

Note: Below are the BEA findings that appear in Volume II of the NTSB accident report. The findings begin on page 258 of the report.

3.1. BEA FINDINGS

The BEA strongly believes that the following Findings are mandated by the facts of this accident. These Findings are fully supported by the previously cited factual references and analysis of the accident.

1. This accident occurred as a result of a prolonged operation of the aircraft in freezing drizzle/rain conditions well beyond the certification envelope for all aircraft.
2. Airworthiness Authorities and the aviation industry worldwide did not sufficiently recognize, prior to the Flight 4184 accident, freezing drizzle characteristics and their potential effect on aircraft performance and controllability.
3. Despite investigation of prior incidents involving icing conditions outside 14 CFR Part 25, Appendix C, by the NTSB, BEA, ATR, FAA and DGAC, these parties did not anticipate the mechanism of the ice-induced aileron hinge moment reversal that was involved in this accident and that was not discovered until the post-accident Edwards AFB testing program.
4. ATR properly analyzed and took appropriate and adequate measures in response to such prior icing related incidents.
5. The DGAC acted correctly and properly in its certifications of the different ATR model aircraft as the primary certification authority, and the FAA properly applied the Bilateral Airworthiness Agreement in its certifications of the aircraft.
6. The DGAC provided appropriate oversight of the continued airworthiness of the ATR-42 and ATR-72 aircraft and took all appropriate actions to assure the continued airworthiness of the aircraft in response to such prior icing related incidents.
7. The DGAC provided the FAA on a timely basis with all relevant airworthiness or safety of operation information developed from previous ATR icing incidents, including those in freezing rain, in full compliance with the BAA and ICAO Annex 8.
8. The FAA Indianapolis Ground Controller released Flight 4184 from a 42-minute ground hold despite having been informed by the Traffic Management Coordinator that conditions were such that the flight would likely be required to hold in the air before reaching its destination. The release of Flight 4184 under these conditions was contrary to the policy established in FAA Order 7110.65, Air Traffic Control, to reduce congestion in the air traffic system and to limit the duration of airborne holding.
9. American Eagle/Simmons' policy precluded the distribution of AIRMET Zulu Update 3 for icing and freezing level in the Flight Release for Flight 4184. This AIRMET was applicable to Flight 4184's route of flight from Indianapolis to Chicago, and stated that "light occasional moderate rime icing in cloud and in precipitation" could be expected. This AIRMET also provided information regarding the freezing level along Flight 4184's route of flight.
10. AMR Eagle/Simmons was adequately warned by ATR prior to the accident about the dangers of operating in freezing precipitation and understood the need to avoid such conditions.
11. AMR Eagle/Simmons, in turn, warned its flight crews prior to the accident about the dangers of operating in icing conditions, including freezing precipitation, and instructed its flight crews to avoid such conditions.
12. The flight crew of Flight 4184 had been expressly warned about the dangers of freezing precipitation and the necessity of crew vigilance.

13. Flight 4184's flight crew knew they were operating in icing conditions.
14. Proper monitoring of the outside air temperature, clouds, precipitation, and the ice accumulating on the aircraft by the crew of Flight 4184 would have informed them that they might be operating in a freezing precipitation environment.
15. Despite these warnings and instructions, and having entered known icing conditions, the flight crew of Flight 4184 had absolutely no discussions regarding: the nature and extent of the icing conditions they were encountering; the outside meteorological conditions; the need to request a clearance to an alternative altitude or route to remain clear of the known icing conditions; the operation of the aircraft's de-icing and antiicing equipment.
16. Flight 4184's flight crew had ample opportunity to ask the ATC for a clearance to exit the icing conditions.
17. AMR Eagle/Simmons' company policies require that flight crews stay out of icing conditions when possible.
18. After the Mosinee incidents, ATR proposed to the FAA, through the DGAC, a revision to the ATR-42 FCOM and AFM which contained information on the effects of freezing rain conditions on aircraft stability and control characteristics and on the autopilot and set forth related operational procedures to be used when an aircraft inadvertently encounters such prohibited conditions. This proposal was not accepted by the FAA.
19. ATR provided Simmons and other operators with the identical information, applied to both the ATR-42 and ATR-72 aircraft, concerning the effects of freezing rain (understood by Simmons to include "freezing precipitation" in the AOM).
20. ATR provided specific warnings to Simmons and other operators, for their pilots, about the adverse characteristics of freezing rain and about roll events which could occur in such conditions and gave specific guidance for recovery from such events and, in addition, developed aircraft modifications seeking to reduce the possibility of such events occurring.
21. Simmons company policy had already provided ample instructions to the Flight Crews regarding the icing threat and the basic rules of behaviour to face such a situation.
22. The failure of Flight 4184's flight crew to follow these company policies and manual provisions and exit the known icing conditions led directly to this accident.
23. Despite the lack of anticipation by the NTSB, BEA, ATR, FAA and DGAC, prior to the accident, of the mechanism of the ice-induced aileron hinge moment reversal, Simmons/AMR Eagle and its flight crews had been warned that, under icing conditions outside those specified in 14 CFR Part 25. Appendix C the ATR 42/72 aircraft performance and controllability might be affected in such a way that auto-pilot self-disconnect and subsequent roll excursions could occur; that roll efficiency would nevertheless be maintained; that recovery could be achieved by making firm aileron inputs to counter the roll excursions and by applying basic stall recovery techniques. These were appropriate and adequate instructions to flight crews based on what was known from prior incidents.
24. ATR adopted appropriate and adequate changes to its flight crew training program and simulator data known from prior icing incidents. training package based on what was
25. Chicago ARTCC controllers were aware that light to moderate icing conditions were forecast for the area of LUCIT intersection at the time Flight 4184 was released from its ground hold.

