NTSB National Transportation Safety Board

Office of Aviation Safety

Air Charter Safety Symposium March 3, 2009

Board Member Debbie Hersman

NTSB

- Independent Federal Agency
- 5-Member Board
  - President appointed, Senate confirmed
- 400 Staff
- Investigates accidents in all modes of transportation
- Determines probable cause
- Issues/Implements recommendations

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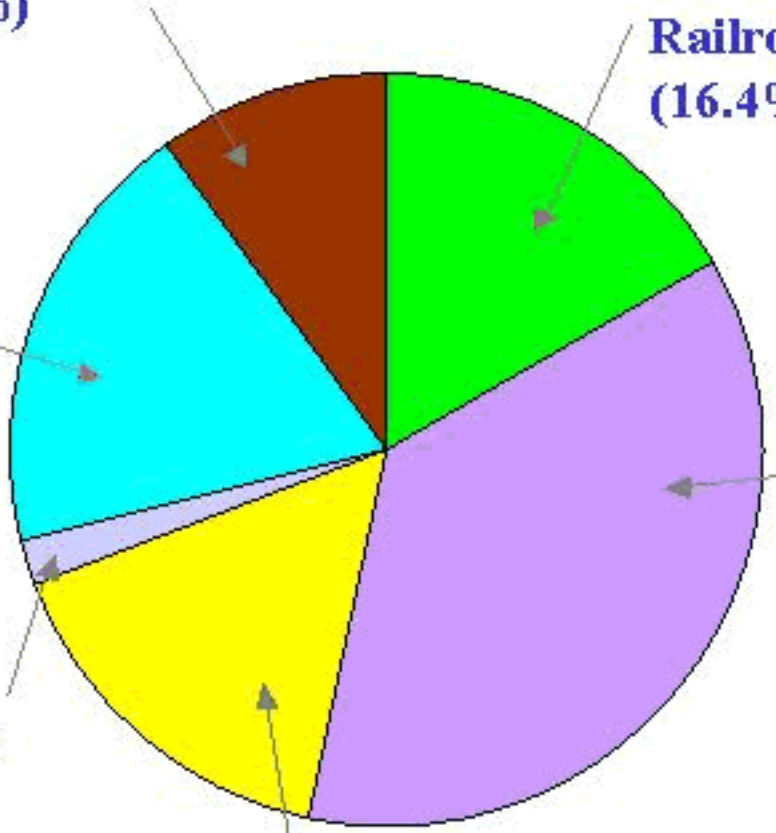
Safety Recommendations

Issued Since 1967
TOTAL = 12,536

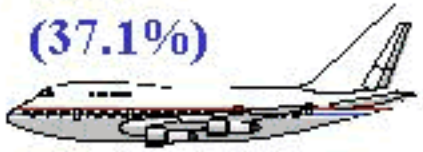


Pipeline 1225 (9.8%)

Railroad 2053 (16.4%)

Marine 2307 (18.4%)

Aviation 4653 (37.1%)

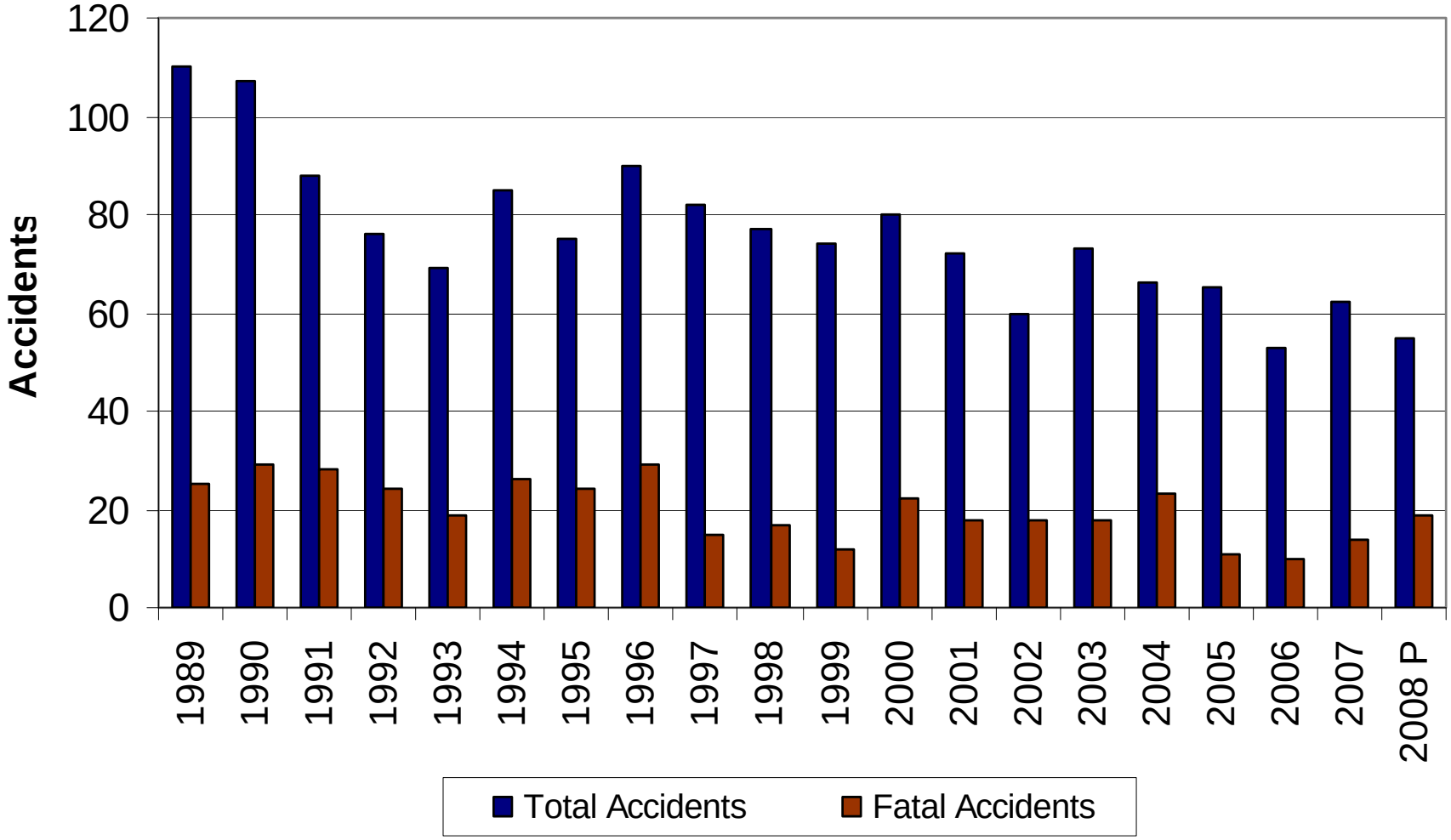


Intermodal 229 (1.8%)

