



**NTSB** National Transportation Safety Board

## Human Error in the Context of Accidents

Society of Experimental Test Pilots  
April 28, 2009

Robert Sumwalt, Board Member  
NTSB



“How could they miss it ?”





Error –*the failure of planned actions to achieve their desired results.*

- “Managing Maintenance Error.” James Reason and Alan Hobbs



- An error is a human action (or human behavior) that unintentionally deviates from the expected action (or behavior).

– From Boeing Maintenance Error Decision Aid (MEDA) User's Guide



## Why investigate accidents and incidents?

“The sole purpose of the investigation of an accident or incident shall be the prevention of accidents and incidents.”

- ICAO Annex 13 Paragraph 3.1

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“The discovery of human error should be considered the starting point of the investigation, and not the ending point.”

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## Active Failures

- Most associated with “front line operators” i.e., pilots, controllers, mechanics
- Consequences known soon after mistake is committed
  - Pilot forgets to lower landing gear
  - Mechanic fails to replace O-rings



## Latent Conditions

- Often the result of decisions or actions by management
  - often with good intentions
- Consequences of this decision / action may be not manifested for a period of time
  - decision to merge two airlines without providing training to standardize operating procedures



## System Failures That Contribute to Accidents



Addressing latent conditions offers the greatest potential for safety improvements

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## Two Icing Accidents

- Allegheny Airlines      February 1979  
(changed name to USAir in 1979)
- USAir      March 1992

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## Allegheny 1979

“The NTSB determines that the probable cause of the accident was the captain’s decision to take off with snow on the aircraft’s wing and empennage surfaces...”

(Allegheny Airlines Nord 262, February 12, 1979. Clarksburg, WV)

## Icing Accidents

- February 1979 - Allegheny Airlines  
Nord 262 Clarksburg, WV
- February 1980 - Redcoat Air Cargo  
Britannia 253F Boston, MA
- January 1982 - Air Florida  
B737 Washington, DC



## Icing Accidents

(continued)

- February 1985 - Airborne Express  
DC-9-10 Philadelphia, PA
- December 1985 - Arrow Air  
DC-8 Gander, Newfoundland
- November 1987 - Continental Airlines  
DC-9-10 Denver, CO



## Icing Accidents

(continued)

- March 1989  
F28                      Air Ontario  
                                 Dryden, Ontario
- November 1989  
F28                      Korean Air  
                                 Kimpo, Korea
- February 1991  
DC-9-15                Ryan International  
                                 Cleveland, OH



## Icing Accidents

(continued)

- December 1991  
MD80                    SAS  
                                 Stockholm, Sweden
- March 1992  
F28                      USAir  
                                 New York, New York







## USAir 405 - 1992

“The NTSB determines that the probable causes of this accident were the failure of the airline industry and the Federal Aviation Administration to provide flightcrews with procedures, requirements, and criteria compatible with departure delays in known icing conditions, and the decision of the flightcrew to take off ...”

## July 10, 2007, Sanford, FL



- Cessna 310 owned by NASCAR
- Flight planned Daytona Beach to Lakeland
- Inflight emergency, request for immediate diversion, crash
- 5 fatalities

## Pilots

- Left seat, PIC
  - NASCAR medical officer
  - Commercial Pilot Certificate
  - 276 total flight hours
- Right seat
  - Full time NASCAR pilot
  - ATP
  - 10,580 total flight hours

