NTSB National Transportation Safety Board

General Aviation Safety NTSB Perspective

NTSB GA Safety Seminar
Challenges of Technically Advanced Aircraft
November 8, 2014

Earl F. Weener, Ph.D.
Member, NTSB

N6529R - B36TC Bonanza

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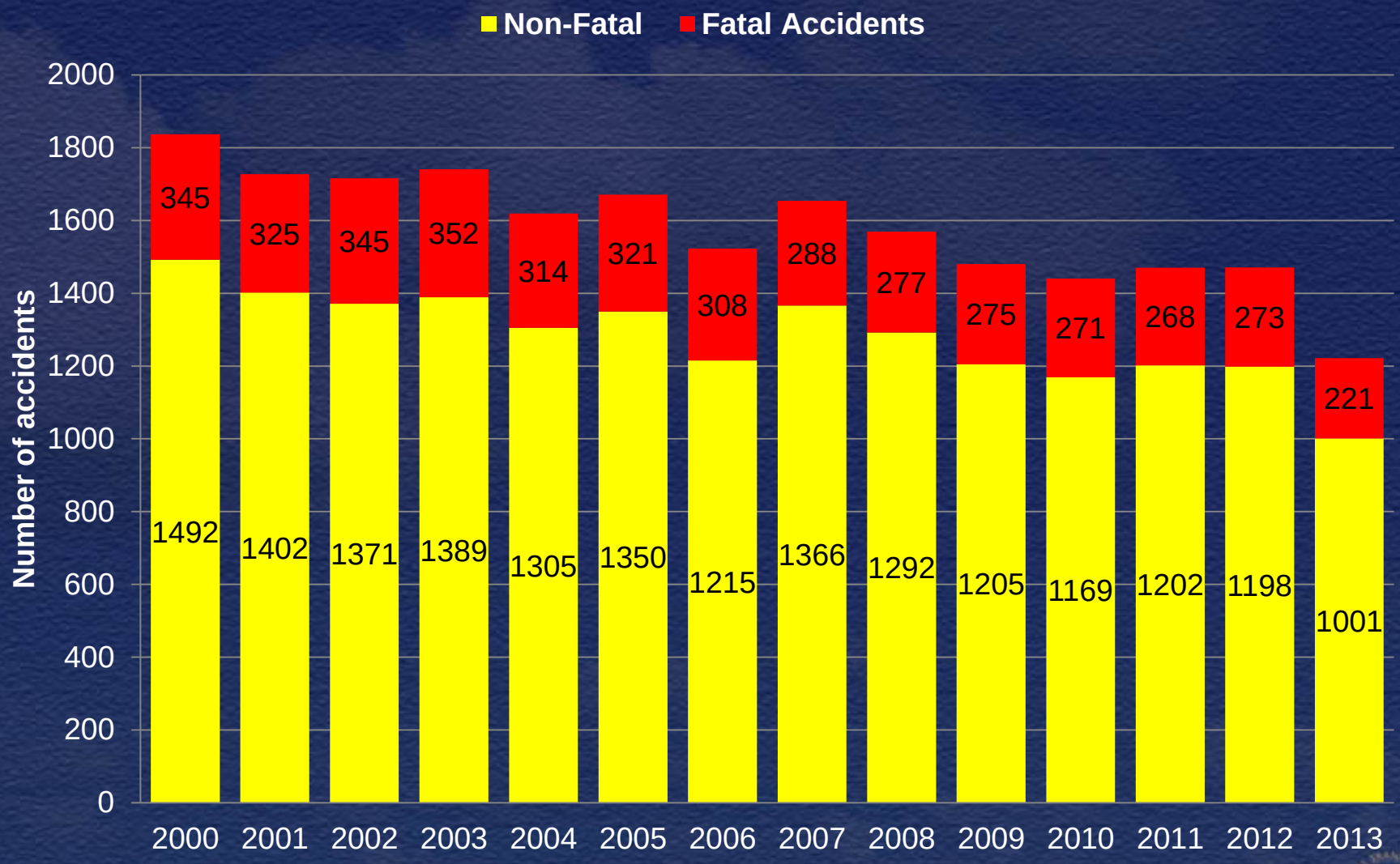
NTSB Mission

The NTSB is an independent US federal agency charged with determining the probable cause(s) of transportation accidents, making recommendations to prevent their recurrence, conducting special studies and investigations, and coordinating resources to assist victims and their families after an accident.

Topics

- General Aviation Accident Trends
- Most Wanted List
- GA Community Activities - JSC
- NTSB Safety Alerts

All GA Accidents



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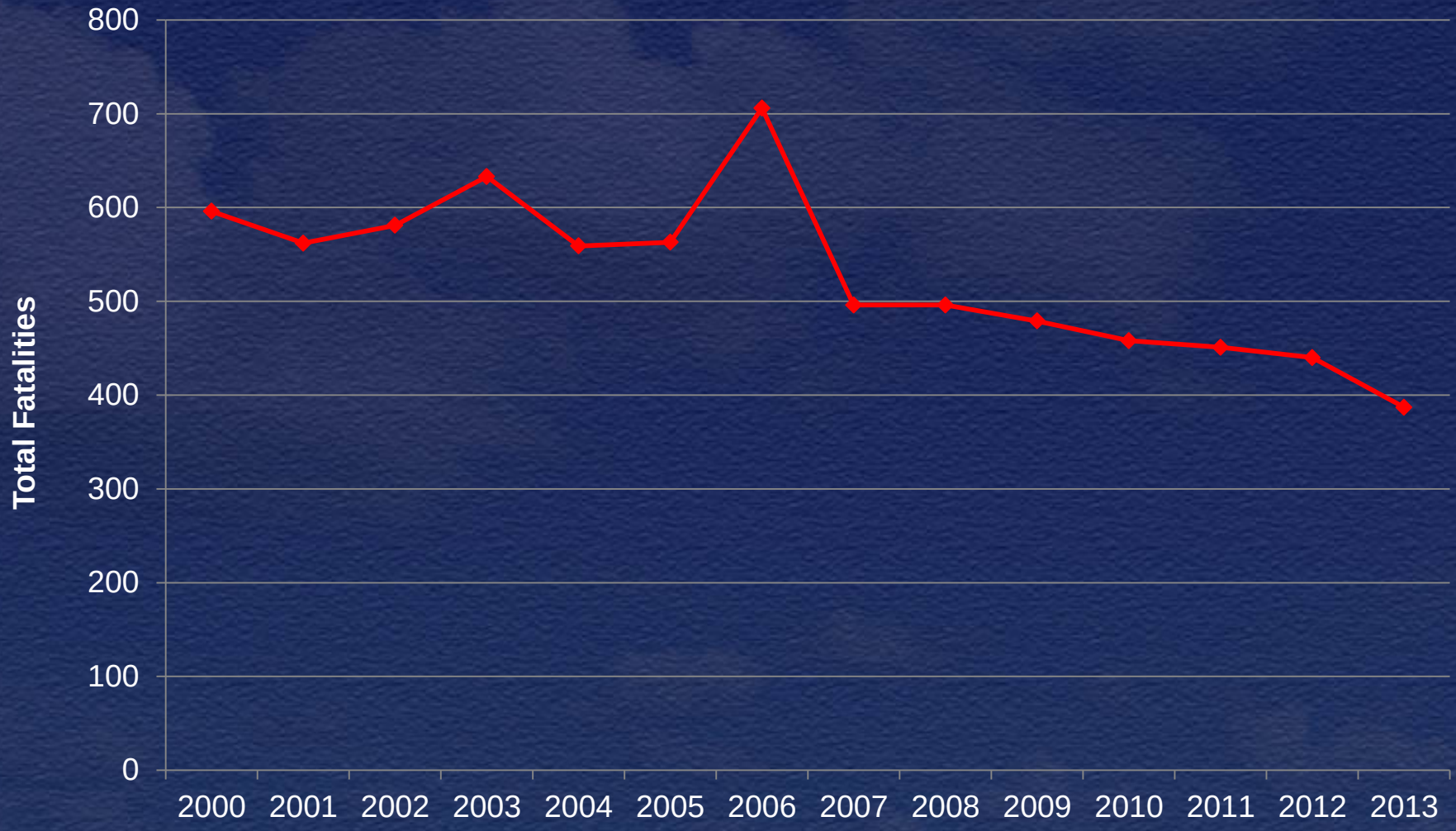
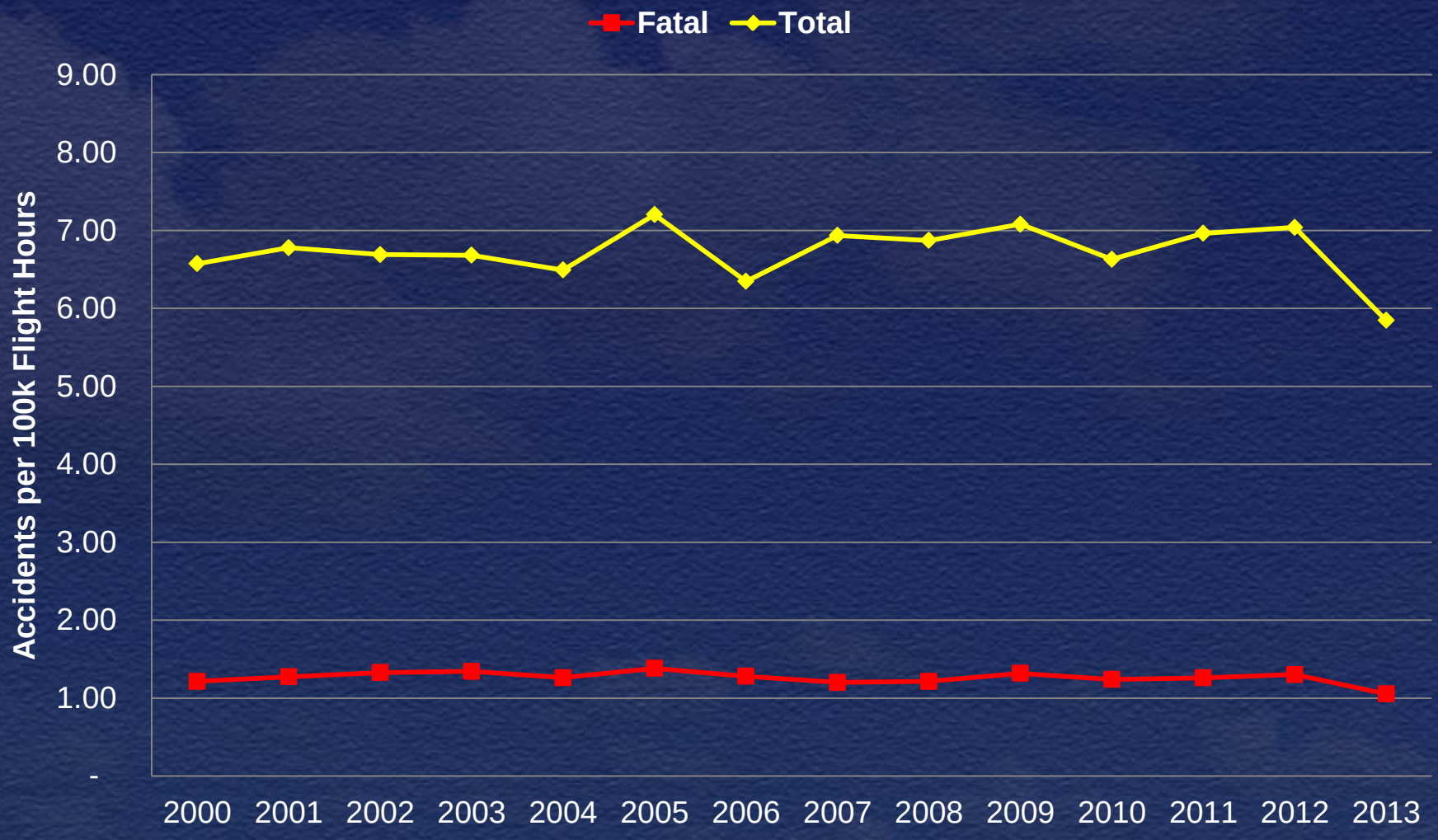
GA Accident-involved Fatalities

