

Safety Board Aviation Fatigue Recommendations

- More than 30 aviation recommendations since 1970s
- On Most Wanted List since 1990
- Most recommendations concern flight and duty time regulations and policies
- Recent accidents highlighted the need for comprehensive fatigue management efforts

Most Wanted Aviation Recommendations

- Flight crews
 - Modify and simplify flight and duty time regulations
 - Prohibit assigning “tail-end” Part 91 flights
- Maintenance personnel
 - Establish science-based duty time limits
- Air traffic controllers
 - Revise work scheduling policies/practices
 - Develop fatigue training for controllers

Fatigue Management Systems

- Intended to reduce fatigue and fatigue-related errors, incidents, and accidents
- Employ multiple strategies to mitigate fatigue
- Shared responsibility of operator and crews
- Continuous evaluation and improvement



NTSB National Transportation Safety Board

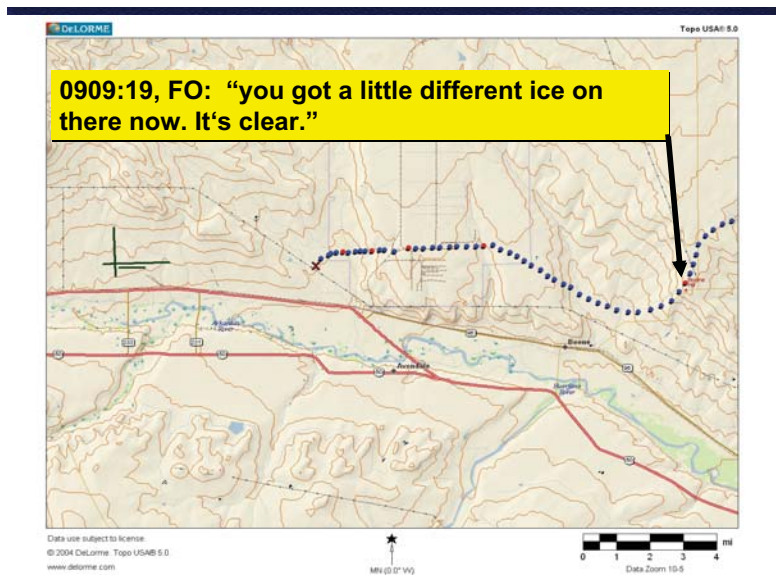
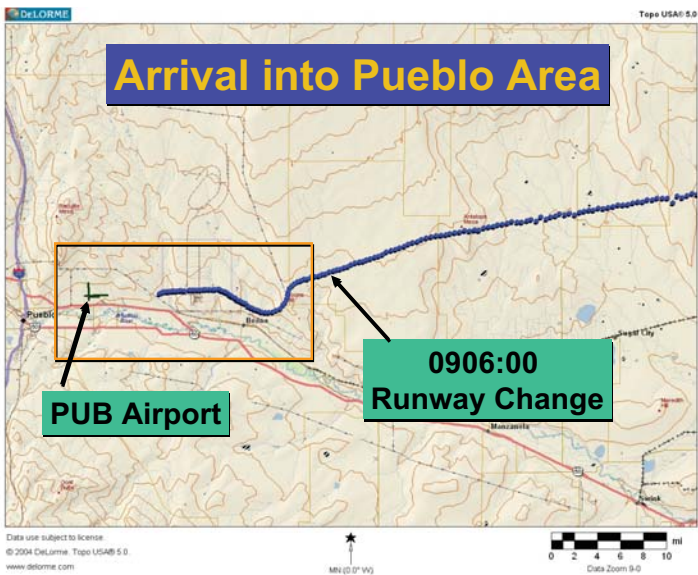
Office of Aviation Safety