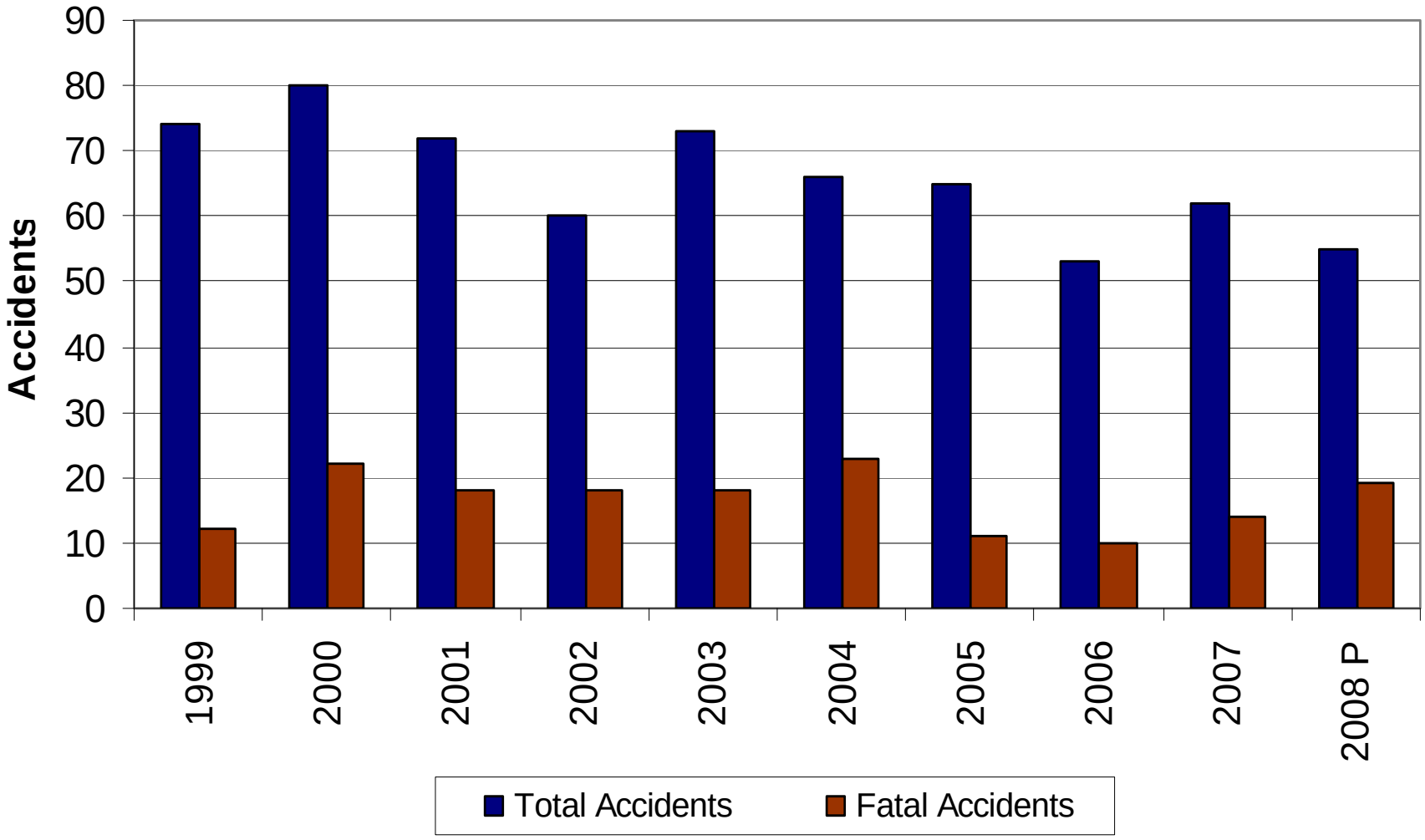
Highway 2069 (16.5%)

November 2006

On-demand Part 135 Accident and Fatal Accidents 1989-2008



On-demand Part 135 Accident and Fatal Accidents 1999-2008



Fatigue Accidents

- Guantanamo — ignored stick shaker
- Guam — descended below altitude profile
- Tallahassee — ignored solid red PAPI for 40 seconds
- Little Rock — failed to deploy spoilers
- Kirksville — descended below MDA
- Cleveland — lost visibility of field

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Recent Fatigue Related Accidents

Traverse City, MI, 2007

Cleveland, OH, 2007

Kirksville, MO, 2004

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Pinnacle Airlines Flight 4712
Bombardier/CRJ
Traverse City, Michigan