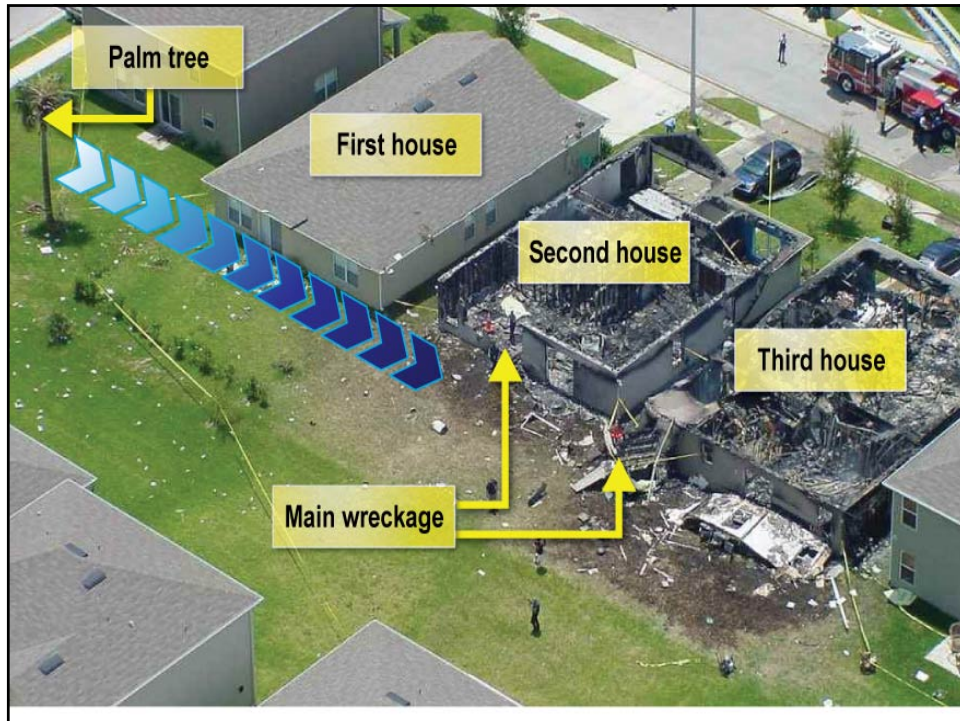


Declared Emergency

“Smoke in the cockpit.”

“Shutting off radios, elec.”





## Maintenance Discrepancy Entry

AIRCRAFT: N561N	DATE: 07-09-07	-ACTT	
MAINTENANCE WRITE-UP		-ACTL	
Entered By: ACT	Location: DND	<input type="checkbox"/> Repaired	<input type="checkbox"/> Replaced
		<input type="checkbox"/> Released- Could Not Duplicate	<input type="checkbox"/> Loaner Installed
Corrective Action:			
RADAR WENT BLANK DURING CRUISE FLIGHT. RECYCLED - NO RESPONSE... SMELL OF ELECTRICAL COMPONENTS BURNING TURNED OFF UNIT - PULL RD RADAR CB - SMELL WENT AWAY. - RADAR INOP			

**“SMELL OF ELECTRICAL COMPONENTS BURNING”**

## Events - Previous Day

- That pilot followed company procedures
  - White original in airplane binder
  - Verbally informed technician
  - Handed yellow copy to DOM
- Brief in-office discussion
- Airplane not inspected, modified, or grounded
- Airplane remained available for flight

## Active Failures

### MECHANIC

- Did not inspect maintenance log or correct the discrepancy

### PILOTS

- ATP dismissed radar issue as unimportant
- Weather radar circuit breaker likely reset for the flight
- Pilots accepted airplane “as is” and departed



## Inadequate Organizational Processes and Procedures

- Maintenance forms not serialized, tracked, or retained
  - Yellow copy never provided
- SOP guidance versus reality
- No assurance discrepancies would be addressed
- Airworthiness status unclear
- No procedures for providing flight operations personnel (pilots and dispatchers) with airplane airworthiness information.



## Inadequate Procedures

- Most often a preflight fact sheet would be taped to airplane with highlighted items signed off by a mechanic
  - Not a requirement, not spelled out in SOP
- No guidance was provided to PIC for determining airworthiness of assigned aircraft



## Culture of Non-Compliance

- Aviation director could not readily locate SOP manual
- SOP manual viewed as a “training tool”
- Aircraft to only be used for company business
  - Accident flight was a personal flight
- PIC must possess ATP
  - PIC did not possess ATP
- Last 3 maintenance discrepancies had not been addressed



## Latent Conditions

- NASCAR enabled the accident by failing:
  - to have adequate processes and procedures to prevent such an event, and
  - to ensure compliance with the procedures they did have in place.
- “This accident started before the aircraft even left the ground.”