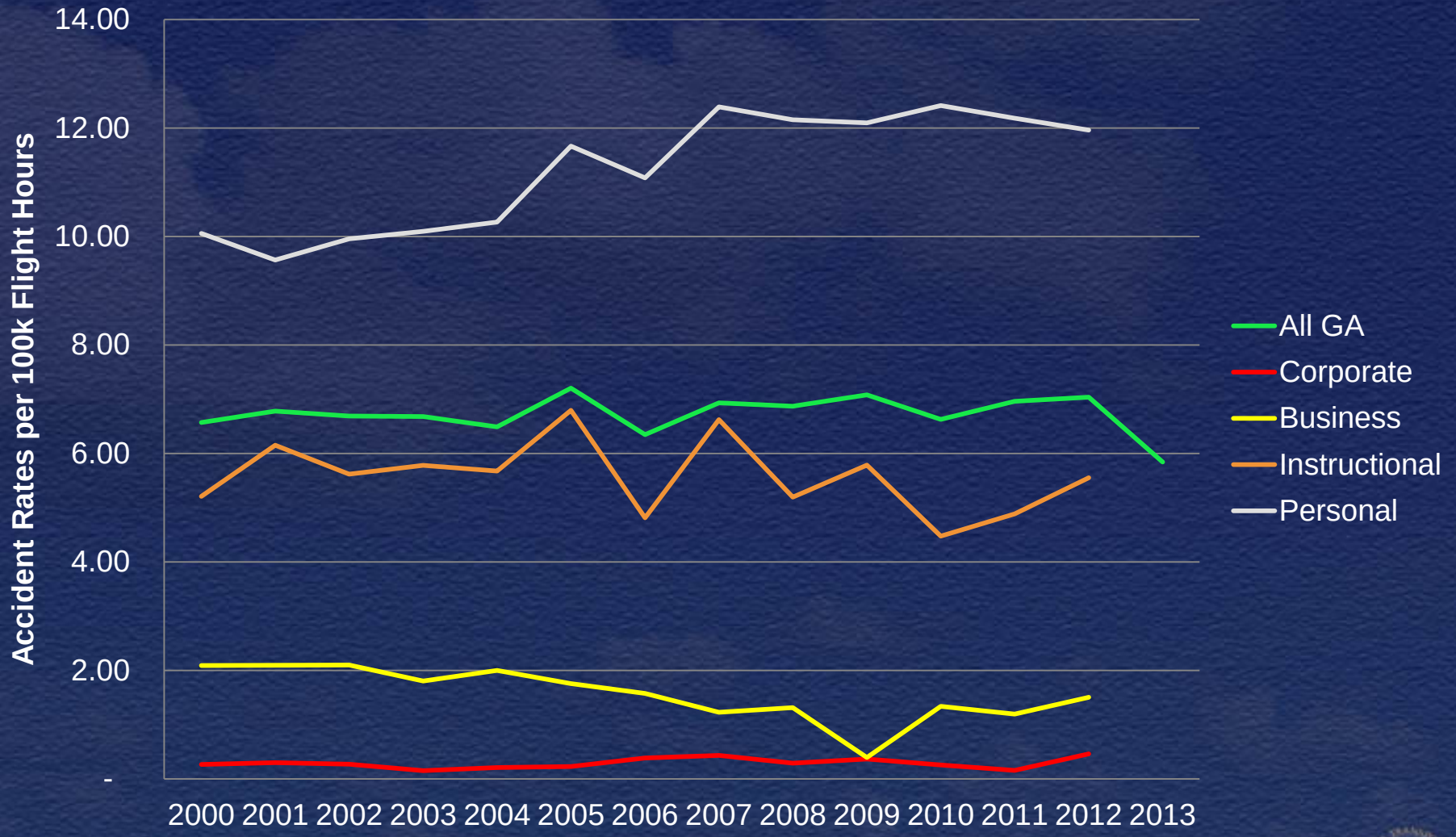


GA Accident Rates



*The 2011 GA Survey is currently not available. FAA is actively engaged in re-calibration efforts and expect to have validated 2011 data published at a later date.

Accident Rates per 100k Flight Hours



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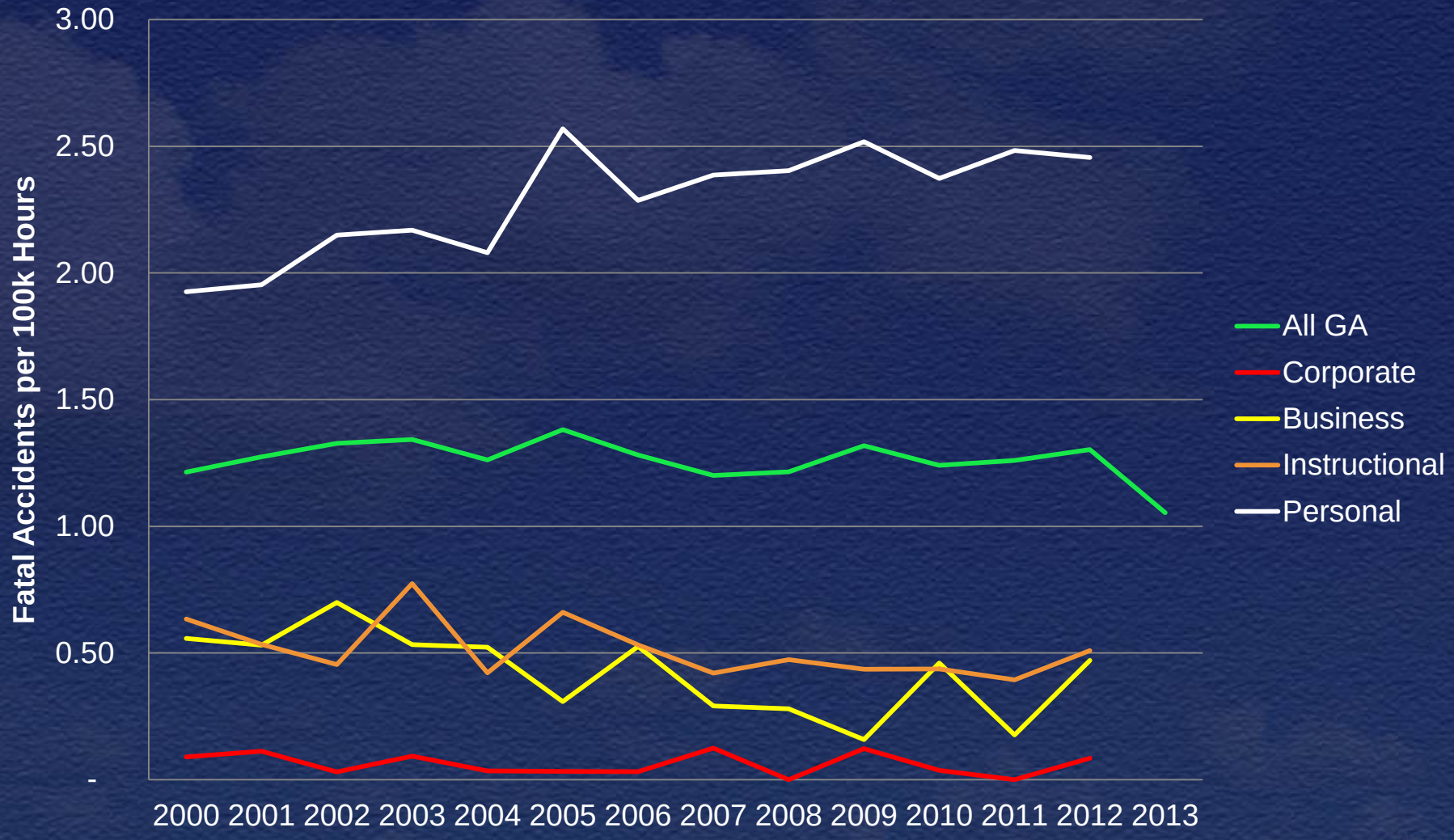
Fatal Accident Rates per 100k Flight Hours



*The 2011 GA Survey is currently not available. FAA is actively engaged in re-calibration efforts and expect to have validated 2011 data published at a later date.

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Defining Fatal Accident Events All Part 91 GA 2008-2012

- Loss of Control in Flight
- System/Component Failure – Powerplant
- Controlled Flight into Terrain
- Collision with Terrain/Object (non-CFIT)
- VFR Encounter with IMC
- System/Component Failure – Non-Powerplant

Topics

- General Aviation Accident Trends
- Most Wanted List
- GA Community Activities - JSC
- NTSB Safety Alerts

NTSB Most Wanted List

- General Aviation: Identify and Communicate Hazardous Weather
- Address Unique Characteristics of Helicopter Operations
- Advance Passenger Vessel Safety
- Eliminate Distraction in Transportation
- Eliminate Substance-Impaired Driving
- Enhance Pipeline Safety
- Improve Fire Safety in Transportation
- Implement Positive Train Control Systems
- Promote Operational Safety in Rail Mass Transit
- Strengthen Occupant Protection in Transportation

Why GA on the Most Wanted List?

- NTSB investigates approximately 1500 GA accidents per year
- Overall GA accident rate flat
  - Has not improved over the last decade
  - Airline accident rate decreased more than 80%
- Personal flying accident rate
  - Increased 20% over last 10 years
  - Fatal rate increased 25% over that period

- ***GA safety needs attention***

GA – 2014 Most Wanted List Item

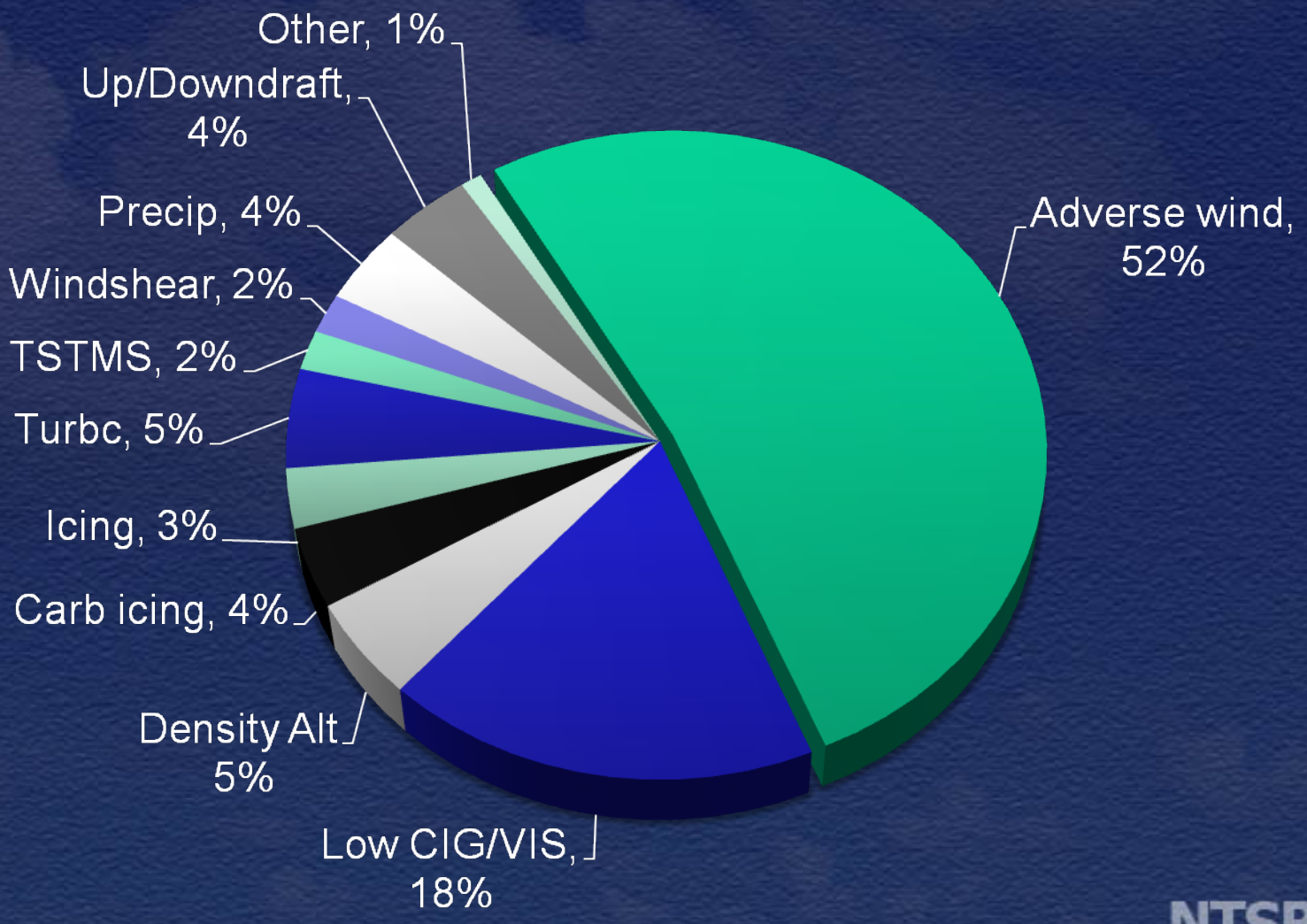
Identify and communicate hazardous weather

- Focus areas
  - Creation of weather information and advisories
  - Collection and dissemination of weather information
  - Pilot training and operations

Why focus on weather?

