651:11
QCYOP-8 Kate, are you in another bad mood?

1651:14
RDO-1 Kansas City center , Lakes Air two fifty one with you climbing out of four thousand six hundred for six thousand. we've got the Quincy AWOS.

1651:22
CTR-2 Lakes Air two fifty one roger, thanks.

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1651:36 HOT-1	um, they are, zero six zero at eight. twelve miles visibility, thirteen thousand broken, twenty thousand overcast, three degrees, negative three on the dew point. three zero zero zero, all balls baby.		
1651:52 HOT-2	that's the way you like it.		
1651:54 HOT-1	oh yeah I like it.		
1651:56 HOT-2	one three.		
1651:58 HOT-1	OK.		
1652:04 CAM	[sound similar to altitude alert signal]		
		1652:07 RDO-1	*** two fifty one is a Beech airliner, just about thirty miles to the north of the field will be inbound for landing runway one three at Quincy. any traffic in the area please advise.
1652:19 HOT-2	[sound of deep breath] OK, cruise if you want.		
1652:26 HOT-1	all right.... power is set.		
1652:30 HOT-1	engine instruments are checked... fuel quantity is checked. and the auto-feather is going to stay on for the * duration.		

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1654:11 CAM	[sound similar to altitude alert signal]	1653:45 RDO-?	[sound similar to someone keying microphone seven times]
		1654:46 CTR-2	Lakes air two fifty one descend and maintain three thousand, that's pilot discretion.
		1654:50 RDO-1	Lakes Air two fifty one, pilots discretion down to three thousand.
		1654:54 CTR-2	*
1654:56 HOT-1	look at that sunset man, that's gorgeous.		
		1655:19 1127D-6	Quincy traffic, King Air one one two seven Delta's taxiing out uh, takeoff on runway four, Quincy.
1655:22 HOT-1	Quincy twaffic.		
1655:26 HOT-2	sounds like a little kid.		
1655:29 HOT-1	Qwincy twaffic. [sound of chuckle]..... he's a little baby, Elmer Fudd girl.		

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1655:40 7646J	Quincy traffic, Cherokee seven six four six Juliet back-taxi uh, taxiing to runway four, Quincy.
1655:48 HOT-1	they're both using four.		
1656:13 HOT-2	in sight.		
1656:16 HOT-1	Okeydoky.		
		1656:21 RDO-1	Lakes Air two fifty one, Quincy in sight.
		1656:26 CTR-2	Lakes Air two fifty one cleared visual approach, Quincy.
		1656:29 RDO-1	cleared for the visual Quincy for Lakes Air two fifty one.
1656:42 HOT-1	landing on one three, right?		
1656:43 HOT-2	what's that?		
1656:44 HOT-1	you're planning on one three still, right?		
1656:46 HOT-2	yeah, unless it doesn't look good then we'll just do a down-wind for four but uh, right now plan one three.		

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

**TIME &
SOURCE**

CONTENT

**TIME &
SOURCE**

CONTENT

1657:20
HOT-2 decent checklist.

1657:21
HOT-1 ice protection?

1657:22
HOT-2 standard three, boards any time.

1657:27
HOT-1 and the uh.... pressurization?

1657:33
HOT-2 that's set checked.

1657:35
HOT-1 antiiii, altimeter, three zero zero zero zero.

1657:38
HOT-2 set right.

1657:40
HOT-1 passenger brief?

1657:42
HOT-2 they're, taken care of.

1657:45
HOT-1 and the landing and logo lights?

1656:56
RDO-1 Quincy area traffic, Lakes Air two fifty one is a Beech airliner currently ten miles to the north of the field. we'll be inbound to enter on a left base for runway one three at Quincy any other traffic please advise.

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1657:47 HOT-2	they're on.		
1657:49 HOT-1	fuel balance?		
1657:50 HOT-2	checked.		
1657:51 HOT-1	oops.... I'd better balance..... and the um, auto-feather?		
1657:58 HOT-2	armed.		
1657:59 HOT-1	anti-skid?		
1658:01 HOT-2	not installed.		
1658:03 HOT-1	and the checklist?		
1658:04 HOT-2	complete.		
1658:05 HOT-1	approach briefing?		
1658:08 HOT-2	complete.		
1658:11 HOT-1	and performance is gonna be one zero... uh one ten VYSE blue line.		

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1658:17 HOT-2	reviewed.		
1658:19 HOT-1	nav radios?		
1658:20 HOT-2	set right.		
1658:21 HOT-1	set left interior lights?		
1658:27 HOT-2	on.		
1658:28 HOT-1	and thee, * flaps?		
1658:32 HOT-2	holding up for right now.		
		1658:41 CTR-2	* two fifty one, cleared visual approach at Quincy. report leaving three thousand.
		1658:45 RDO-1	Lakes Air two fifty one we're already cleared for the visual at Quincy um , before you switched and uh, we're currently out of two thousand three hundred.
		1658:54 CTR-2	Lakes Air two fifty one roger. radar service is terminated, change to advisory frequency is approved. report the cancellation or down time on this frequency.

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1659:02 RDO-1	over to advisory....
		1659:03 1127D	[this transmission heard on both pilot's radio channels] Quincy traffic, King Air one one two seven Delta holding short of runway four. be uh, takin' the runway for departure and heading uh, southeast, Quincy.
		1659:04 RDO-1 we'll uh, cancel on the ground with you and cleared for the visual for Lakes two fifty one, good night.
1659:14 HOT-1	does sound little doesn't she.		
1659:15 HOT-2	takeoff flaps.		
1659:19 HOT-1	she's takin' runway four right now?		
1659:22 HOT-2	yeah.		
		1659:29 RDO-1	Quincy area traffic, Lakes Air two fifty one is a Beech airliner currently uh, just about to turn, about a six mile final for runway uh, one three, more like a five mile final for runway one three at Quincy.
1659:42 HOT-2	gear down.		
1659:50 HOT-2	landing checks.		

INTRA-COCKPIT COMMUNICATION

AIR-GROUND COMMUNICATION

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1659:52 HOT-1	landing gear?		
1659:52 HOT-2	down three green.		
1659:54 HOT-1	* is.		
1659:57 HOT-2	flaps approach.		
1659:59 HOT-1	full indicated.		
1700:12 CAM-3	five hundred.		
		1700:16 RDO-1	and Quincy traffic Lakes Air two fifty one's, on short final for runway one three um, the aircraft gonna hold in position on runway four or you guys gonna take off?
		1700:28 7646J	seven six four six Juliet uh, holding uh, for departure on runway four
1700:34 CAM-3	two hundred.		
		1700:35 7646J * on the uh, King Air.
		1700:37 RDO-1	OK, we'll, we'll get through your intersection in just a second sir * we appreciate that.

INTRA-COCKPIT COMMUNICATION**AIR-GROUND COMMUNICATION**

TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1700:42 HOT-1	landing gear's down three green, flaps are at landing. your yaw damp is off. finals are complete.		
1700:48 HOT-1	we kinda		
1700:49 HOT-2	kinda what?		
1700:50 HOT-1	we kinda fudged, in there a little.		
1700:59 CAM	[sound similar to aircraft touching down on runway]		
1701:01 HOT-1	max reverse.		
1701:01 HOT-1	oh #.		
1701:03 HOT-2	what, ooooh #.		
1701:07 HOT-2	oh # me.		
1701:08 END of RECORDING			
END of TRANSCRIPT			