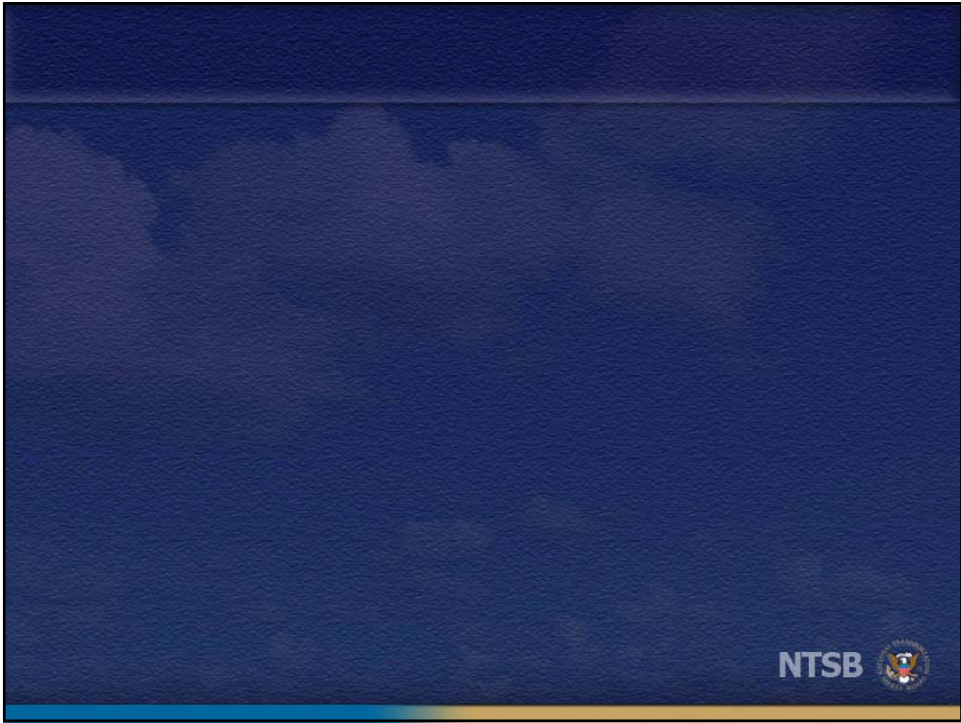


## Probable Cause

- Actions and decisions by NASCAR's corporate aviation division's management and maintenance personnel to allow the accident airplane to be released for flight with a known and unresolved discrepancy, and;
- The accident pilots' decision to operate the airplane with that known discrepancy, a discrepancy that likely resulted in an in-flight fire.







# Air Inter A320 Accident

**9 Survive as Airbus Carrying 96 Crashes in French Hills**

*Associated Press*

MONT SAINT-ODILE, France, Jan. 21 (Tuesday)—A French Airbus A-320 carrying 96 people crashed in snow and fog on a wooded ridge in eastern France Monday night. At least nine survivors, including a toddler, were found during a four-hour search.

The 20-month-old girl was the only person to emerge unscathed from the wreckage of the state-run Air Inter flight, police said. The smoking debris was strewn about a snowy pine forest.

Two of the survivors were critically injured. Most or all of the survivors were seated in the rear of the plane, rescuers said. Crews worked in 20-degree cold to remove the injured and the dead from the crash site near Mont Sainte-Odile, a 2,500-foot peak in the Vosges Mountains, 30 miles southwest of Strasbourg near the German border.

Rain and snow slowed the search by about 1,000 people. Logging roads provided the only access to reach of the fog-shrouded area. The airline set up a center at Lyon's Maitland airport for relatives of those aboard. Few details about the passengers were available, although most reportedly were business travelers.

Flight IT-5144 was en route from Lyon to Strasbourg when radio contact was lost shortly before the scheduled landing at 7:25 p.m. (11:25 p.m. EST), officials said. The wreckage was located shortly before midnight. The plane carried 90 passengers and a crew of six, Air Inter said.