26. Chicago ARTCC controllers had received PIREPs reporting icing conditions on the day of the accident and had their supervisor at the beginning of their shift icing conditions and because “Icing Kills”. been specifically briefed by that they must be aware of

27. Chicago ARTCC controllers were aware that the weather conditions were deteriorating throughout the Chicago area before and during the time Flight 4184 was enroute from Indianapolis to Chicago. Therefore they could not have ignored the specific weather conditions at the Lucit holding pattern, at Flight Level 100.

28. If the Controller at Chicago ARTCC had received an icing PIREP from Flight 4184, immediate precautionary communication would have been made by ATC with the crew regarding exiting the icing area.

29. Flight 4184 was the only aircraft holding at LUCIT intersection, and multiple altitudes were available for diversion from the known icing conditions.

30. AMR Eagle/Simmons’ company policy, Federal Aviation Regulations, and the Airman’s Information Manual require that flight crews provide ATC with a PIREP of known icing conditions. However the crew of Flight 4184 did not to provide such a report of their known icing conditions.

31. Had the crew of Flight 4184 provided to ATC the mandatory PIREP of their known icing conditions, ATC would have provided them with a diversionary clearance so that they could have immediately exited the icing conditions. The flight crew’s failure to provide a PIREP of their known icing conditions contributed to this accident.

32. FAA Order 711 0.65J, *Air Traffic Control*, requires ATC controllers to solicit PIREPS of “icing of light degree or greater” when such conditions exist or are forecast to exist in their area of jurisdiction. ATC did not solicit an icing PIREP from Flight 4184, that contributed to this accident.

33. ARTCC failed to report to the Air Traffic Control System Command Center (ATCSCC) and the Traffic Management Coordinator of the excessive holding time experienced by Flight 4184 as required.

34. The Sterile Cockpit Rule (as imposed by FAR 121.542 and Simmons/AMR Eagle’s Flight Manual) requires the captain to impose the rule during any phase of a particular flight as deemed necessary. This rule should have been applied by the Captain of Flight 4184.

35. Flight 4184’s holding in known icing conditions at 10,000 feet, in instrument conditions, awaiting momentary clearance to descend below 10,000 feet to commence an instrument approach into one of the world’s busiest airports constituted a “critical phase of flight” within the meaning and intent of FAR Section 121.542.

36. The flight crew of Flight 4184 demonstrated a lack of involvement in primary duties and failed to exercise proper situational awareness as well as proper Cockpit Resource Management. This directly contributed to the accident.

37. The Captain’s lack of assertiveness and complete failure to integrate himself into the required flight activities left the entire operation of the aircraft to the First Officer.

38. AMR Eagle/Simmons’ ATR42/72 Airplane Operating Manual (AOM) provides only for holding with the aircraft configured in the flap zero degree configuration. Flight 4184’s flight crew’s unauthorized use of the flap 15 configuration while holding at 175 knots in icing conditions created the critical ice ridge beyond the de-icing boots which ultimately led to the roll upset, and thereby directly contributed to the accident.

39. Post-accident flight tests at Edwards Air Force Base and in France confirmed that Flight 4184 was recoverable after the initial roll upset.