April 12, 2007


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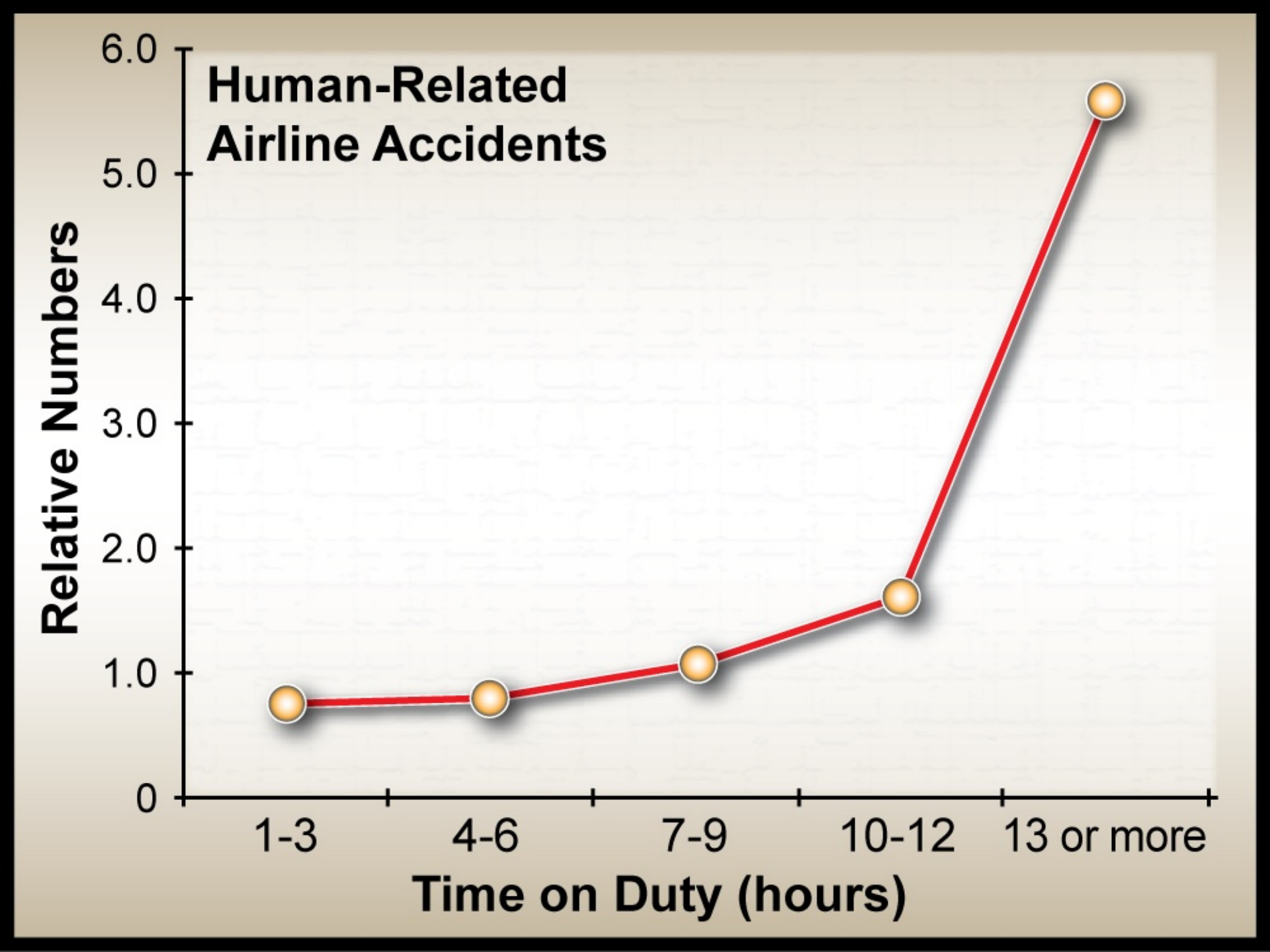
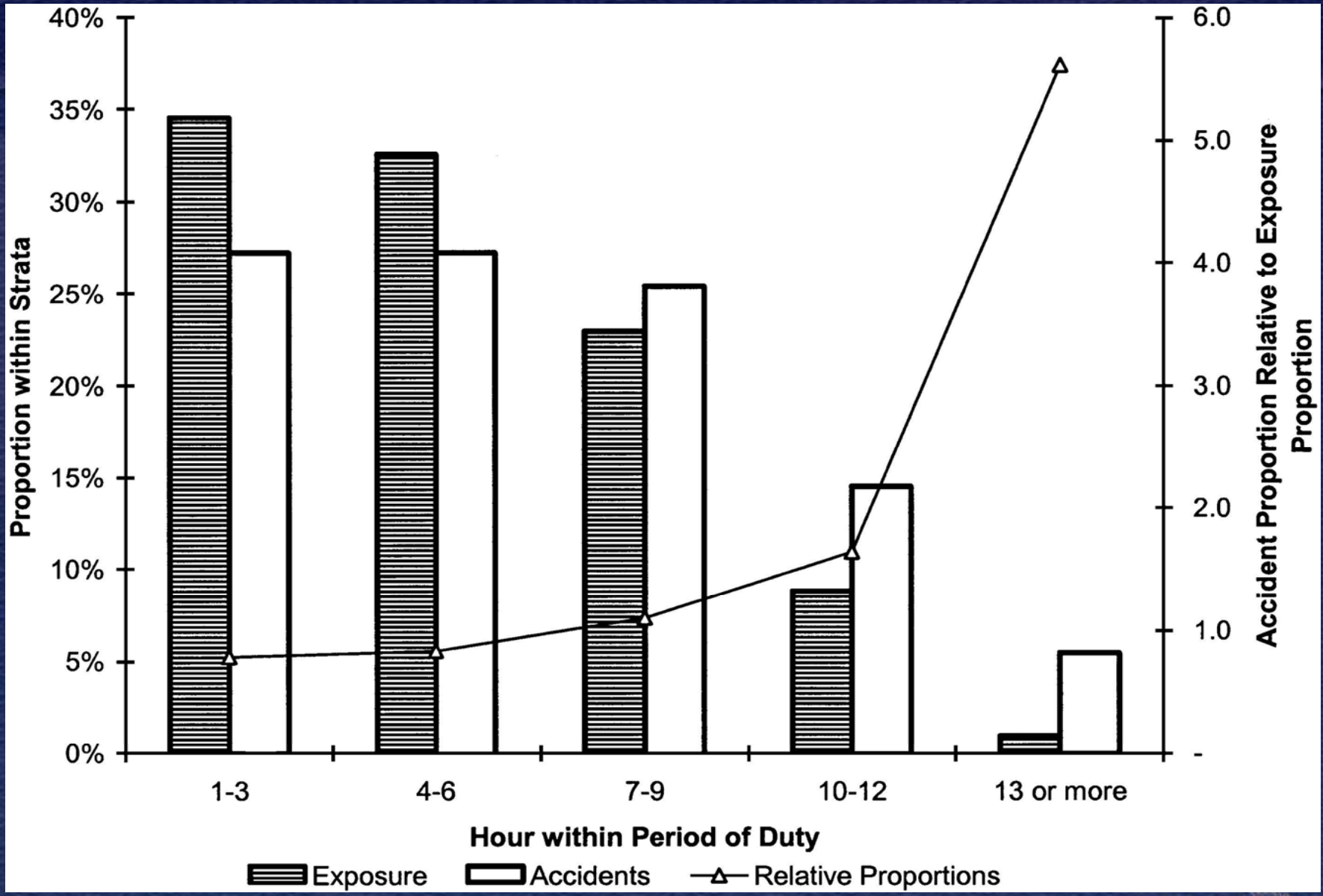

