SAFETY ALERT

NTSB National Transportation Safety Board

SA097 | August 2024

AVIATION HIGHWAY MARINE RAILROAD PIPELINE

Flying in Icing Conditions?

Assess the Effect on Airplane Performance and Consult Your Pilot's Operating Handbook!

The problem

- Flying in icing conditions can present operational risks, including the adverse effects of airframe and propeller icing on aircraft performance, which can make managing the airplane's flightpath and airspeed more difficult and can prevent the airplane from maintaining level flight.
- In addition, as little as 1/4-inch of wing leading-edge ice accumulation can increase the stall speed by 25 to 40 knots and cause sudden departure from controlled flight.
- Ice accumulation on pitot tubes can cause flight instruments to cease operating and can affect airspeed, altimeter, and vertical speed indicator indications.
- Some pilots have been taught to wait for a prescribed accumulation of leading-edge ice before activating deice boots to alleviate ice accumulation on flight control surfaces because of the believed threat of ice bridging. However, performance degradation could develop if the deice boots are not activated as soon as icing is encountered.
- Many pneumatic deice boot systems have no provision for continuous operation and require pilots to manually cycle the systems.
- In icing conditions, continuous use of the autopilot can deprive the pilot of the opportunity to detect the buildup of ice on the airframe through changes in the airplane's longitudinal trim requirements and control forces.

Related accidents

The following NTSB investigations highlight accidents involving flight in icing conditions in which pilots did not adequately comply with instructions in their pilot's operating handbooks (POH) or aircraft flight manuals (AFM), which led to in-flight loss of control:

- The pilot of a Piper PA-46-310P airplane encountered light rain and trace clear-air icing, as forecasted, during climbout in instrument meteorological conditions along his intended route of flight. Although he activated pitot heat when he noticed a decrease in airspeed, ice accumulated on the pitot static system,

causing the primary flight display (PFD) and multifunction display (MFD) to malfunction. The autopilot commanded the airplane to descend, and it emerged into visual meteorological conditions in an unusual attitude. The pilot disconnected the autopilot and recovered the airplane to a level attitude. The PFD and MFD operation returned, and the pilot continued the flight and landed without further incident. Both wings sustained substantial damage during the loss of control. The pilot activated pitot heat during climbout, but the procedures in the Piper PA-46-310P "Before Takeoff" checklist call for the pitot heat to be activated *before* departing if flight into icing conditions is anticipated or encountered. **Had the pilot activated the pitot heat before departing into forecasted icing conditions, he likely would have prevented the ice accumulation on the pitot tubes that led to temporary failure of the flight instruments and a subsequent loss of control.** (WPR23LA236)

- The pilot of an Embraer EMB-500 began a descent from 23,000 ft. The pilot confirmed to air traffic control that he had the destination airport's current weather observation, which indicated conditions favorable for structural icing during the airplane's descent and approach. About 3/4 mile from the approach end of the runway, the airplane stalled and impacted three houses and the ground, and a postcrash fire ensued (see figure 1). The pilot, both passengers, and all three people in one of the houses sustained fatal injuries. Before beginning the descent, the pilot incorrectly used the Normal checklist (non-icing), which did not call for the activation of the wing and horizontal stabilizer deice system. Further, he set the landing reference speed at 92 knots rather than the 126 knots he should have used to account for the icing conditions. **Had the pilot used the correct checklist in the POH for approach in icing conditions, the airframe likely would not have accumulated ice, and the pilot would have used appropriate landing performance speeds for the conditions. Thus, not using the correct checklist led to an aerodynamic stall at an altitude at which recovery was not possible.** (AAR-16-01)

Figure 1. Fuselage showing impact and fire damage to house.

- After encountering supercooled large droplets that led to ice accumulation, the pilot of a Cessna 208B airplane began a gradual descent from 10,500 ft mean sea level (msl) to 10,000 ft msl during which the airplane entered an abrupt uncommand right bank followed by a steep, nose-down, spiral descent. The pilot regained control of the airplane, returned to the departure airport, and made an emergency landing. The airplane's POH and applicable supplements stated that the minimum speed for flight in icing conditions was 130 knots and that the autopilot must be disconnected once every 10 minutes in icing conditions to check for any out-of-trim conditions caused by ice buildup. Data obtained from the autopilot revealed that it was not disconnected every 10 minutes through the course of the flight as required, and the indicated air speed was below 100 knots in the seconds preceding the upset. A postaccident examination revealed substantial damage to the

Figure 2. Damage to right aileron.

wings and right aileron (see figure 2). **Had the pilot complied with instructions in the POH to periodically disconnect the autopilot to check for out-of-trim conditions and to maintain the minimum airspeed for flight in icing conditions, he likely would not have experienced a loss of control of the airplane and subsequent substantial damage to the aircraft.** (ANC21LA073)

- A pilot had been operating a Piper PA46 airplane above the freezing level within a heavy rain shower band for 20 minutes. Although the pilot did not access specific preflight icing forecasts, he received a preflight weather briefing that contained sufficient information to indicate possible icing at his chosen cruise altitude. After encountering supercooled large droplets and icing conditions that exceeded the capability of the airplane's icing protection system, the airframe accumulated ice, which ultimately resulted in an uncontrolled descent, an in-flight separation of a section of the right wing, and water impact. The pilot and passenger sustained fatal injuries. **Had the pilot departed the icing conditions as soon as the airplane began to accumulate ice, the airplane likely would not have accumulated ice in excess of what the airplane's icing protection system was able to shed.** (ERA19LA072)

What can you do?

- **When operating in icing conditions, use the autopilot only as directed by checklists and aircraft manuals, which might call for periodically disconnecting the autopilot to better feel changes in the handling qualities of the aircraft.**
- **Maintain the recommended airspeed for flight in icing conditions as specified in the AFM or POH.**
- **Activate leading-edge deice boots and pitot heat in accordance with the AFM or POH.**
- **While icing conditions exist, continue to manually cycle the deice system unless the system has a provision for continuous operation.**
- **Review your aircraft POH or AFM for specific operational requirements to determine the most effective means of shedding ice.**
- **Closely monitor windshield, windshield wiper, engine air inlets and wings for ice accumulation, and do not hesitate to leave icing conditions as soon as possible to avoid ice accumulation.**
- **Be aware of the potential for icing conditions and use all checklists associated with operations in such conditions.**

Interested in more information?

- Aircraft Owners and Pilots Association Safety Advisory Weather No. 1, "Aircraft Icing," covers de-icing and anti-icing equipment and ice-flying strategies and tactics.

- FAA Advisory Circular 91-74B, "Pilot Guide: Flight in Icing Conditions," contains information concerning safe flight in icing conditions, what conditions a pilot should avoid, and how to exit those conditions if encountered.

- FAA Advisory Circular 20-73A, Appendix H, “Aircraft Ice Protection,” provides guidance on how to operate an aircraft in an icing environment.

- FAA Advisory Circular 25.1419-1A, "Certification of Transport Category Airplanes for Flight in Icing Conditions," provides guidance for certification of airframe ice protection systems on transport category airplanes along with information on icing requirements for other parts of the airplane.

- FAA Information for Operators, “Pilot Training and Checking Under Title 14 of the Code of Federal Regulations (14 CFR) Parts 61, 91, 91 Subpart K (91K), 121, 135, 141, and/or 142,” provides information to pilots of pneumatic deicing boot-equipped airplanes on proper operation of those systems and on maintaining an appropriate airspeed in icing conditions.

- NTSB Safety Alert SA-082, “Flight in Snow,” describes the importance of assessing the risk of flight in wet snow conditions.