- Weather plays a major role in GA accidents and incidents
- Most weather related accidents and incidents are preventable

Part 91 Weather Related Accidents 2007-2009



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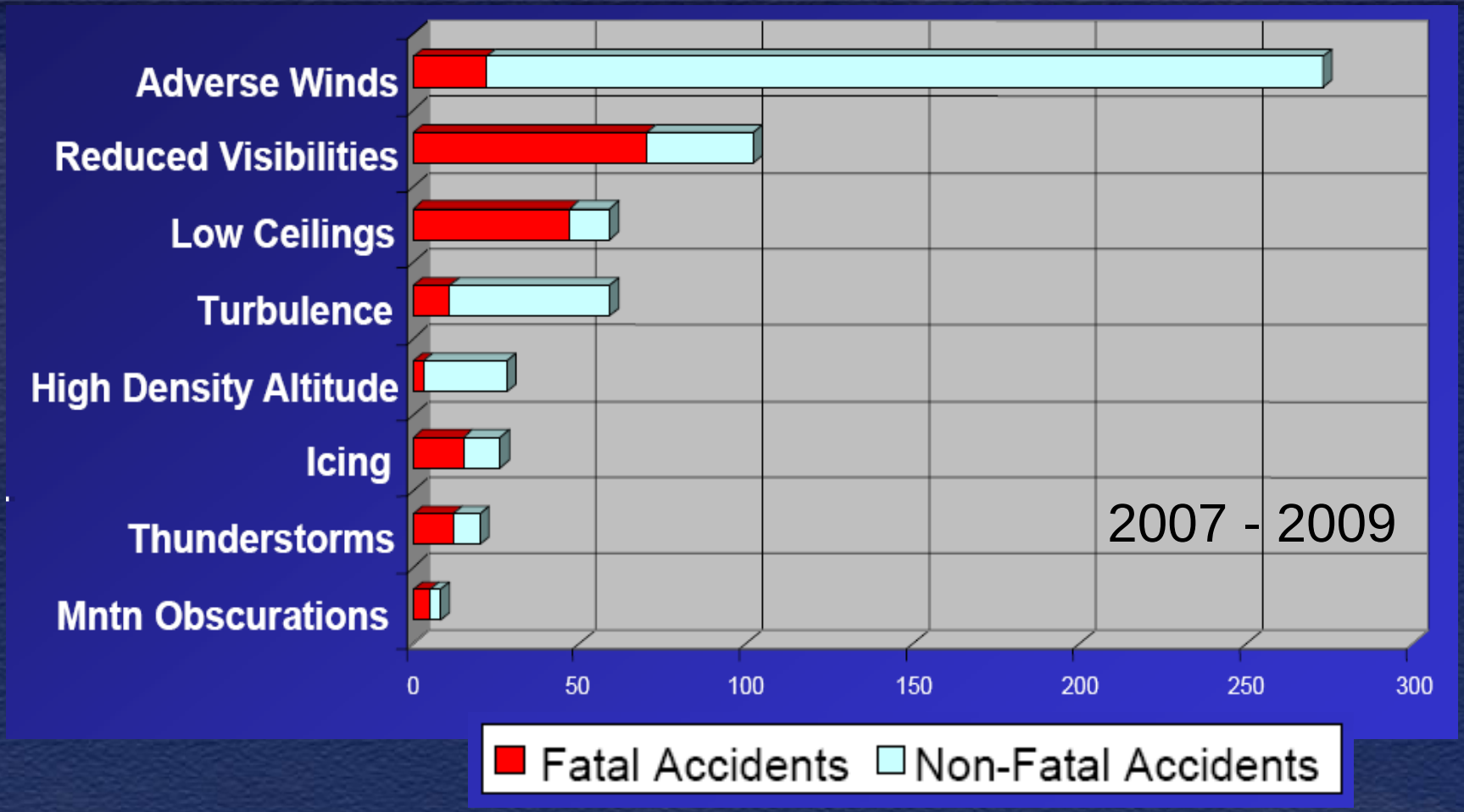
Weather Related Accidents



Weather related accident categories can have high fatality rates!

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Areas of Concern

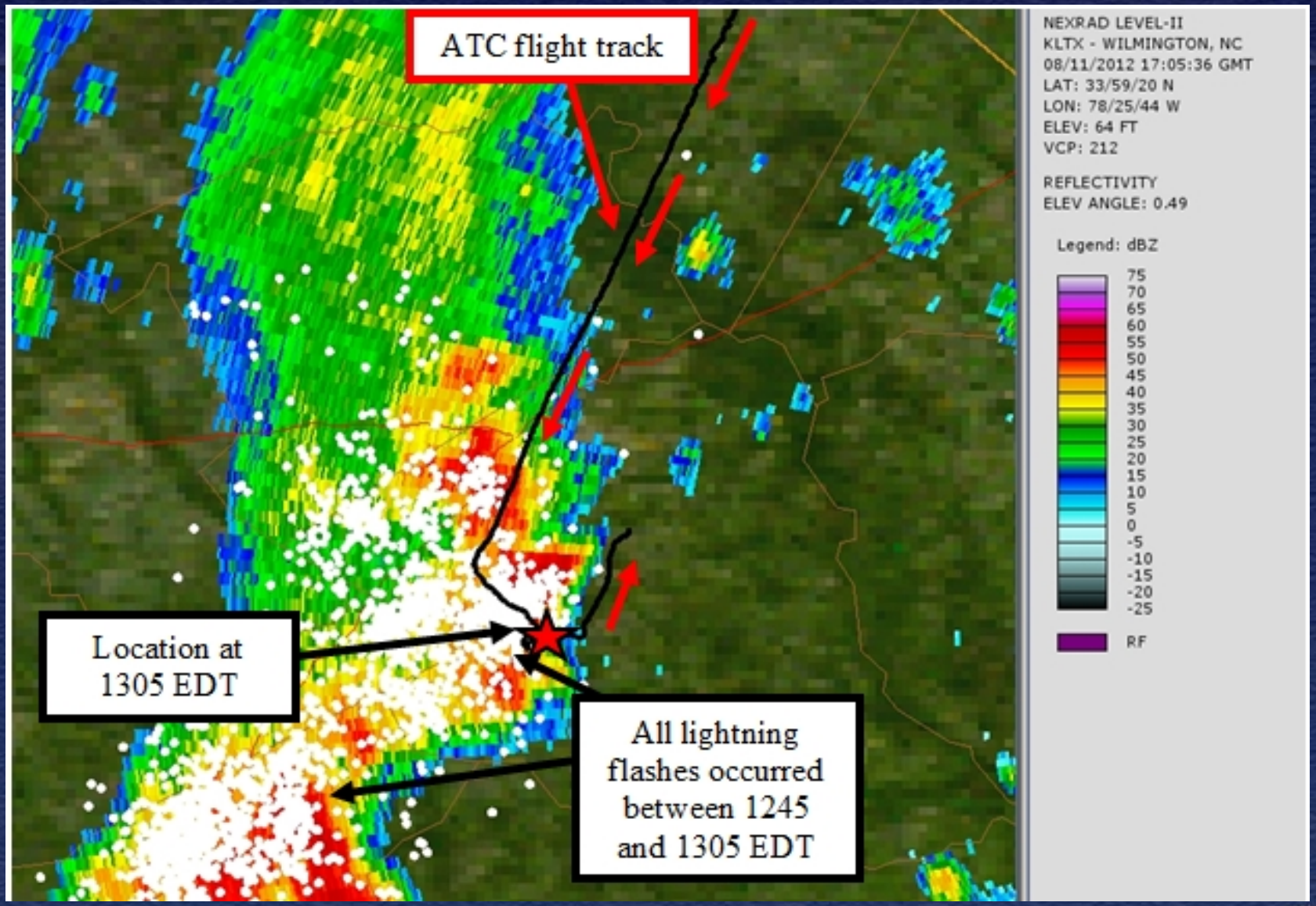
- The overall ATC/pilot/met culture
- Wx training for ATC and pilots
- NWS consistency in aviation information/products
- PIREPs

ERA12LA500

Beech V35B, N11JK
Effingham, SC
August 11, 2012

- IFR flight
- Weather briefing obtained/ flight plan filed
- Non-fatal

KFLO 111730Z 22008G25KT 1 3/4SM +RA BR FEW033 BKN049 22/20 A2997 RMK AO2 PK WND 26033/1714 RAB14 P0008=


ATC flight track
Location at 1305 EDT
All lightning flashes occurred between 1245 and 1305 EDT
NEXRAD LEVEL-II
KLTX - WILMINGTON, NC
08/11/2012 17:05:36 GMT
LAT: 33/59/20 N
LON: 78/25/44 W
ELEV: 64 FT
VCP: 212
REFLECTIVITY
ELEV ANGLE: 0.49
Legend: dBZ
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
RF


Effingham
Florence
Timmonsville
Darlington
Witherspoon Island
Byrds Island
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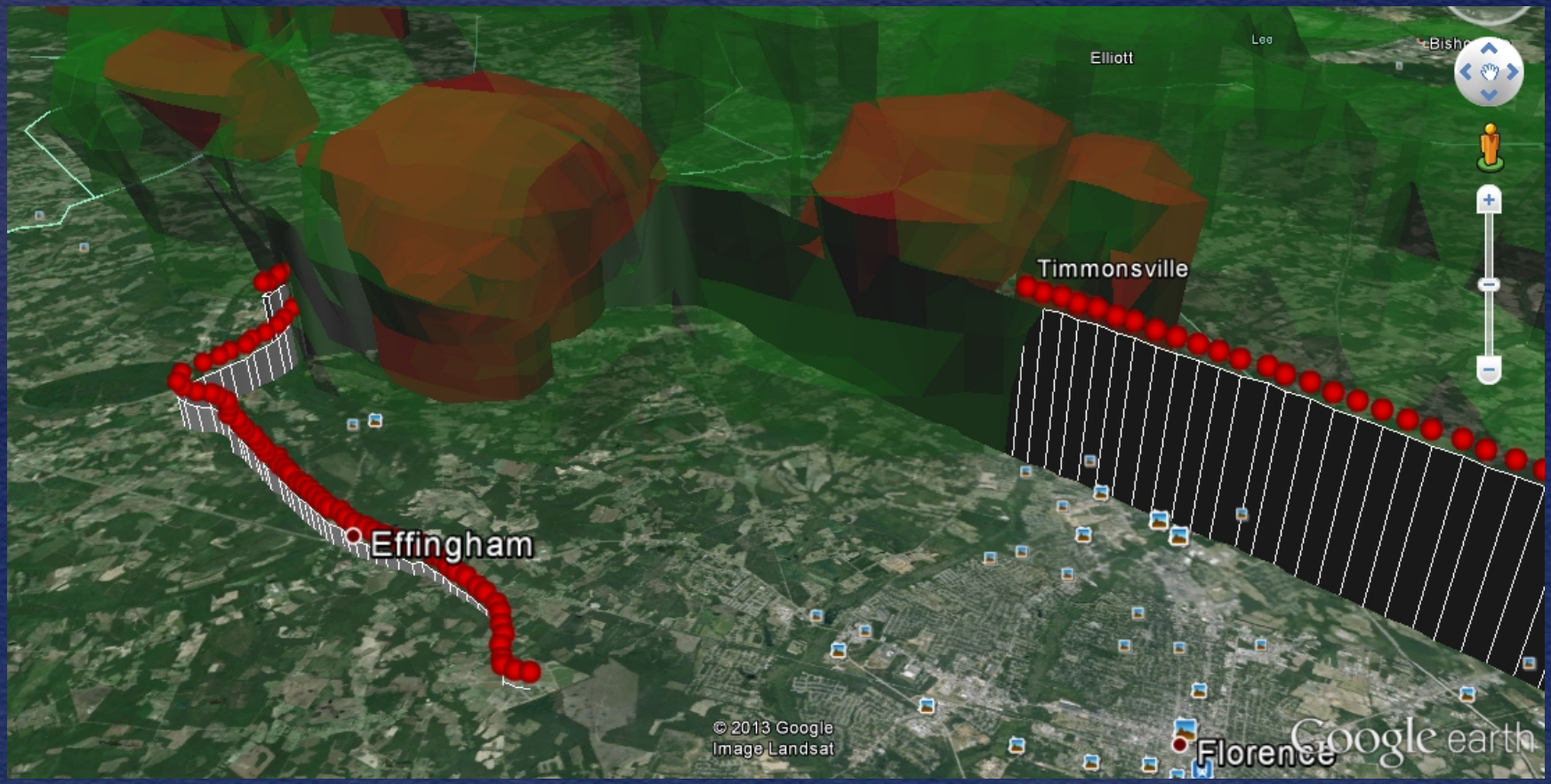
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Timmonsville
Effingham
Florence
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Timmonsville
Darlington
Florence
Effingham
Coward
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CEN12FA108
Piper PA-32-260, N3590T
Near Bryan, TX
December 19, 2011

- IFR flight
- Weather briefing – unknown
- Five fatalities

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Main Wreckage, Forward View

CEN12FA108

Main Wreckage, Left Side View

CEN12FA108

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Main Wreckage, Right Side View

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Left Wing

CEN12FA108

Bryan Texas Accident (CEN12FA108)

- History of Flight
  - December 11, 2011
  - Cross country flight with four passengers
    - Jackson, MS to Waco, TX
  - Level cruise at 8,000 ft.
  - Pilot informed ATC he was diverting around an area of thunderstorms
  - Last reported he was in “bad” weather and was going to try to get out of it.
  - Radio and radar contact lost
  - Pilot and four passenger fatalities

Bryan Texas Accident (Cont)

- Aircraft
  - Piper PA-32-260 (Cherokee Six)
    - 6,125 hrs. on airframe
  - Postcrash examination
    - no preimpact anomalies of engine or systems
- Pilot
  - Private, SEL, Instrument rating
  - Total time 392 hrs.
  - 14 hrs. actual instruments

Bryan Texas Accident (cont)

- Wreckage
  - Main wreckage consisted of airplane except for
    - Left wing, vertical stabilizer, rudder, and right wing tip fuel tank
    - Wreckage spread over path a half mile long and 200 ft. wide
  - Left wing spar showed wing failed in positive overload

Bryan Texas Accident (Cont)

- Weather conditions SIGMET
  - Potential for
    - heavy rain showers,
    - thunderstorms,
    - wind in excess of 45 knots,
    - clear air turbulence,
    - low-level wind shear
  - Pilot relying on Garmin 696 with XM weather – NEXRAD mosaic

Bryan Texas Accident (Cont)

- NEXRAD data likely showed pilot clear of precipitation
- Near end of flight, flew into rapidly developing rain shower
- Last three updates were at least 6, 7, and 8 minutes old when displayed