Human-Related
Airline Accidents
Relative Numbers
6.0
5.0
4.0
3.0
2.0
1.0
0
1-3
4-6
7-9
10-12
13 or more
Time on Duty (hours)


40%
35%
30%
25%
20%
15%
10%
5%
0%
Proportion within Strata
6.0
5.0
4.0
3.0
2.0
1.0
-
Accident Proportion Relative to Exposure Proportion
1-3
4-6
7-9
10-12
13 or more
Hour within Period of Duty
Exposure
Accidents
Relative Proportions

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Human Performance Issues

- Decision-making
- Fatigue
- Training

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Decision-making

- Captain familiar with procedure
- Crew monitored weather
- Adequate time available
- Pilots were trained and had time to perform landing distance assessment

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Fatigue effects

- Long duty periods associated with errors/accidents
- Fatigue degrades decision-making
- Poor decision-making likely reflected the effects of fatigue

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Training

- Must reinforce the need for calculating landing distance assessments

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Recommendations

- Hours of service standards
- Training guidance
- Fatigue management programs

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Safety Issues

- Flight crew decision-making
- Fatigue
- Check airman duty limits
- Runway criteria – winter weather
- Airport operations communications

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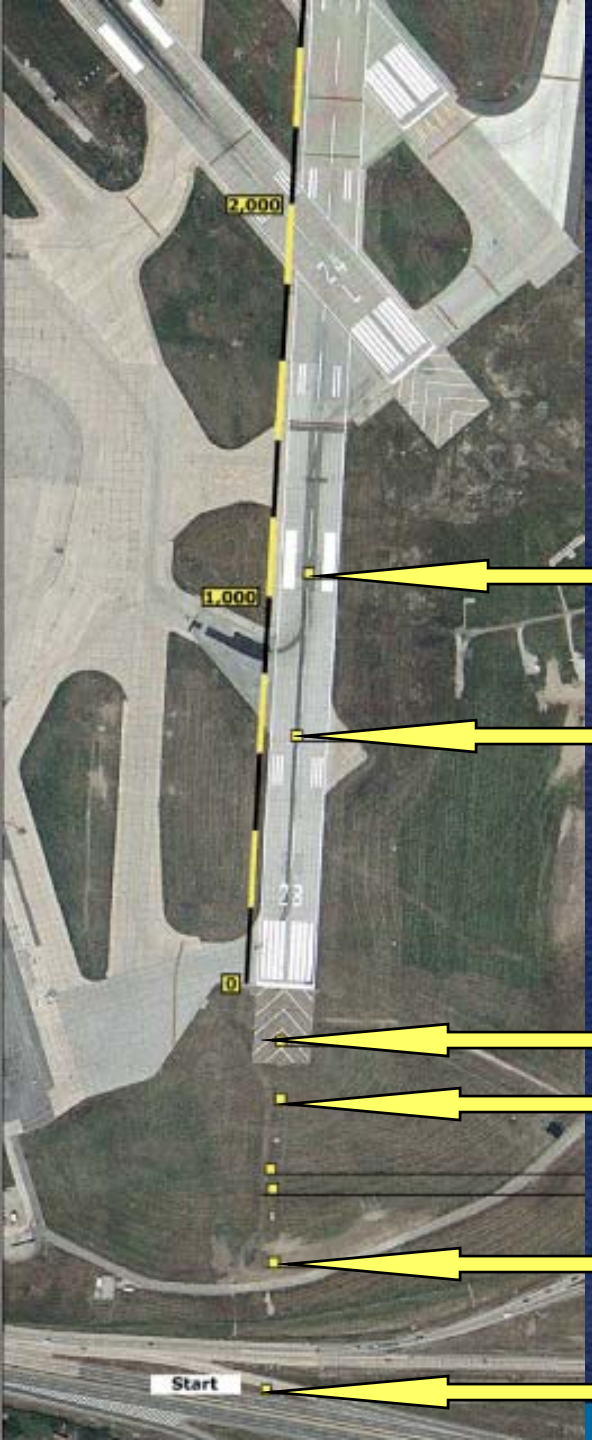
Shuttle America, Inc.
Delta Connection Flight 6448
Cleveland, Ohio

February 18, 2007


Connection



10 Feet

30 Feet

40 Feet

Captain Sees Runway

F/O Sees Runway

80 Feet

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Aircraft Stopped

25% N1

Capt 90% Braking

F/O 75% Braking

63% N1

TRs Deployed

Nose Gear Touchdown

Main Gear Touchdown

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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

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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

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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