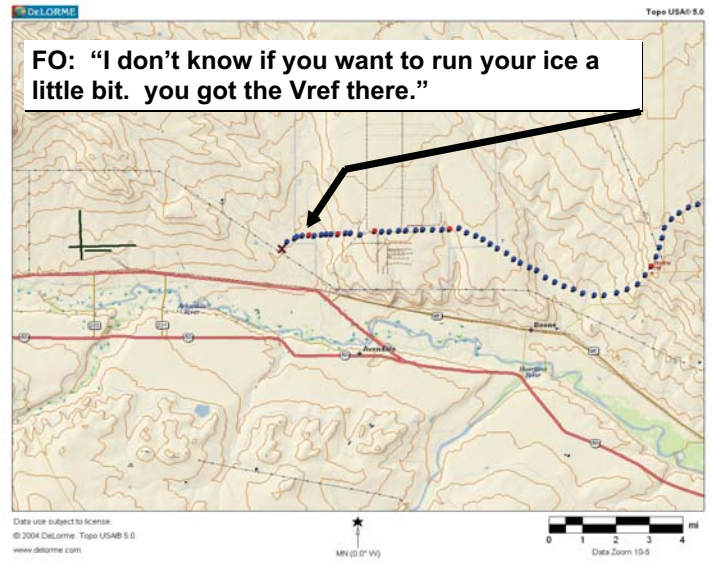
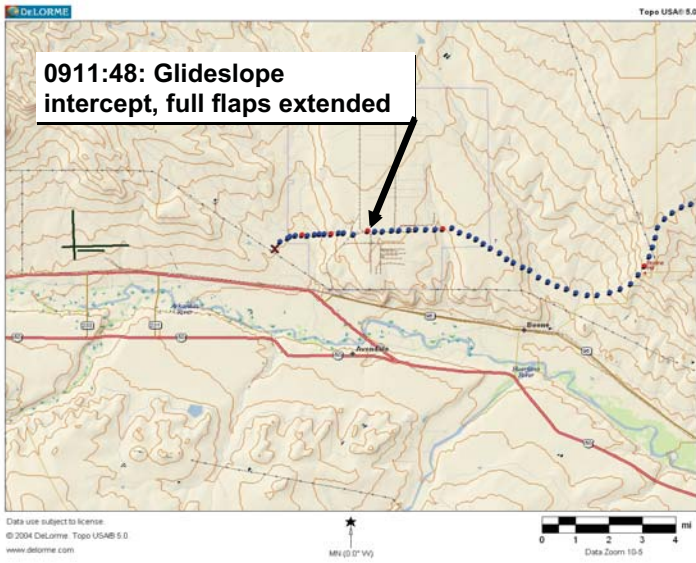
Cessna Citation 560
operated by Martinair, Inc.
Pueblo, CO