Pilot's On-Board Weather Image

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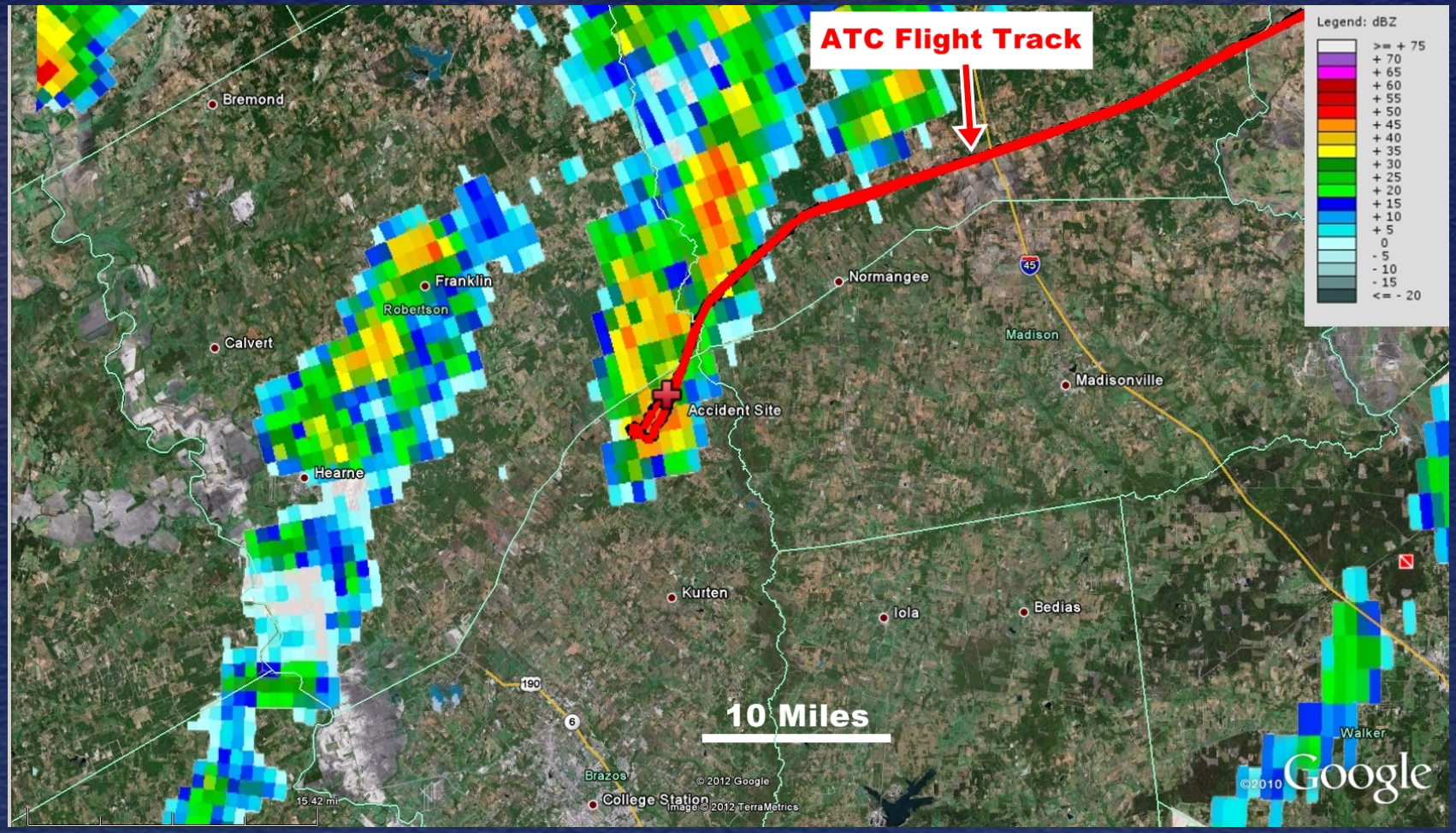
Actual Flight Path



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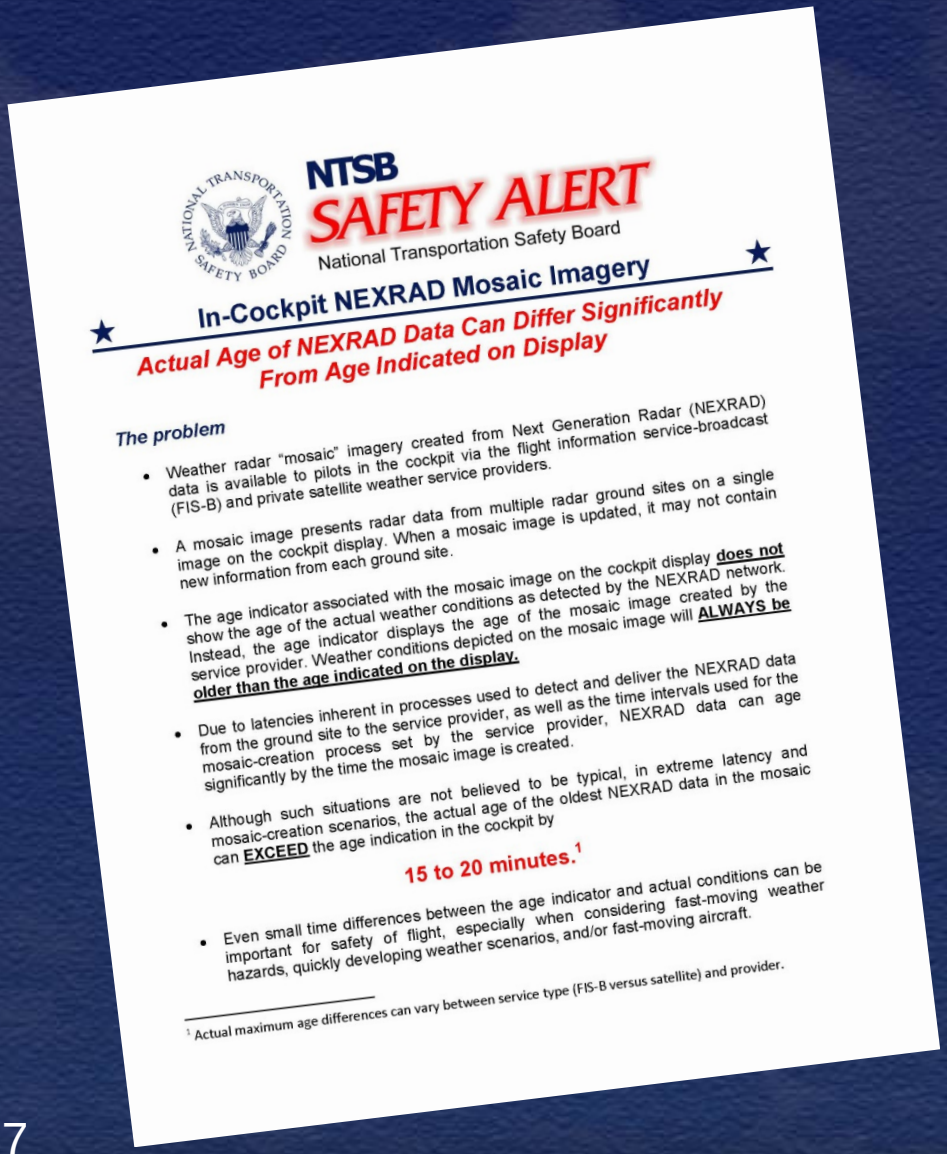
Bryan Texas Accident (Cont)

- NEXRAD displayed age indicator - time of mosaic image compilation/creation
- Not all components of mosaic are updated
- Oldest data can exceed age indication by 15 to 20 minutes in extreme cases

NEXRAD mosaic shows where weather WAS, not where it IS

SA - In-Cockpit NEXRAD Imagery



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In-Cockpit NEXRAD Mosaic Imagery

Actual Age of NEXRAD Data Can Differ Significantly From Age Indicated on Display

The problem

- Weather radar "mosaic" imagery created from Next Generation Radar (NEXRAD) data is available to pilots in the cockpit via the flight information service-broadcast (FIS-B) and private satellite weather service providers.
- A mosaic image presents radar data from multiple radar ground sites on a single image on the cockpit display. When a mosaic image is updated, it may not contain new information from each ground site.
- The age indicator associated with the mosaic image on the cockpit display **does not** show the age of the actual weather conditions as detected by the NEXRAD network. Instead, the age indicator displays the age of the mosaic image created by the service provider. Weather conditions depicted on the mosaic image will **ALWAYS be older than the age indicated on the display.**
- Due to latencies inherent in processes used to detect and deliver the NEXRAD data from the ground site to the service provider, as well as the time intervals used for the mosaic-creation process set by the service provider, NEXRAD data can age significantly by the time the mosaic image is created.
- Although such situations are not believed to be typical, in extreme latency and mosaic-creation scenarios, the actual age of the oldest NEXRAD data in the mosaic can **EXCEED** the age indication in the cockpit by

15 to 20 minutes.[1]

- Even small time differences between the age indicator and actual conditions can be important for safety of flight, especially when considering fast-moving weather hazards, quickly developing weather scenarios, and/or fast-moving aircraft.

[1] Actual maximum age differences can vary between service type (FIS-B versus satellite) and provider.

"…the actual age of the oldest NEXRAD data in the mosaic can EXCEED the age indication in the cockpit by 15 to 20 minutes."

Available on www.ntsb.gov

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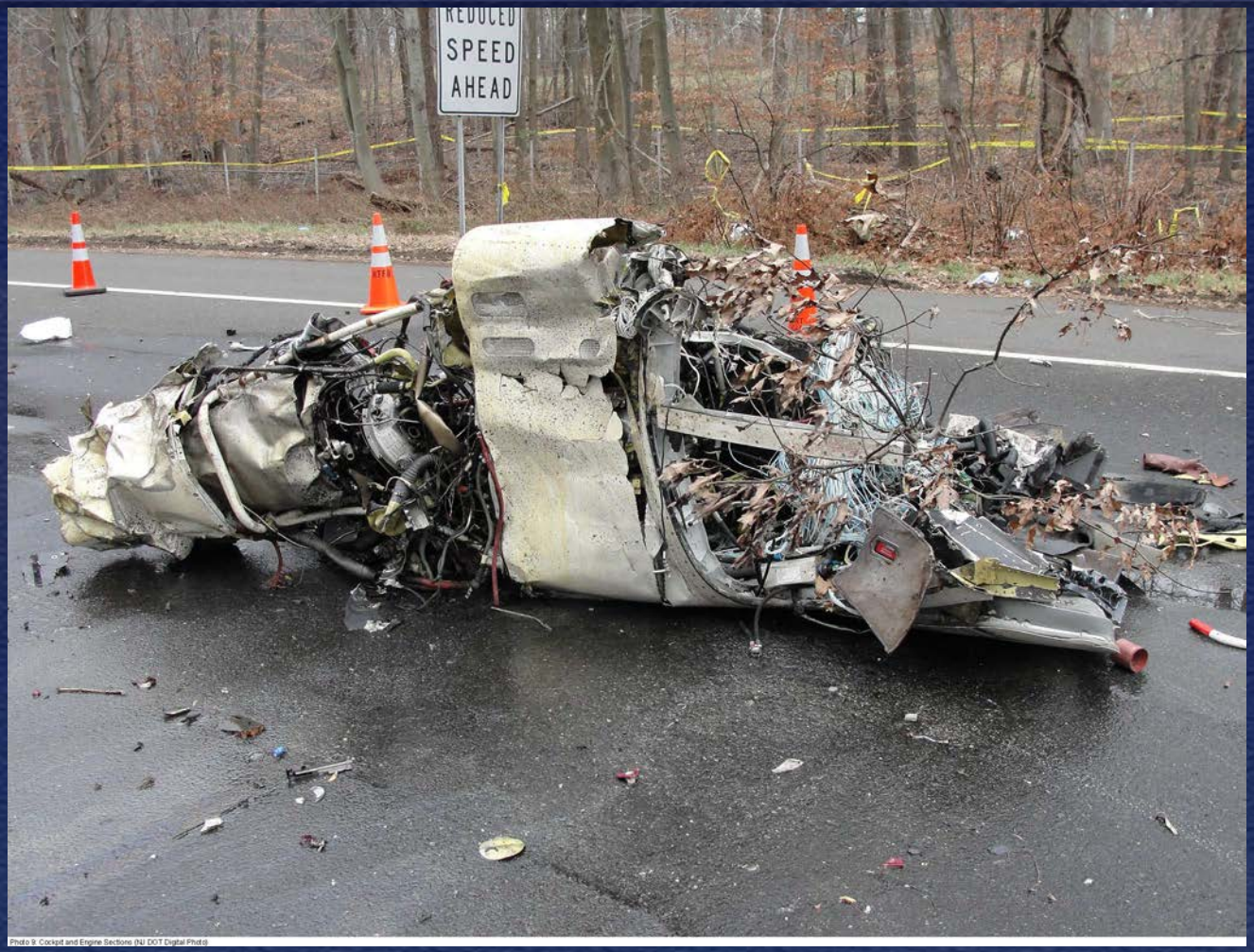
ERA12FA115

- Socata TBM 700 N731CA
- Morristown, NJ
- December 20, 2011

IFR
General Aviation
Part 91 Personal Flight
5 Fatalities

ERA12FA115



Cockpit and Engine Sections

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ERA12FA115

Outboard Section Right Wing

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ERA12FA115

Left Horizontal Stabilizer and Elevator,
Inboard Section Right Horizontal Stabilizer

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ERA12FA115

Deice System Panel

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ERA12FA115

- Aircraft
  - Socata TBM 700
  - Manufactured 2005
  - Standard Airworthiness Certificate
  - Annual Inspection July 2011
  - 725 hr Estimated Total Time one month before accident
  - No evidence of pre-accident mechanical malfunction or anomaly

ERA12FA115

- Pilot
  - Age 45
  - Private Pilot Certificate
    - SEL, Instrument Ratings
    - Approximately 1400 Total Time
  - TBM 700 two day recurrent training
    - November 2011
    - November 2010
  - Personal log books not found

ERA12FA115

- History of flight
  - 0950 departure KTEB for KPDK
    - IFR flight plan filed via DUATS
    - No record of weather briefing
  - During climb-out at 8,000 ATC advised
    - Light rime icing at 14,000 ft
    - Moderate rime icing 15,000 to 17,000 ft
  - At 17,800 ft flight turned 70 deg left, entered descent - In-flight breakup

ERA12FA115

- Probable Cause:
  - The airplane's encounter with unforecasted severe icing conditions that were characterized by high ice accretion rates and the pilot's failure to use his command authority to depart the icing conditions in an expeditious manner, which resulted in a loss of airplane control.