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

February 16, 2005

Cessna Citation 560

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Arrival into Pueblo Area

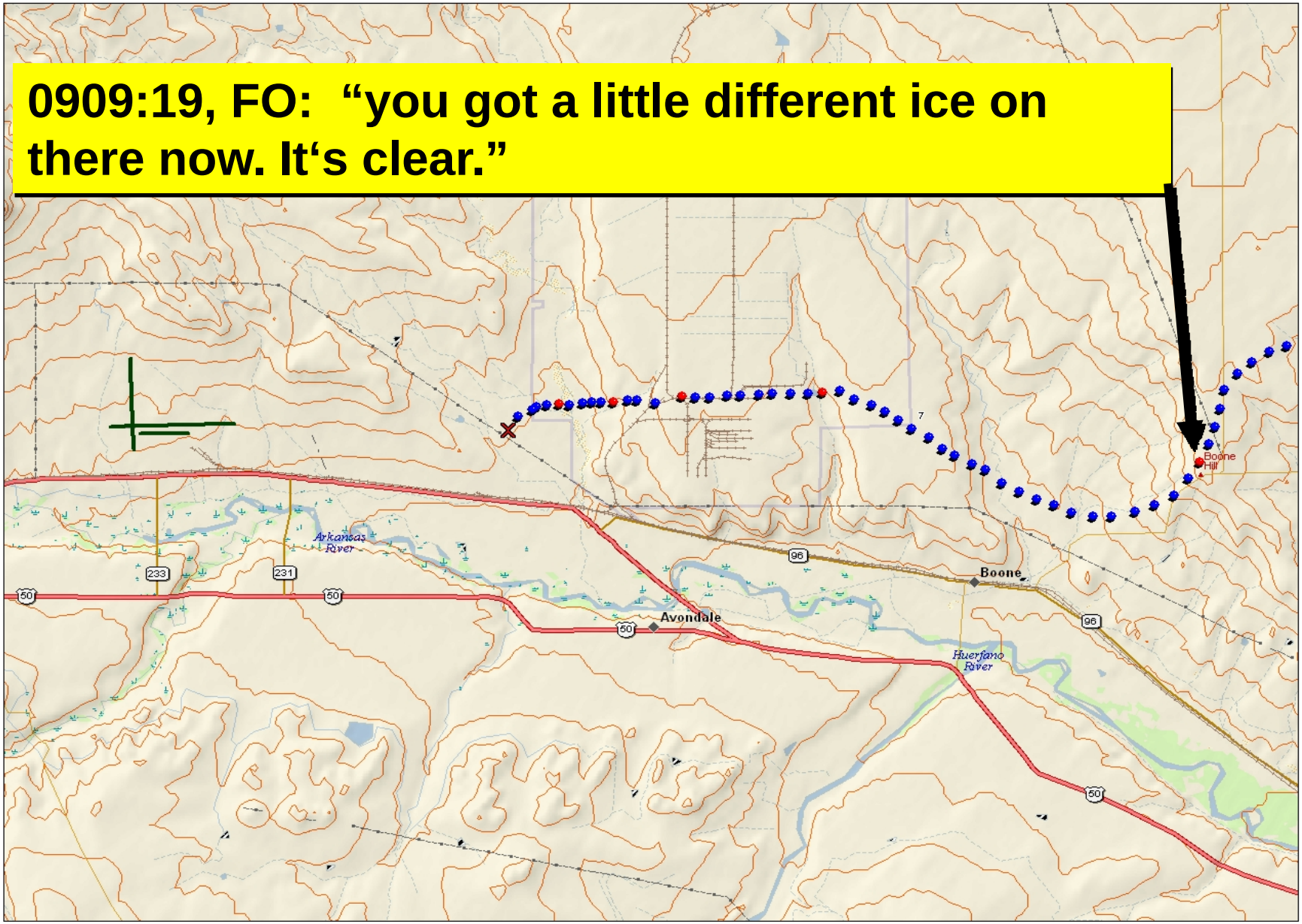
PUB Airport

0906:00
Runway Change

MN (0.0° W)

0 2 4 6 8 10 mi

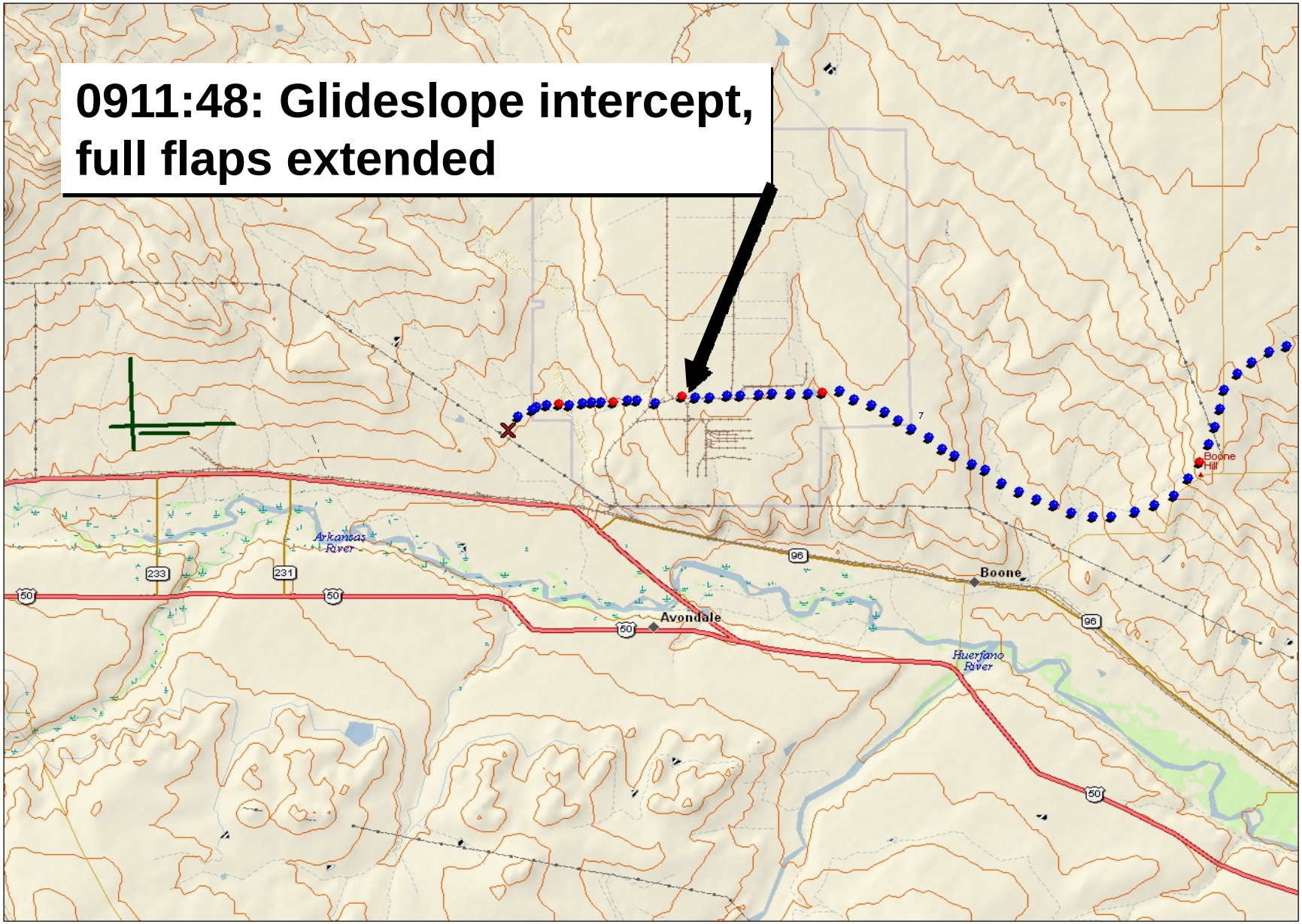
Data Zoom 9-0



MN (0.0° W)

