



# 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.<sup>1</sup>

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.

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<sup>1</sup> 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.<sup>2</sup>

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

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<sup>2</sup> 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.<sup>3</sup>

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

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<sup>3</sup> 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.<sup>4</sup> (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

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<sup>4</sup> 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.<sup>5</sup> 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.<sup>6</sup> 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.

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<sup>5</sup> 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.”

<sup>6</sup> 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).<sup>7</sup> 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

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<sup>7</sup> 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