ERA12FA115

- Meteorological Information
  - Area Forecast - no mention of icing
  - AIRMET ZULU at 0645
    - Moderate icing freezing level to FL180
  - AIRMET ZULU at 0945
    - Moderate icing freezing level to FL200
  - Many PIREPS of moderate to severe icing over general area
  - ***No record of accident pilot briefing***

Pilot Reports - PIREPS

- PIREPs are a critical source of aviation weather information
- PIREPs allow ATC and meteorologists to keep all pilots aware of weather hazards
- **ALL** PIREPs (including *"null"* and *"light"* reports) are operationally significant to an aviation meteorologist !
- PIREPs can communicate better flying conditions, help reduce AIRMET size, and prevent weather advisories from "crying wolf"
- PIREPs can help warn pilots of conditions that may be worse than forecasted

What should pilots do?

- YOUR reports provide the BEST situational information on aviation weather for other pilots, ATC, and meteorologists
- Give detailed PIREP's, especially when reporting hazardous weather conditions, to ATC or Flight Watch
  - Report weather that does vary greatly from what is forecast
  - Report weather that does not vary greatly from what is forecast
  - Provide routine reports even if it's severe clear and no turbulence

What should pilots do?

- To ensure your report gets to those who need it, begin communication with “I want to make a PIREP”
- Report icing and turbulence encounters in accordance with FAA criteria:
  - Icing (sections 7-1-21 and 7-1-22 in AIM)
  - Turbulence (section 7-1-23 in AIM)

AOPA PIREP resource:

http://flash.aopa.org/asf/skyspotter/swf/flash.cfm

Most Wanted List - Summary

- Identifying and Communicating Hazardous Weather - Most Wanted List
- Multi-year/on going effort
- Most weather related accidents and incidents are preventable

Topics

- General Aviation Accident Trends
- Most Wanted List
- GA Community Activities - JSC
- NTSB Safety Alerts

GA Joint Steering Committee

Adapt the successful CAST model

- Cooperative Government and Industry
- Data driven risk management
- Consensus decision-making
- Voluntary commitment
- Implementation focused

The GAJSC is a means to…

- *Focus limited Government/Industry resources to data-driven risks and solutions*

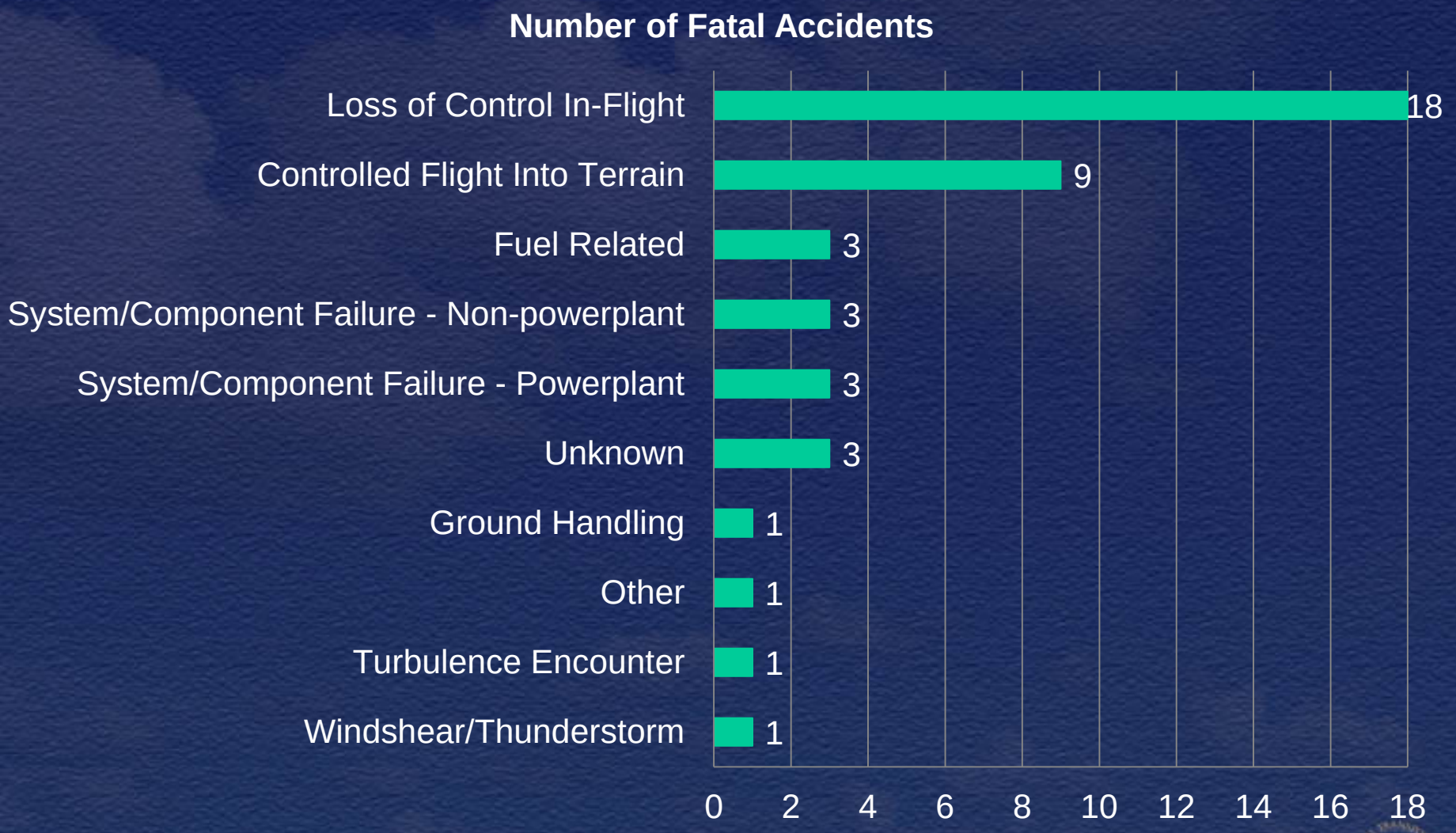
GA JSC Organization

- Steering Committee
  - Co-chaired by FAA and AOPA
- Safety Analysis Team
  - Co-chaired by FAA and GAMA
- Working Group(s)
  - Composed of subject matter experts as appropriate and relevant to topic

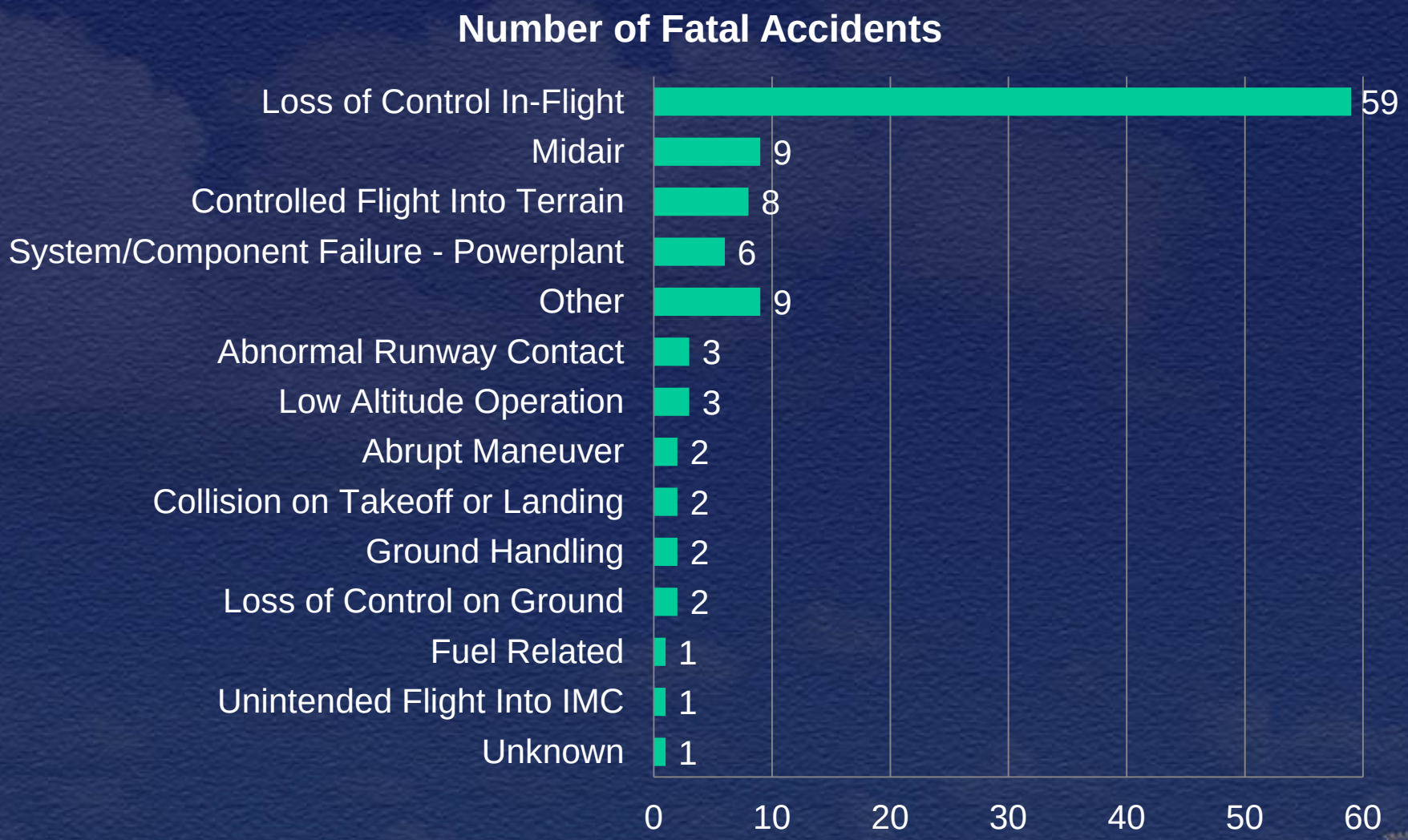
GA JSC Participants

- Government
  - FAA, NASA, NTSB, NWS
- Industry/Operational Community
  - GAMA, EAA, NBAA, NATA, AOPA, SAFE, NAFI, FSF, UAA, Pegasus, SAMA, Insurance, Academia…

Business Flying, 2008-2013



Instructional Flying, 2008-2013



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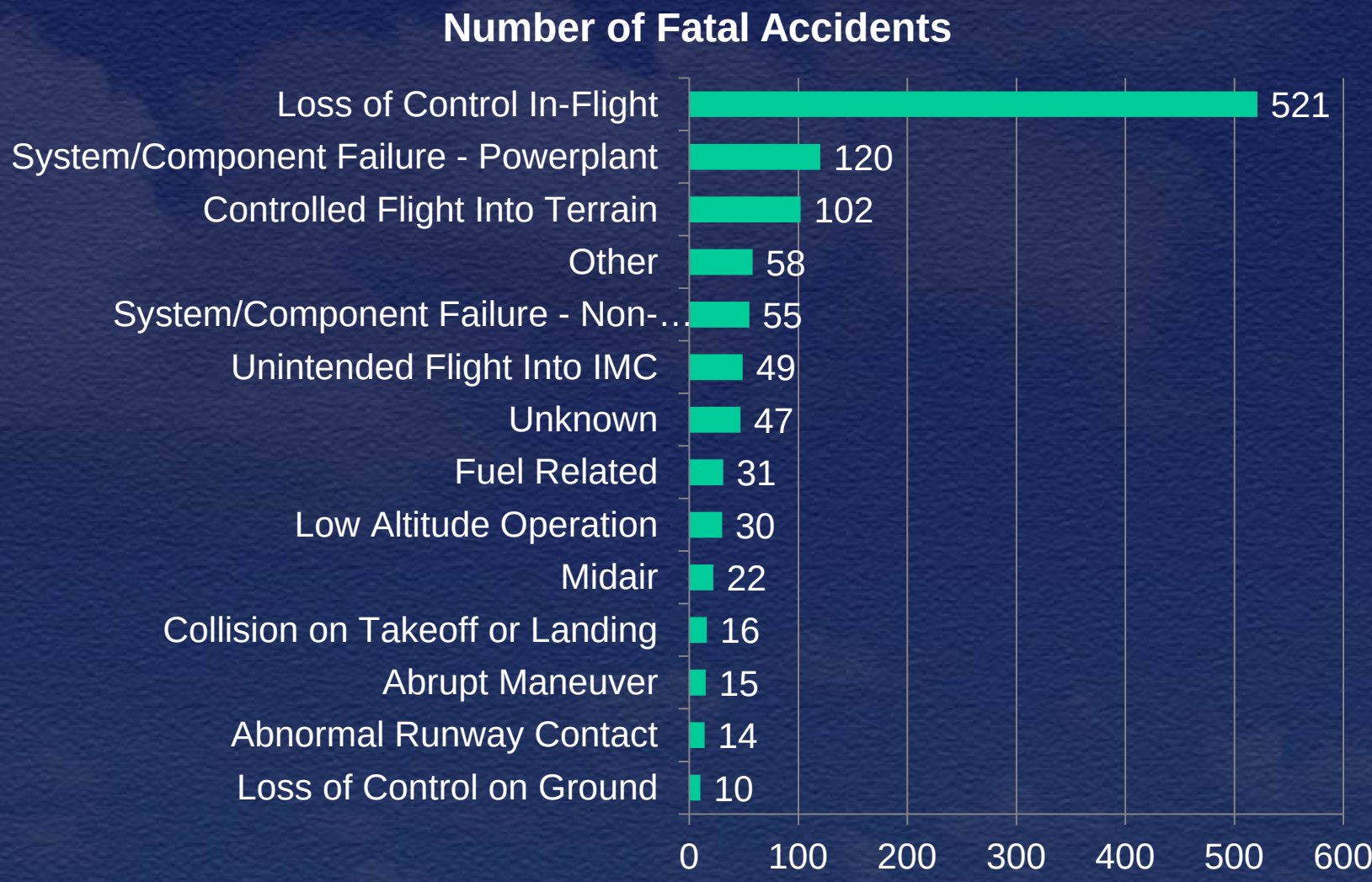
Personal Flying, 2008-2013