February 16, 2005

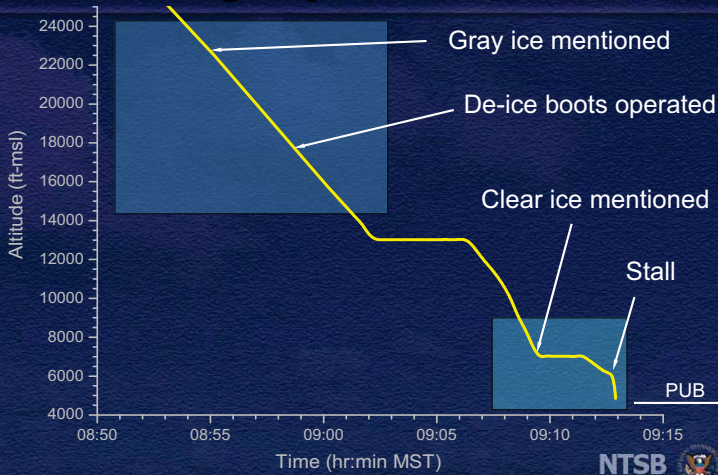
Cessna Citation 560



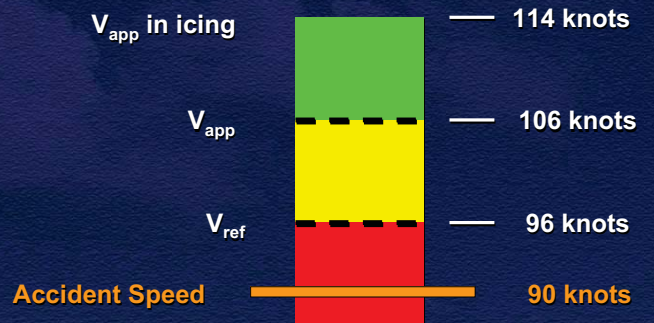




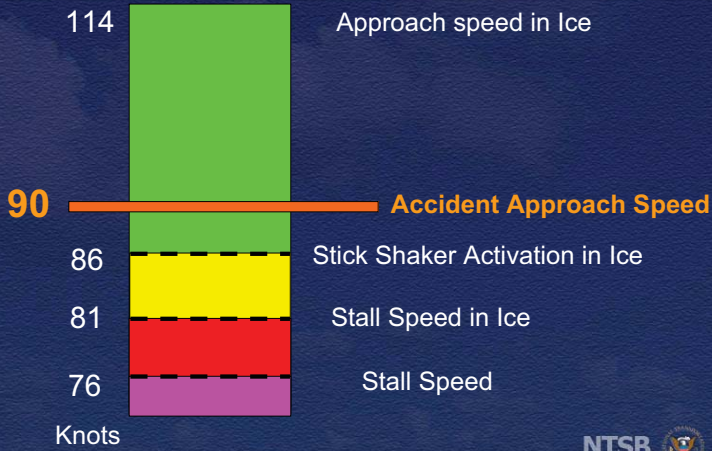
Two Icing Layers Encountered



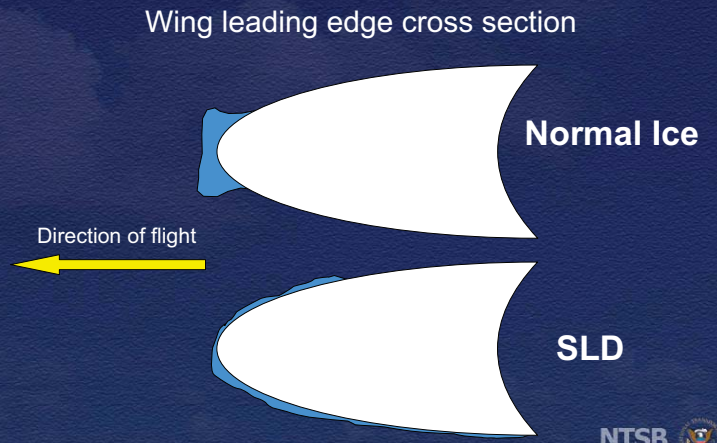
Approach Speeds in Icing



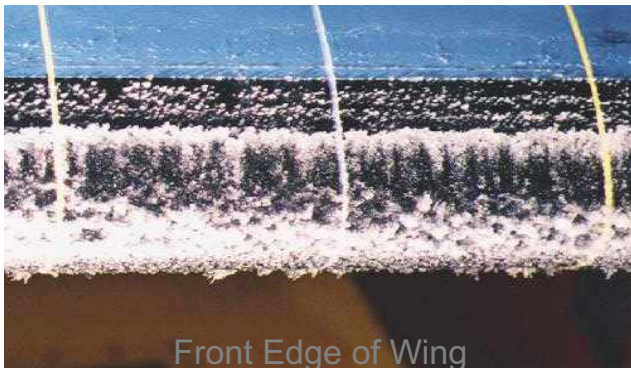
Approach and Stall Speeds



Effect of SLD on ice accretion



Resultant Ice Shapes



SLD Ice

Probable Cause

- Failure to Monitor Airspeed
- Failure to Activate Boots
- Inadequate Icing Certification Standards

Accident Recommendations

- Improved training for C-560 pilots to emphasize flight manual requirements for flight in icing conditions.
- Train monitoring and cross-checking
- Revise flight manual guidance regarding de-ice boot activation.
- Require modifications to C560 stall warning system.



Safety Alert



★ Activate Leading Edge Deice Boots As Soon as Airplane Enters Icing Conditions

Thin amounts of ice, as little as 1/4 inch, can be deadly

- The problem**
- As little as 1/4 inch of leading-edge ice can increase the stall speed 25 to 40 knots. The danger is that some 1/4-inch accumulations have minimum impact and pilots become over confident.
 - Sudden departure from controlled flight is possible with only 1/4 inch of leading-edge ice accumulation at normal approach speeds.
 - For 40 years, pilots have been taught to wait for a prescribed accumulation of leading-edge ice before activating the deice boots because of the self-led threat of ice stripping.
 - In theory, ice stripping could occur if the expanding boot pushes the ice into a frozen shape around the expanded boot, thus rendering the boot ineffective at removing ice.
 - The Safety Board has no review cases where ice stripping has caused an incident or accident, and has investigated numerous incidents and accidents involving a delayed activation of deice boots.
 - Ice stripping is extremely rare, if it exists at all.
 - Early activation of the deice boots leads to the effects of leading-edge ice and improves the operating safety margin.
 - Using the Activated Air Risk changes to the handling qualities of the airplane that may be a precursor to premature stall or loss of control.
 - Many airplanes still require pilots to visually identify ice on the wings and its thickness, which can be difficult to see from the cockpit.
 - Many pneumatic deice boot systems only provide a means to manually cycle the system and have no provision for continuous operation.
- What should pilots do when they encounter leading edge ice?**
- Leading-edge deice boots should be activated as soon as icing is encountered, unless the aircraft flight manual or the pilot's operating handbook specifically directs not to activate them.

- If the aircraft flight manual or the pilot's operating handbook specifies to wait for an accumulation of ice before activating the deice boots, maintain extremely careful vigilance of airspeed and any unusual handling qualities.
- While icing conditions exist, continue to manually cycle the deice system unless the system has a provision for continuous operation.
- Turn off or limit the use of the autopilot in order to better "feel" changes in the handling qualities of the airplane.
- Be aware that some aircraft manufacturers maintain that waiting for the accumulation of ice is still the most effective means of stripping ice.

Need more information?

- Visit the NTSB website at <http://www.ntsb.gov> to access the following documents:
 - Accident Brief addressing a non-98Ae landing accident of a Cessna 550 on March 17, 2007, in Beverly, Massachusetts, NTSB identification: NTC07LA0811.
 - Critical Query Approach to Landing, Circuit City Stores, Inc., Cessna, Cessna 660, Pease, Colorado, February 10, 2008 NTSB AAR-07-020.
 - In-Flight Icing Encounter and Uncontrolled Descent with Terrain, Comair Flight 3572, Toronto, Michigan, January 6, 1997 NTSB AAR-98-041.
 - NTSB's latest training and icing recommendations: http://www.ntsb.gov/docs/andrews/air_ice.htm
- FAA Advisory Circular 25-1470-1A
- Professional Postscript: "NTSB advises immediate activation of deice boots on entering icing conditions," December 2008. http://www.pilotmag.com/archives/2009/06/01/AC_25_1470_1A.html

SA014
December 2008



NTSB