NTSB

SAFETY ALERT

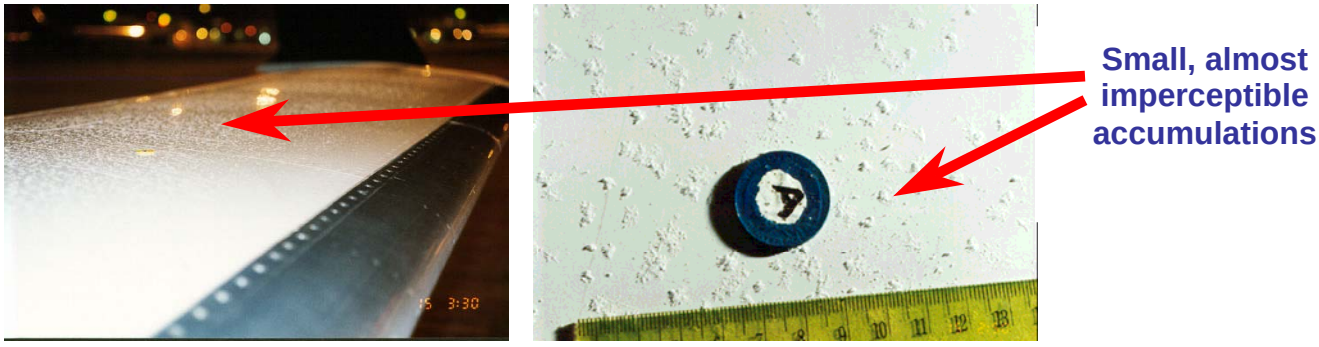
National Transportation Safety Board

★ Aircraft Ground Icing

Pilots urged to beware of aircraft upper wing surface ice accumulation before takeoff

The problem:

- Fine particles of frost or ice, the size of a grain of table salt and distributed as sparsely as one per square centimeter over and airplane wing's upper surface, can destroy enough lift to prevent a plane from taking off.
- Almost virtually imperceptible amounts of ice on an aircraft wing's upper surface during takeoff can result in significant performance degradation.
- Small, almost visually imperceptible amounts of ice distributed on an airplane's wing upper surface cause the same aerodynamic penalties as much larger (and more visible) ice accumulations.



- Small patches of ice or frost can result in localized, asymmetrical stalls on the wing, which can result in roll control problems during lift off.
- It is nearly impossible to determine by observation whether a wing is wet or has a thin film of ice. A very thin film of ice or frost will degrade the aerodynamic performance of any airplane.
- Ice accumulation on the wing upper surface may be very difficult to detect from the cockpit, cabin, or front and back of the wing because it is clear/white.
- Accident history shows that nonslatted, turbojet, transport-category airplanes have been involved in a disproportionate number of takeoff accidents where undetected upper wing ice contamination has been cited as the probable cause or sole contributing factor.
- Most pilots understand that visible ice contamination on a wing can cause severe aerodynamic and control penalties, but it is apparent that many pilots do not recognize that minute amounts of ice adhering to a wing can result in similar penalties.
- Despite evidence to the contrary, these beliefs may still exist because many pilots have seen their aircraft operate with large amounts of ice adhering to the leading edges (including the dramatic double horn accretion) and consider a thin layer of ice or frost on the wing upper surface to be more benign.

What should pilots know and do about airplane icing before takeoff?

- Pilots should be aware that no amount of snow, ice or frost accumulation on the wing upper surface should be considered safe for takeoff. It is critically important to ensure, by any means necessary, that the upper wing surface is clear of contamination before takeoff.
- The NTSB believes strongly that the only way to ensure that the wing is free from critical contamination is to touch it.
- With a careful and thorough preflight inspection, including tactile inspections and proper and liberal use of deicing processes and techniques, airplanes can be operated safely in spite of the adversities encountered during winter months.
- Pilot should be aware that even with the wing inspection light, the observation of a wing from a 30- to 40-foot distance, through a window that was probably wet from precipitation, does not constitute a careful examination.
- Pilots may observe what they perceive to be an insignificant amount of ice on the airplane's surface and be unaware that they may still be at risk because of reduced stall margins resulting from icing-related degraded airplane performance.
- Depending on the airplane's design (size, high wing, low wing, etc.) and the environmental and lighting conditions (wet wings, dark night, dim lights, etc.) it may be difficult for a pilot to see frost, snow and rime ice on the upper wing surface from the ground or through the cockpit or other windows.
- Frost, snow, and rime ice may be very difficult to detect on a white upper wing surface and clear ice can be difficult to detect on an upper wing surface of any color.
- Many pilots may believe that if they have sufficient engine power available, they can simply "power through" any performance degradation that might result from almost imperceptible amounts of upper wing surface ice accumulation. However, engine power will not prevent a stall and loss of control at lift off, where the highest angles of attack are normally achieved.
- Some pilots believe that if they cannot see ice or frost on the wing from a distance, or maybe through a cockpit or cabin window, it must not be there – or if it is there and they cannot see it under those circumstances, then the accumulation must be too minute to be of any consequence.

Need more information?

- Crash During Takeoff in Icing Conditions, Canadair, Ltd., CL-600-2A12, N873G, Montrose, CO, November 28, 2004. Aircraft Accident Report NTSB/AAB-06/03: **www.ntsb.gov/publictn/2006/AAB0603.htm**
- Epps Air Service, Challenger 604, Birmingham International Airport, Birmingham, UK, January 4, 2002. Air Accidents Branch (AAIB), Department of Transport, UK. Aircraft Accident Report 5/2004 (EW/C2002/1/2): **www.aaib.gov.uk/cms_resources/dft_avsafety_pdf_030576.pdf**
- NTSB recommendation letter issued as a result of 26 Cessna 208 icing-related incidents and accidents: **www.ntsb.gov/Recs/letters/2004/A04_64_67.pdf**
- Takeoff Stall in Icing Conditions, USAir flight 405, Fokker F-28, N485US, LaGuardia Airport, Flushing, NY, March 22, 1992. Aircraft Accident Report NTSB/AAR-93-02: **www.ntsb.gov/ntsb/brief.asp?ev_id=20001211X14270&key=1**
- Loss of Control on Takeoff , Ryan International Airlines, DC-9-15, N565PC, Cleveland-Hopkins International Airport, Cleveland, OH, February 17, 1991. Aircraft Accident Report NTSB/AAR-91/09: **www.ntsb.gov/ntsb/brief.asp?ev_id=20001212X16434&key=1**
- Crash During Takeoff in Icing Conditions, Continental Airlines, DC-9-14, N26TX, Stapleton International Airport, Denver, CO, November 15, 1987. Aircraft Accident Report NTSB AAR-88/09: **www.ntsb.gov/publictn/1988/AAR8809.htm**
- NTSB website: **www.ntsb.gov**
- NTSB Most Wanted List: **www.ntsb.gov/Recs/mostwanted/air_ice.htm**