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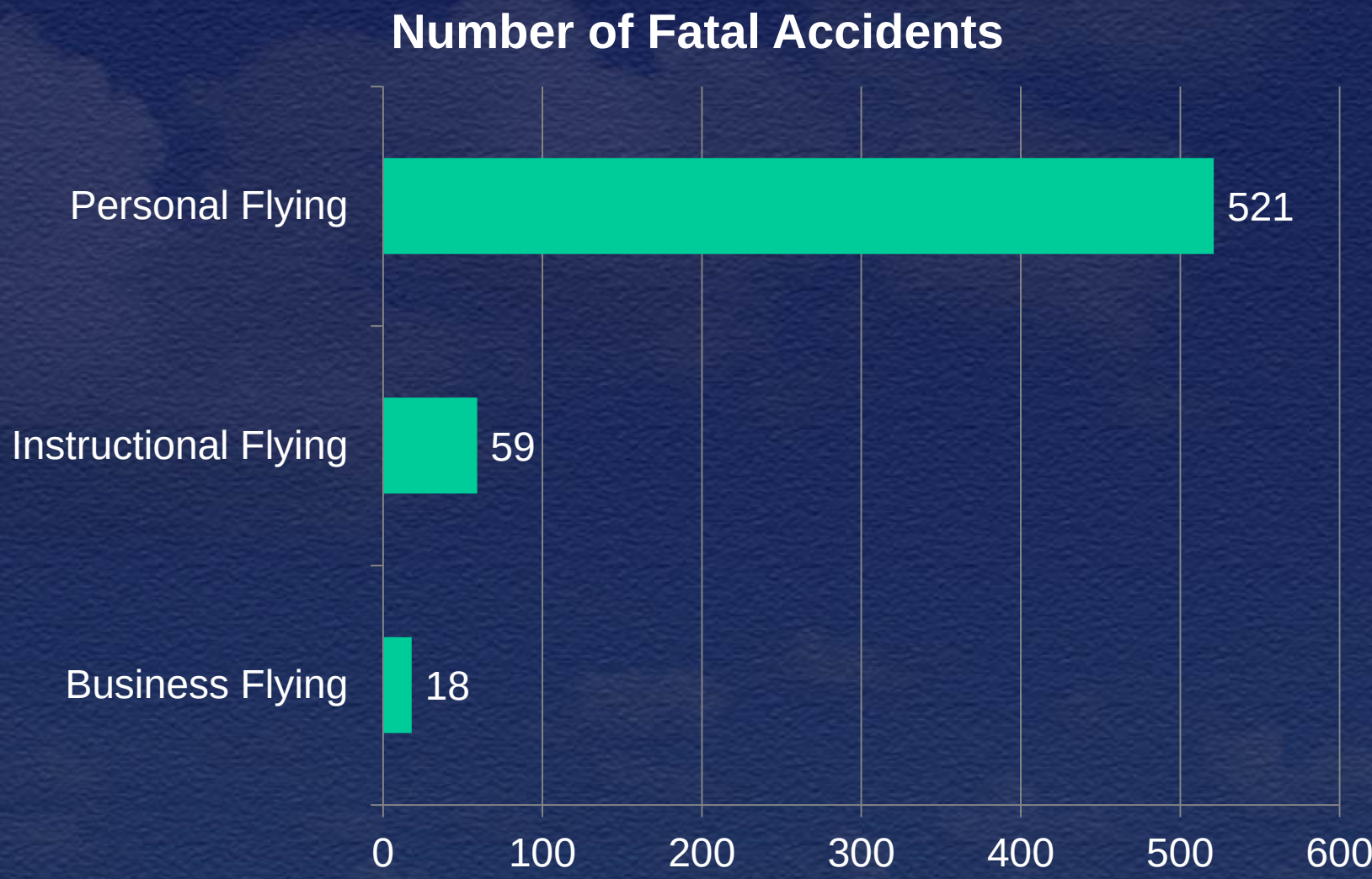
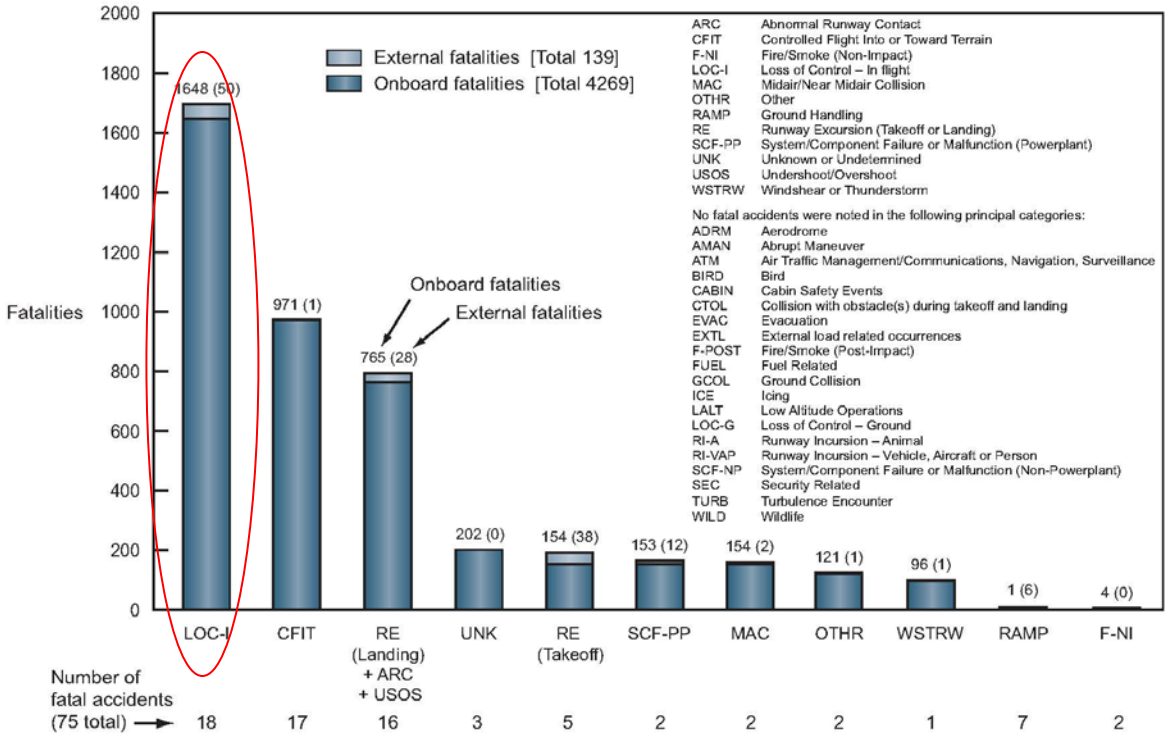
Loss of Control In-Flight, 2008-2013



Boeing Annual Statistical Summery

Fatalities by CAST/ICAO Common Taxonomy Team (CICTT) Aviation Occurrence Categories

Fatal Accidents – Worldwide Commercial Jet Fleet – 2003 Through 2012



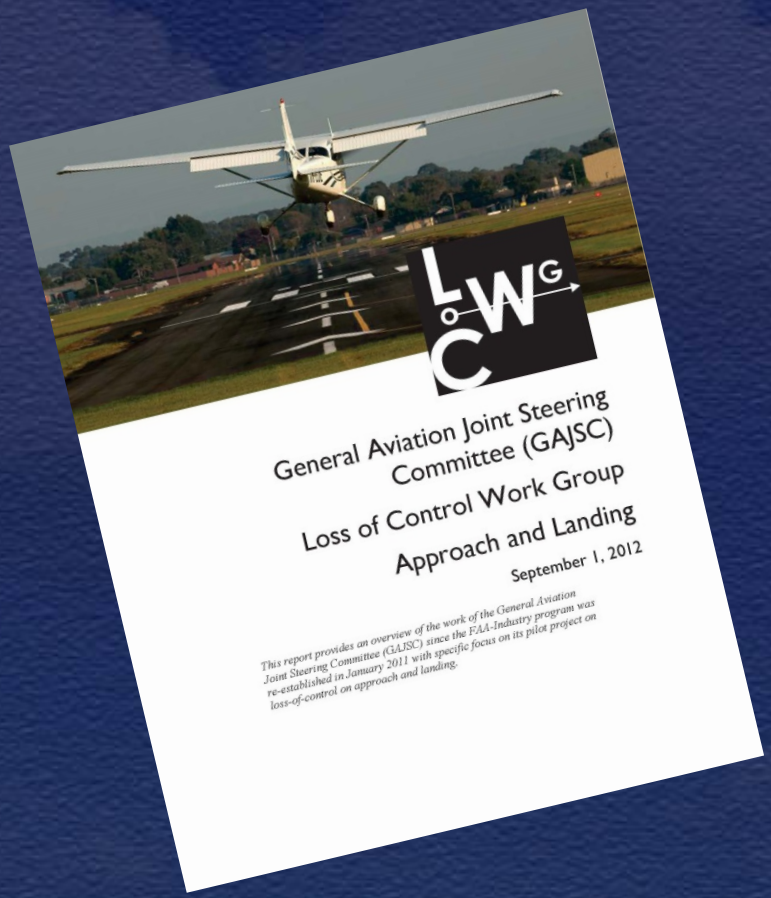
Note: Principal categories as assigned by CAST.

For a complete description of CICTT Aviation Occurrence Categories, go to: http://www.intlaviationstandards.org/

Primary category of accidents

Personal flying	–	LOC
Instructional flying	–	LOC
Business flying	–	LOC
Airline flying	–	LOC

Loss-of-control Working Group



Safety Enhancements Identified

- AOA – New, Current, Retrofit
- Aeronautical Decision Making
- Stabilized Approach
- Single Pilot CRM
- Medication effects
- Weather Technologies
- Etc…

28 Safety Enhancements

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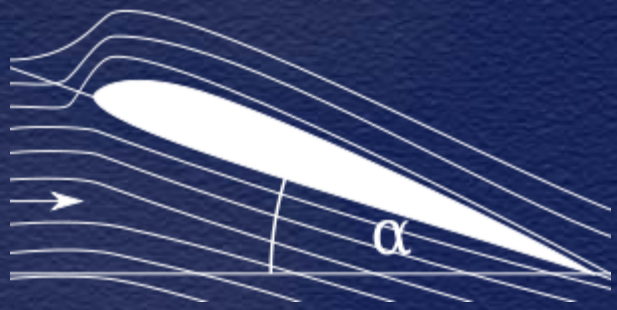
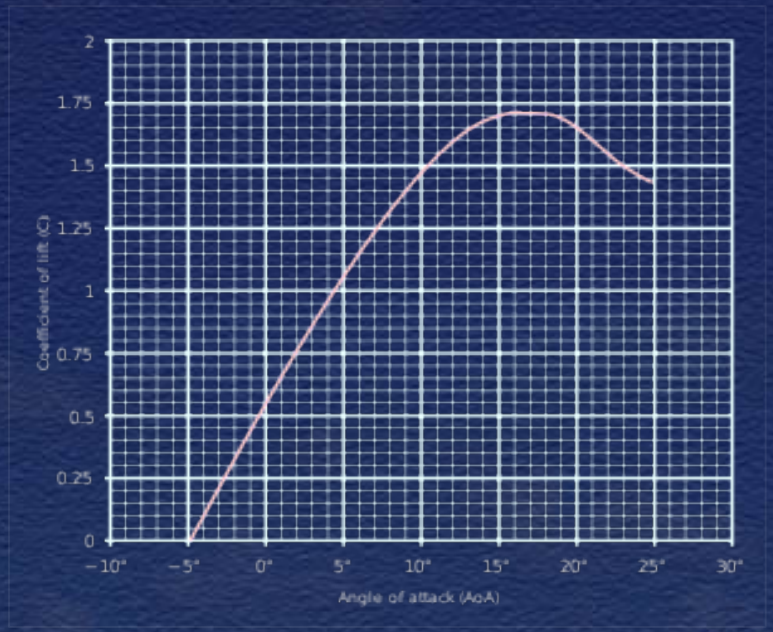
Lower Cost AOA Displays

- Stall occurs at a specific Angle-of-Attack
  - But not always at the same airspeed



First of AOA indicators built to ASTM stds and installed as a minor mod

FAA installation policy changed



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Stall Recovery

- Reduce the angle-of-attack below maximum lift coefficient
  - Push over to eliminate stall warning
- Level wings
- Adjust throttle
  - Avoid overspeed and high G levels
- Pitch back to level
- Don’t try to “Power out of a stall”

Impairment

Continuum from fully awake and alert to unconscious

Ready to go **Unconscious**

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Impairment in Transportation

- Occurs from a variety of factors
- Medical and psychiatric conditions
- Alcohol
- Drugs
  - Over-the-counter
  - Prescription
  - Illicit

Study Objectives

- Initial step
- Examine among fatally injured pilots
  - Prevalence of positive toxicology tests
  - Trends in positive toxicology tests
  - Comparison to the general population
  - Differences between categories of pilots

Why the Focus on Pilots?