0 1 2 3 4 mi

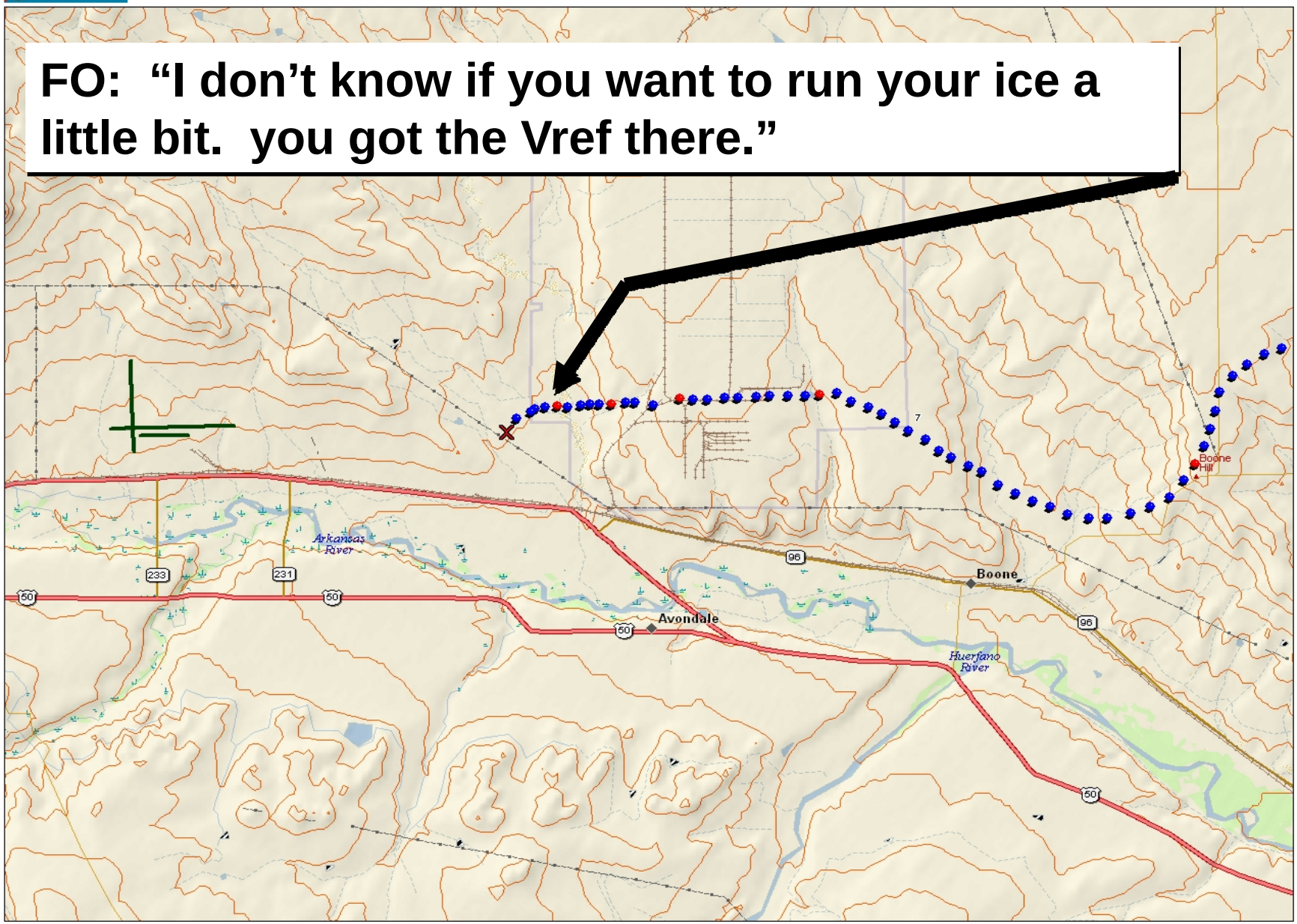
Data Zoom 10-5



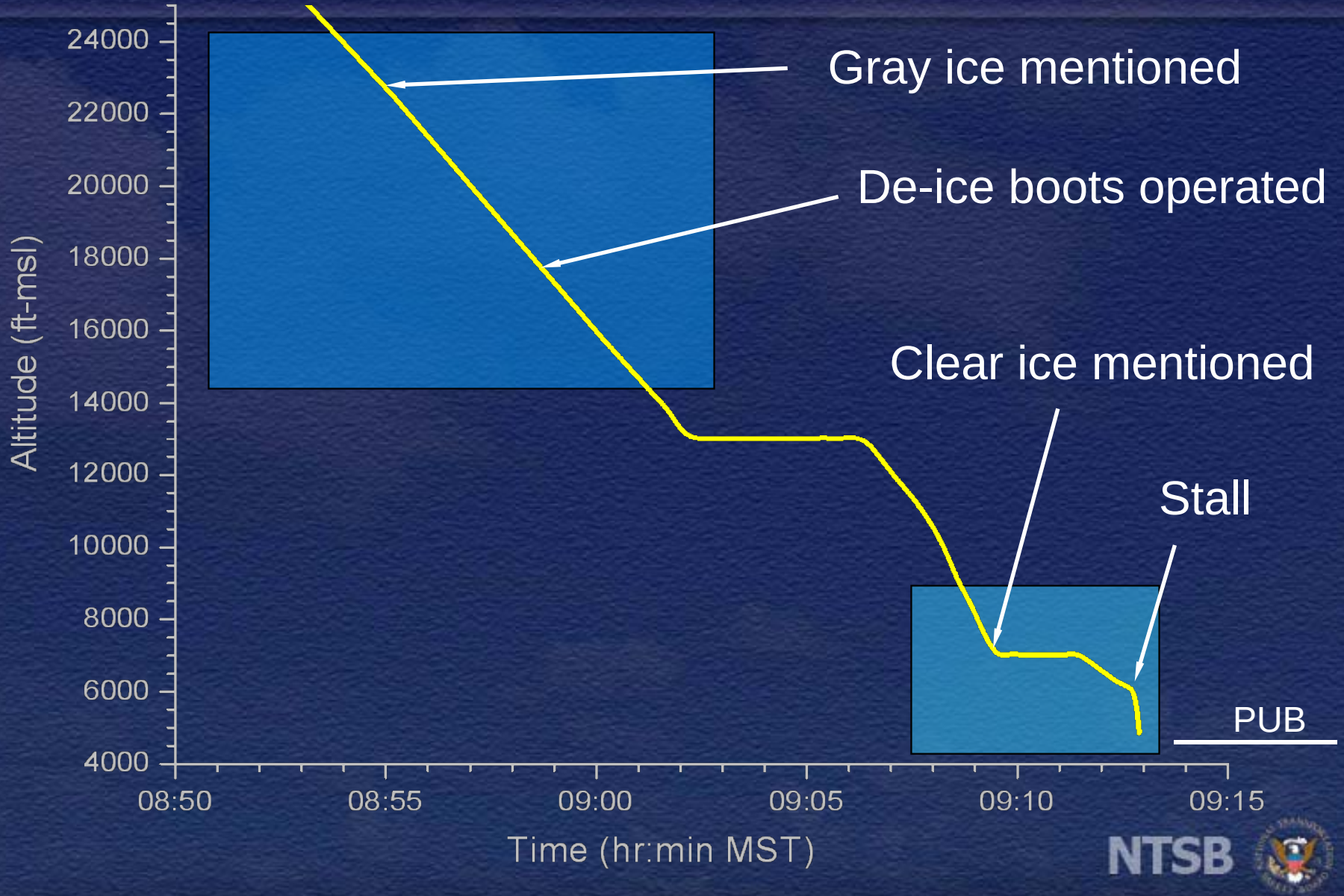
MN (0.0° W)