- Fatally injured pilots
  - More than 1,300 drugs and metabolites
- DOT mandatory testing requirements
  - Urine specimen
  - 11 drugs
- Best opportunity to study trends in drug use by transportation operators

Data Sources: 1990-2012

- Bioaeronautical Research Laboratory at Federal Aviation Administration (FAA) Civil Aerospace Medical Institute (CAMI)
  - Toxicology test results database
- NTSB's Aviation Accident Database

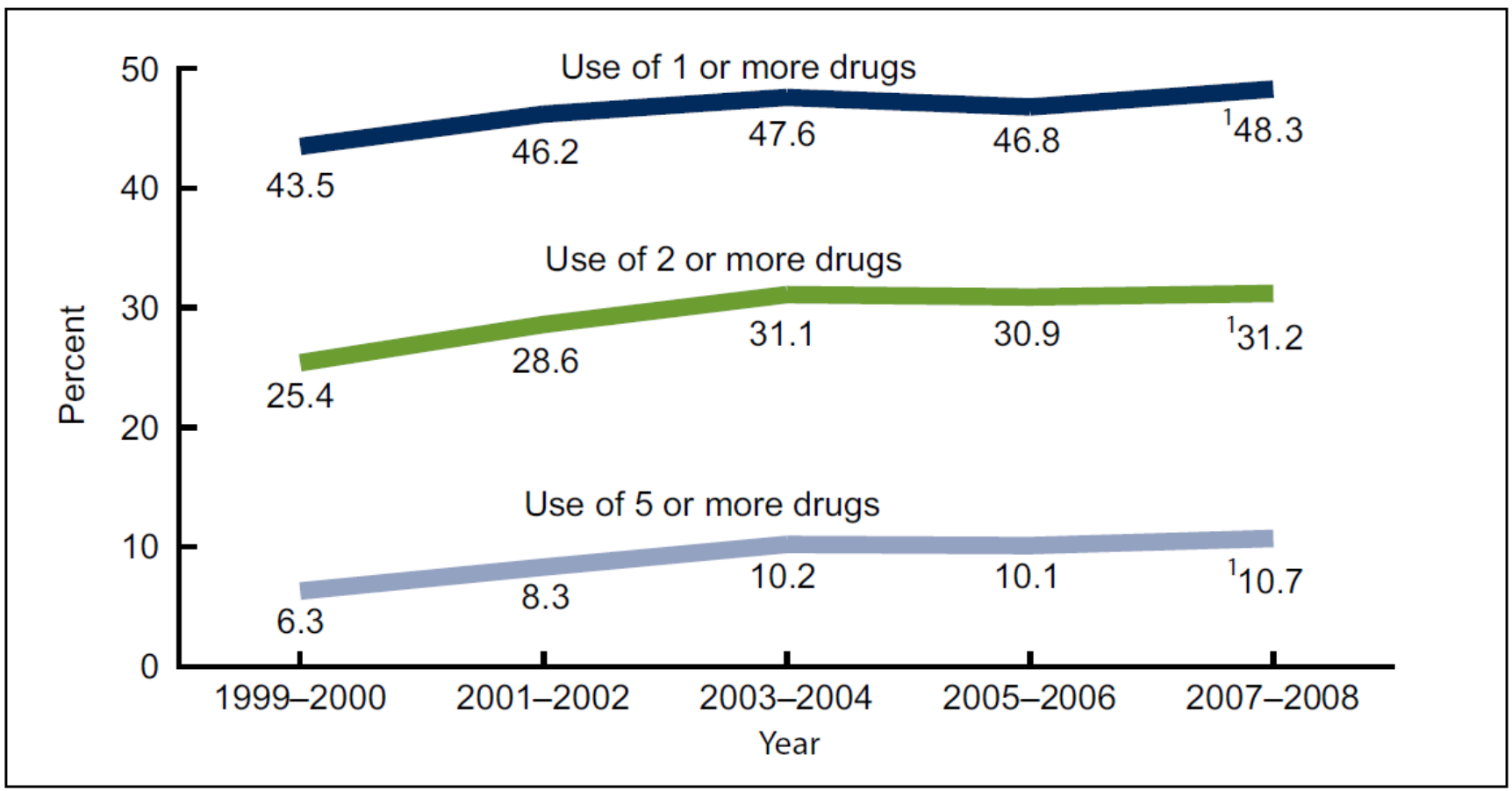
Safety Issues

- Enhance drug information for pilots
- Collect information to evaluate safety of pilots without medical certification
- Enhance communication between health care providers and patients about transportation safety risks
- Further research on relationship between drug use and accident risk

Mental and Physical Functions

- Perception
- Attention
- Executive functioning
- Cognitive processing
- Judgment
- Alertness
- Reaction time
- Mood

Prescription Drug Use by US Population



[1]Significant linear trend from 1999–2000 through 2007–2008.
NOTE: Age adjusted by direct method to the year 2000 projected U.S. population.
SOURCE: CDC/NCHS, National Health and Nutrition Examination Survey.

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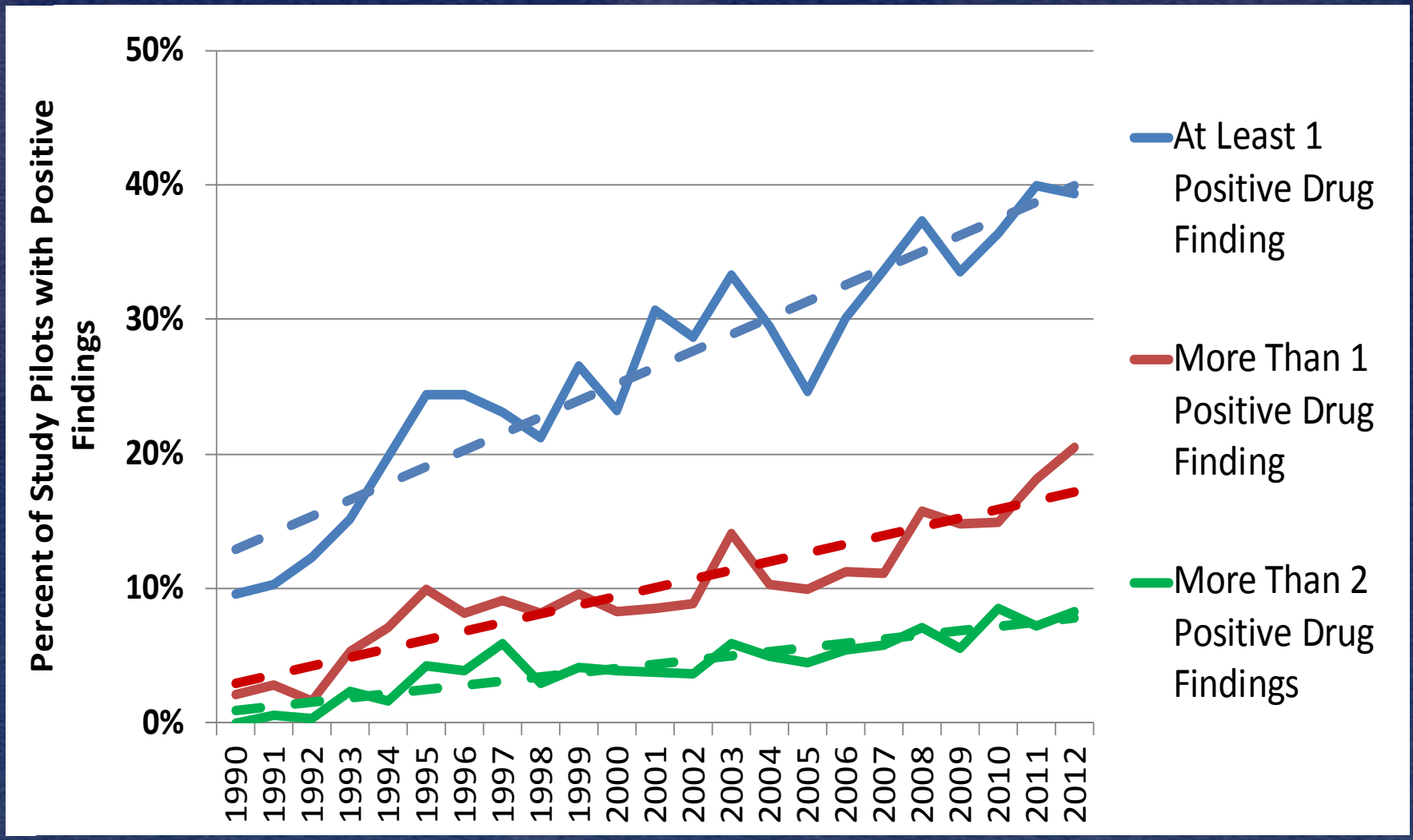
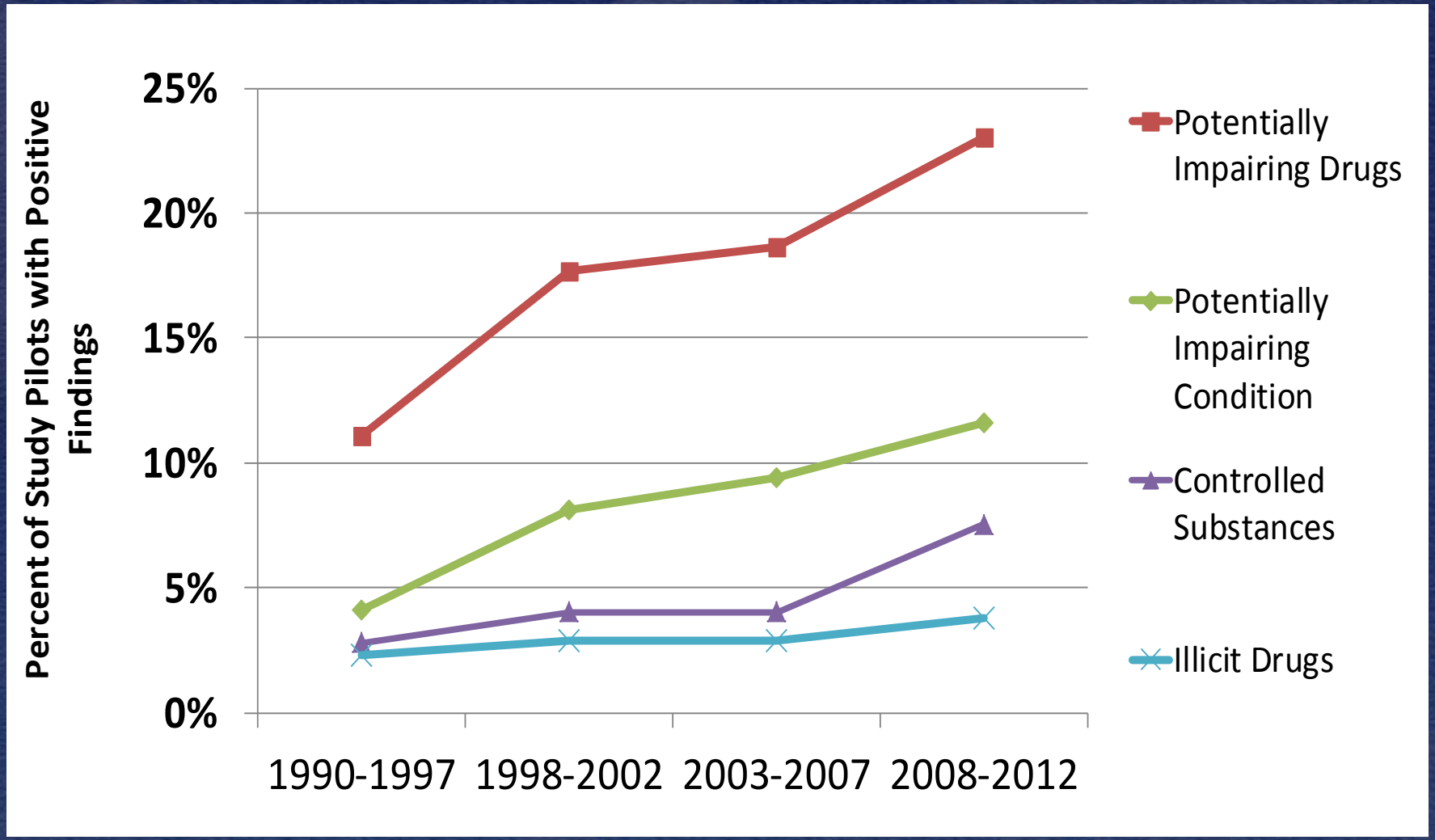
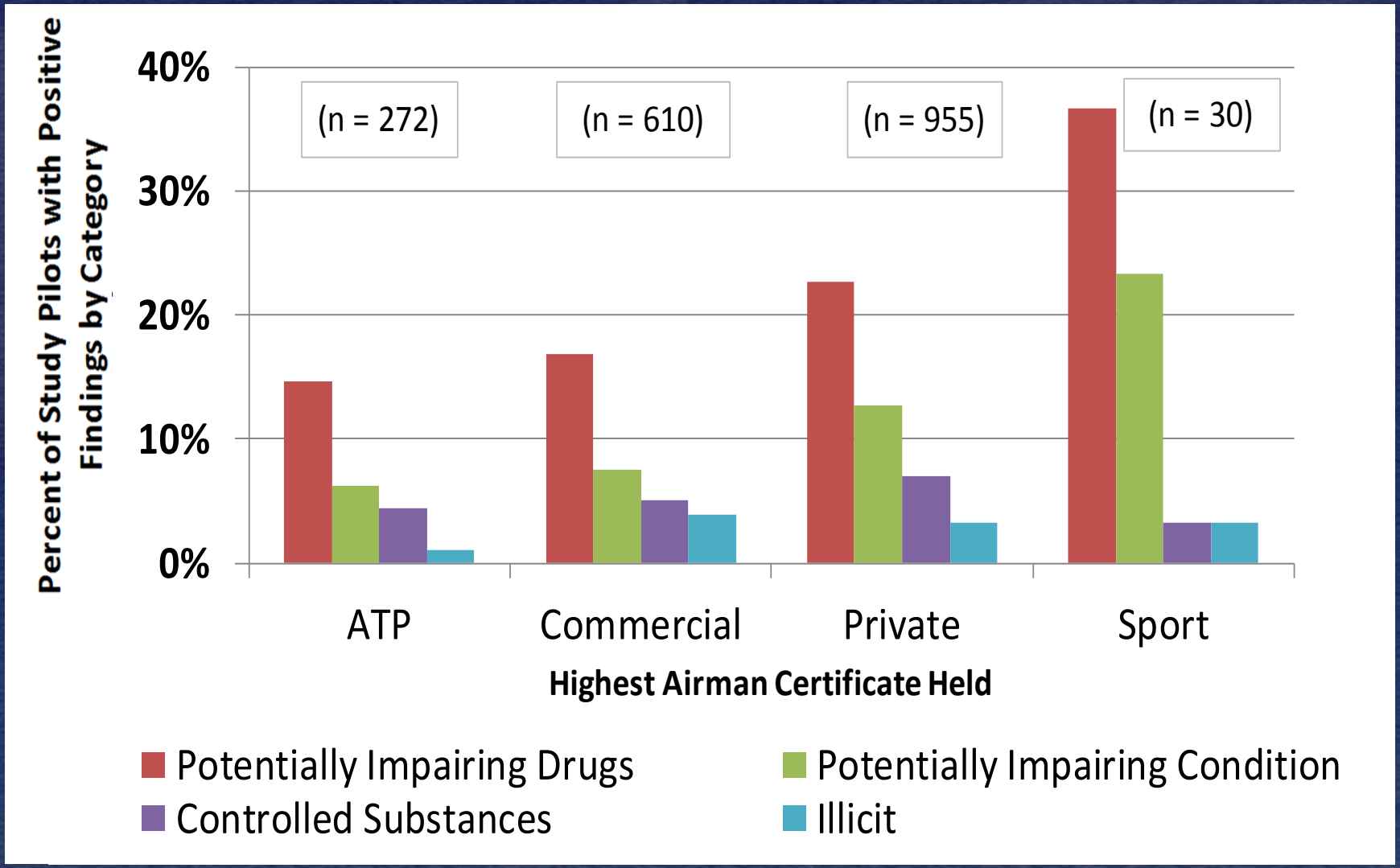
Toxicology Findings for All Drugs, 1990-2012