0 1 2 3 4 mi

Data Zoom 10-5


DeLORME
Topo USA® 5.0
FO: "I don't know if you want to run your ice a little bit. you got the Vref there."
Arkansas River
Boone
Avondale
Huerfano River
Boone Hill
233
231
50
96
Data use subject to license.
© 2004 DeLorme. Topo USA® 5.0.
www.delorme.com
MN (0.0° W)
0 1 2 3 4 mi
Data Zoom 10-5

Two Icing Layers Encountered



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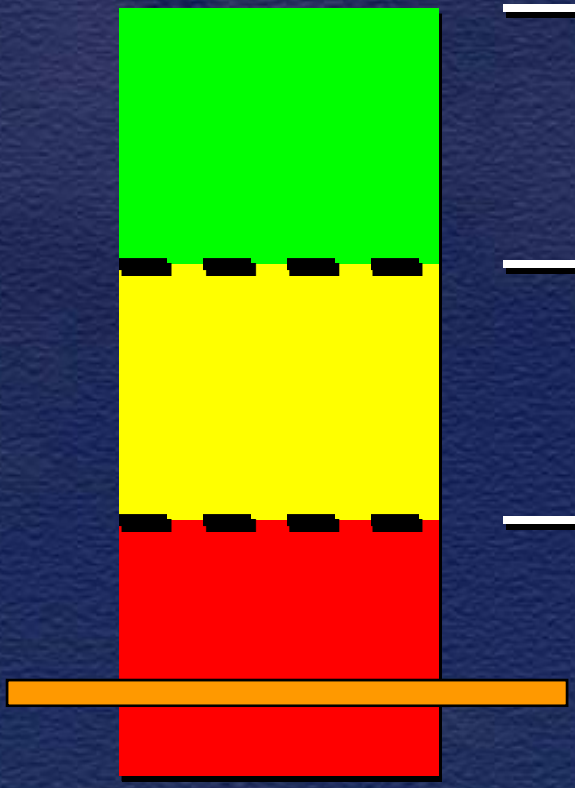
Approach Speeds in Icing



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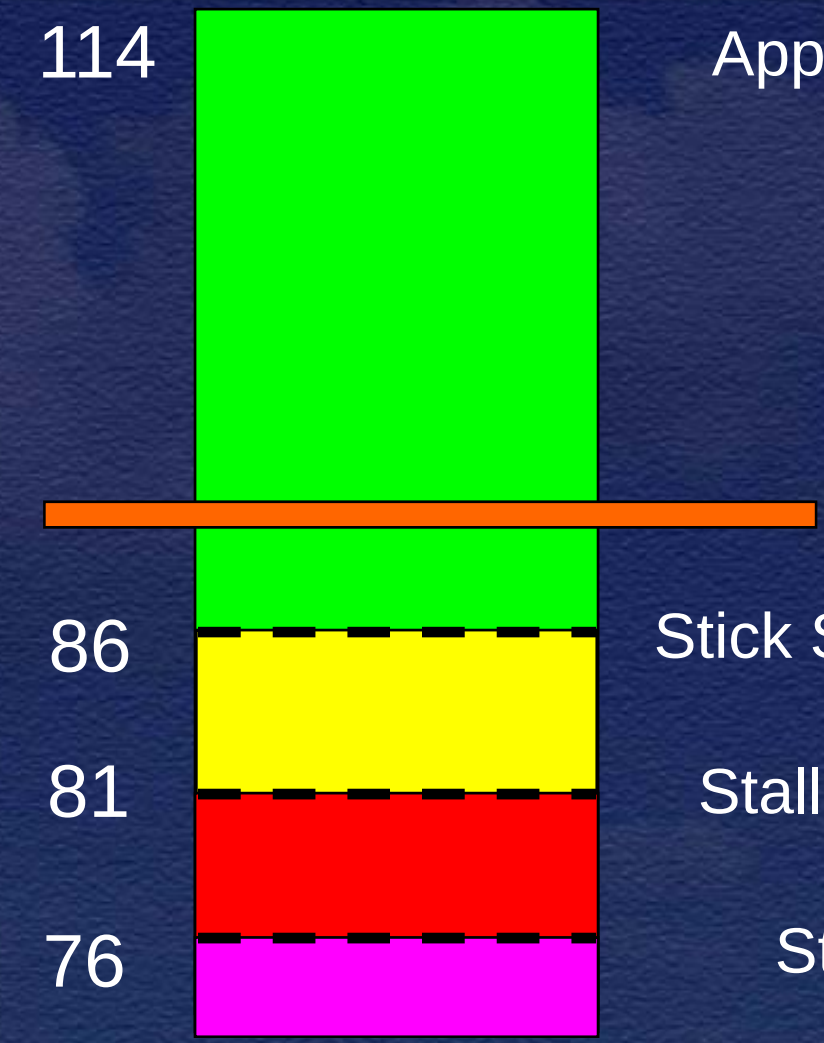
Approach and Stall Speeds



Approach speed in Ice

Accident Approach Speed

Stick Shaker Activation in Ice

Stall Speed in Ice

Stall Speed

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Effect of SLD on ice accretion

Wing leading edge cross section

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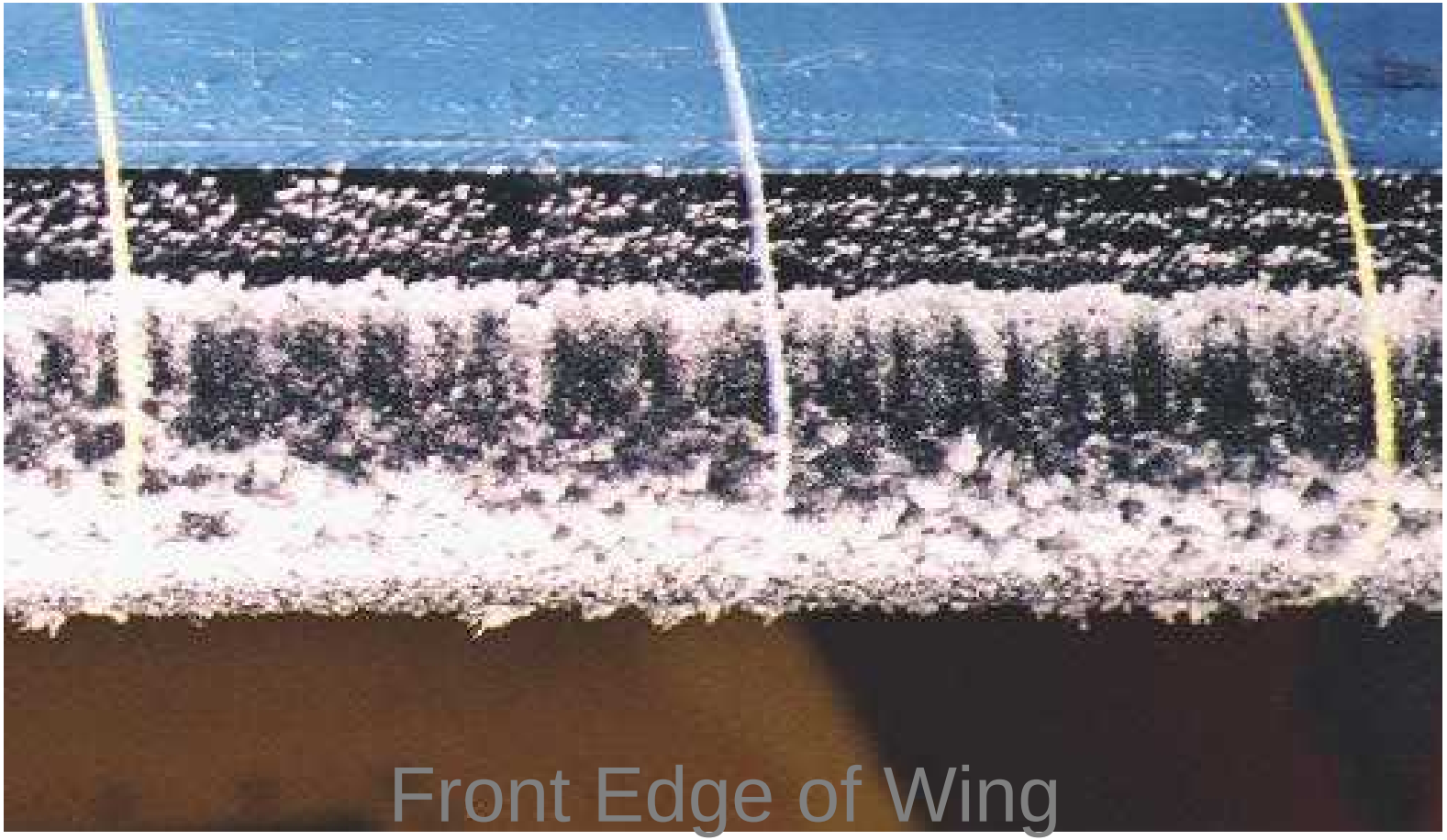
Resultant Ice Shapes



SLD Ice

Probable Cause

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

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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.

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Safety Alert

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National Transportation Safety Board

★ 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 60 years, pilots have been taught to wait for a prescribed accumulation of leading-edge ice before activating the deice boots because of the believed threat of ice bridging.
- In theory, ice bridging 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 known cases where ice bridging has caused an incident or accident, and has investigated numerous incidents and accidents involving a delayed activation of deice boots.
- Ice bridging is extremely rare, if it exists at all.
- Early activation of the deice boots limits the effects of leading-edge ice and improves the operating safety margin.
- Using the autopilot can hide changes in 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 shedding ice.

Need more information?

- Visit the NTSB website at <http://www.ntsb.gov> to access the following documents:
  - Accident brief addressing a non-fatal landing accident of a Cessna 500 on March 17, 2007, in Beverly, Massachusetts (NTSB identification: NYC07LA081).
  - *Crash During Approach to Landing, Circuit City Stores, Inc., Cessna Citation 560, Pueblo, Colorado, February 15, 2006* (NTSB/AAR-07/02).
  - *In-flight Icing Encounter and Uncontrolled Collision with Terrain, Comair Flight 3272, Monroe, Michigan, January 9, 1997* (NTSB/AAR-98/04).
  - NTSB's Most Wanted List icing recommendations: <http://www.ntsb.gov/Recs/mostwanted/air_ice.htm>
- FAA Advisory Circular 25.1419-1A
- Professional Pilot Magazine: "NTSB advises immediate activation of deice boots on entering icing conditions," December 2008 <http://www.propilotmag.com/archives/2008/Dec08/A2_Icing_p1.html>

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