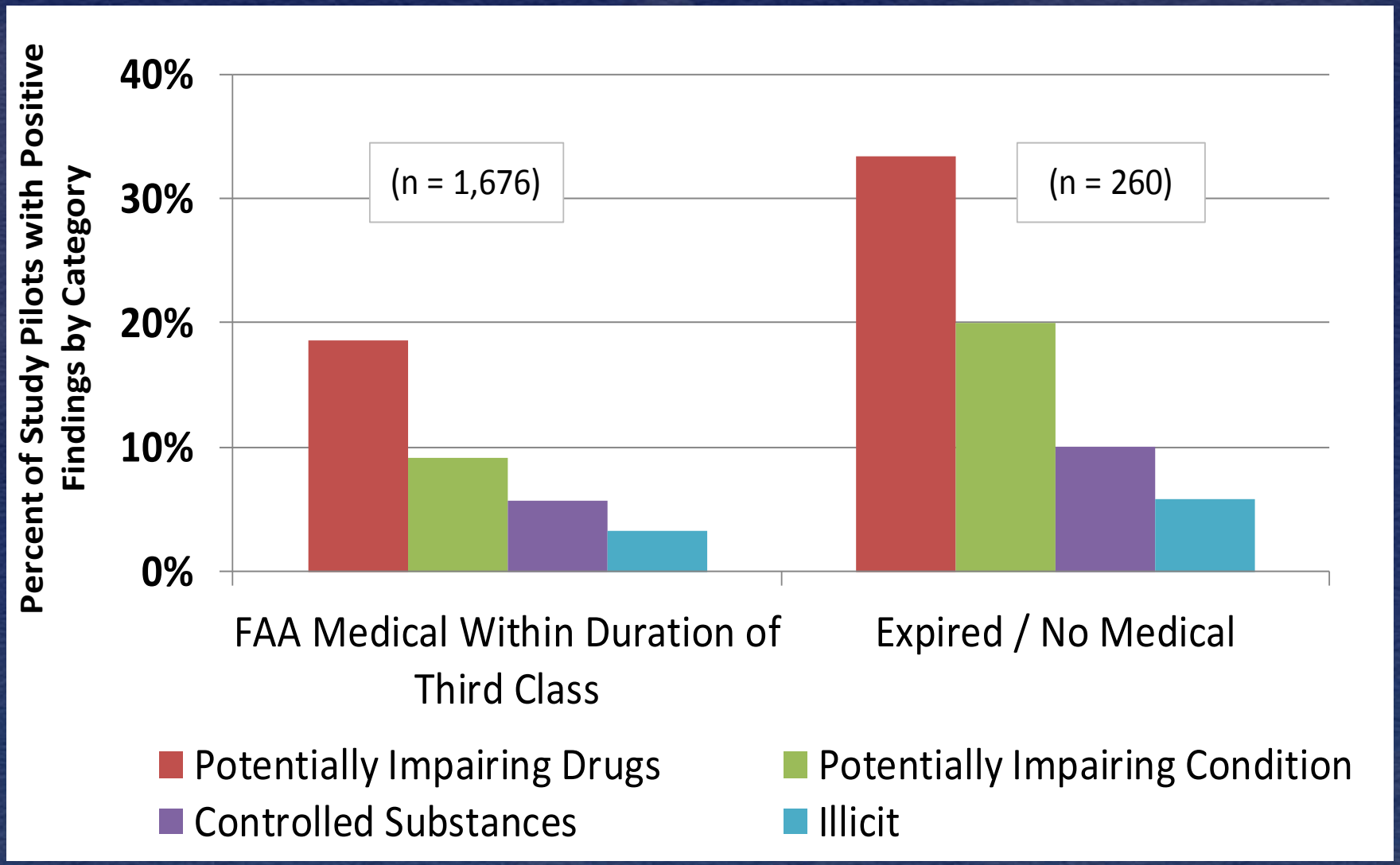
Toxicology Findings by Category, 1990-2012



Toxicology Findings by Certificate, 2005-2012



Toxicology Findings by Medical, 2005-2012



Medical Resources for Pilots

- FAA Publications
  - *Medications and Flying*
  - *Guide for Aviation Medical Examiners*
- Aircraft Owners and Pilots Association (AOPA)
  - Member resources

Medical Resources for Pilots

- General Aviation Joint Steering Committee (GAJSC)
  - 2013 Letter to pilots
  - 2014 Initiatives
    - Drug database
    - Training course

Topics

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- Most Wanted List
- GA Community Activities - JSC
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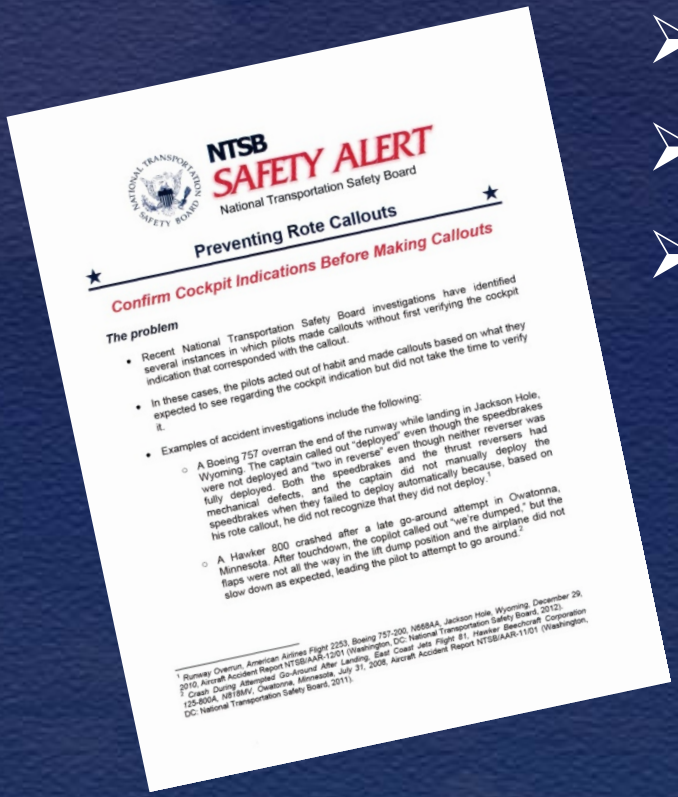
NTSB Safety Alerts



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Preventing Rote Callouts

Confirm Cockpit Indications Before Making Callouts

The problem

- Recent National Transportation Safety Board investigations have identified several instances in which pilots made callouts without first verifying the cockpit indication that corresponded with the callout.
- In these cases, the pilots acted out of habit and made callouts based on what they expected to see regarding the cockpit indication but did not take the time to verify it.
- Examples of accident investigations include the following:
  - A Boeing 757 overran the end of the runway while landing in Jackson Hole, Wyoming. The captain called out "deployed" even though the speedbrakes were not deployed and "two in reverse" even though neither reverser was fully deployed. Both the speedbrakes and the thrust reversers had mechanical defects, and the captain failed to deploy automatically because, based on speedbrakes when they did not manually deploy the his rote callout, he did not recognize that they did not deploy.[1]
  - A Hawker 800 crashed after a late go-around attempt in Owatonna, Minnesota. After touchdown, the copilot called out "we're dumped," but the flaps were not all the way in the lift dump position and the airplane did not slow down as expected, leading the pilot to attempt to go around.[2]

[1] Runway Overrun, American Airlines Flight 2253, Boeing 757-200, N668AA, Jackson Hole, Wyoming, December 29, 2010, Aircraft Accident Report NTSB/AAR-12/01 (Washington, DC: National Transportation Safety Board, 2012).
[2] Crash During Attempted Go-Around After Landing, East Coast Jets Flight 81, Hawker Beechcraft Corporation 125-800A, N818MV, Owatonna, Minnesota, July 31, 2008, Aircraft Accident Report NTSB/AAR-11/01 (Washington, DC: National Transportation Safety Board, 2011).

- Preventing Aerodynamic Stalls
- Reduced Visual References
- Is Your Aircraft Talking to You
- Risk Management for Pilots
- Risk Management for Mechanics

Available on www.NTSB.gov

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Safety Alert Video Preview

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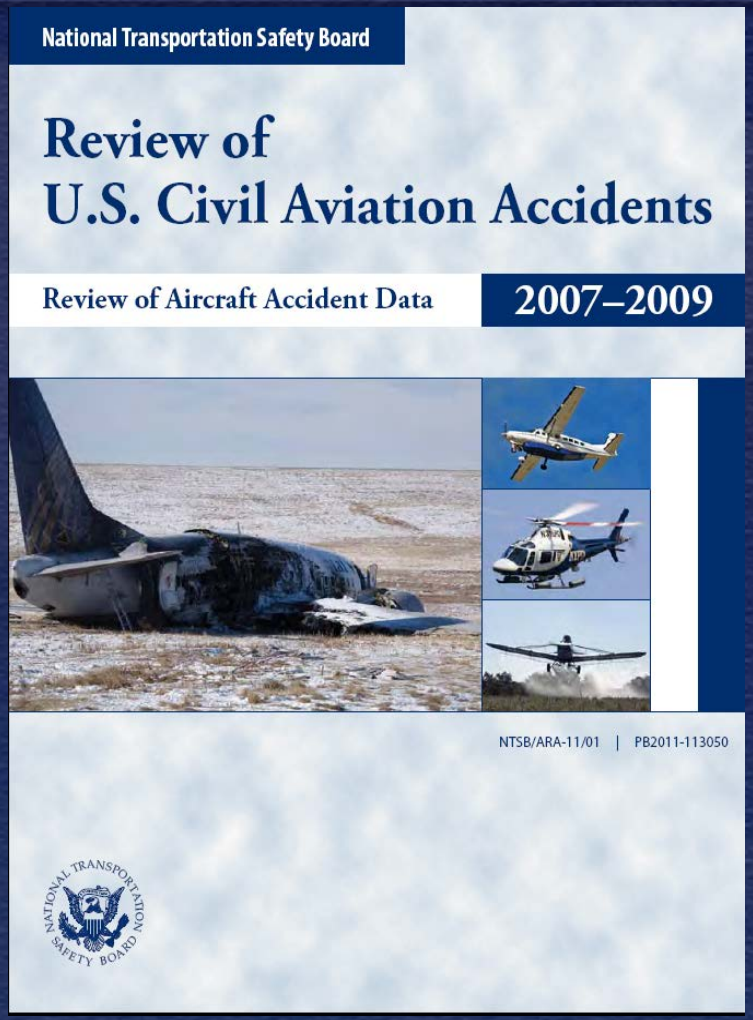
Accident Investigations



- NTSB accident files are on-line
- Many recent accident Dockets are on-line
  - Factual reports,
  - Interviews
  - Photographs
- www.ntsb.gov

http://www.ntsb.gov/doclib/reports/2011/ARA1101.pdf

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Alfred Sheinwold

"Learn all you can from the mistakes of others. You won't have time to make them all yourself"

Douglas Adams

"Human beings, who are almost unique in having ability to learn from the experience of others, are also remarkable for their apparent disinclination to do so."

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