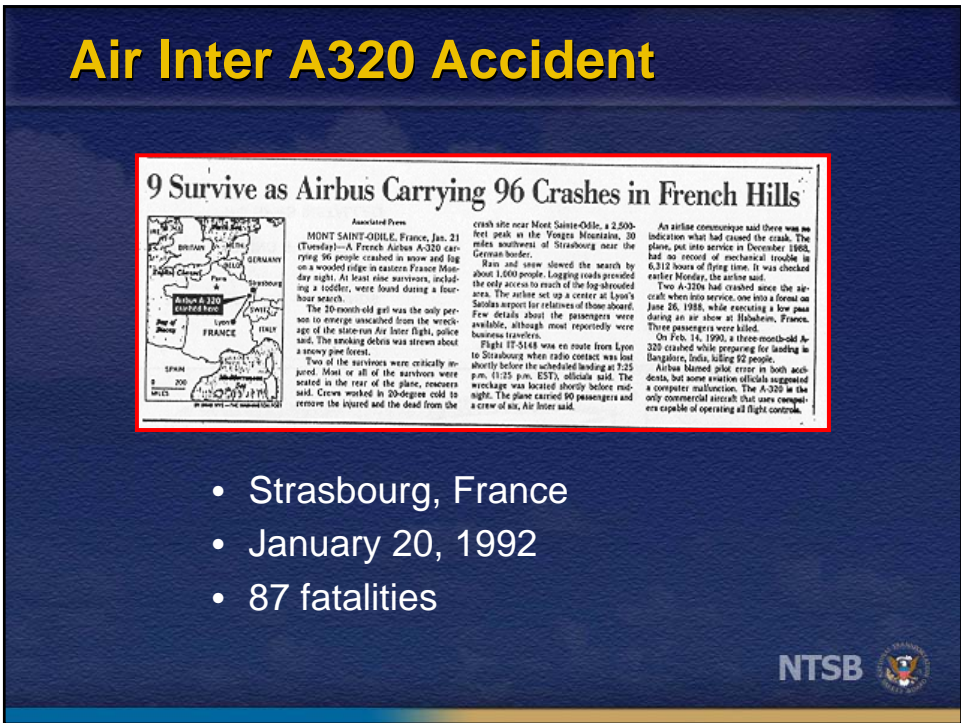
An airline spokesman said there was no indication what had caused the crash. The plane, put into service in December 1989, had no record of mechanical trouble in 6,312 hours of flying time. It was checked earlier Monday, the airline said.

Two A-320s had crashed since the aircraft when into service, one into a forest on June 26, 1988, while executing a low pass during an air show at Habsheim, France. Three passengers were killed.

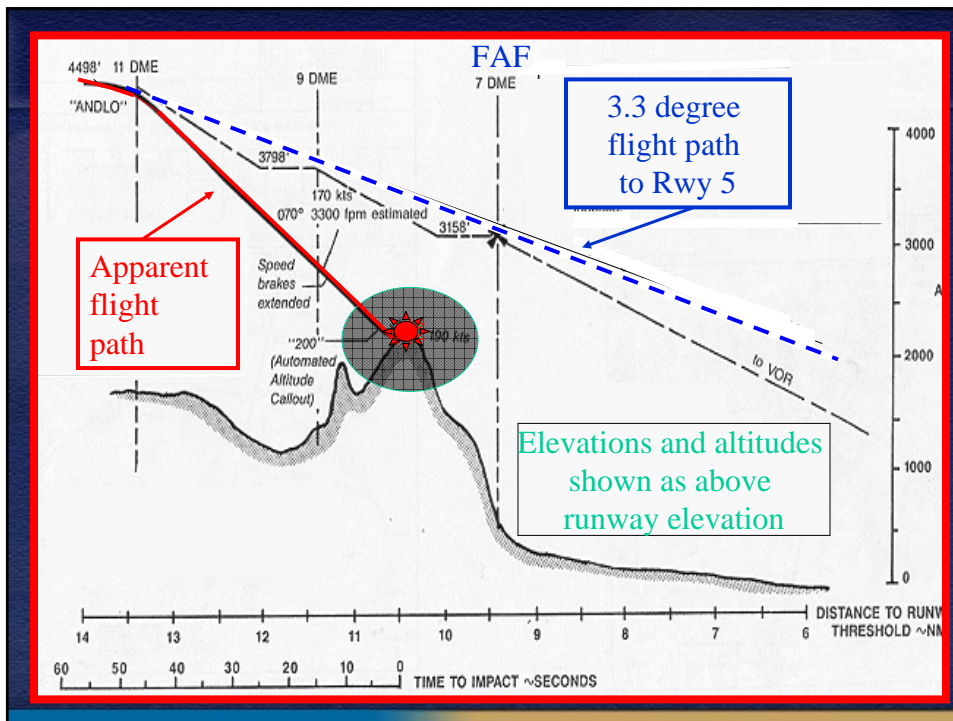
On Feb. 14, 1990, a three-month-old A-320 crashed while preparing for landing in Bangalore, India, killing 92 people.

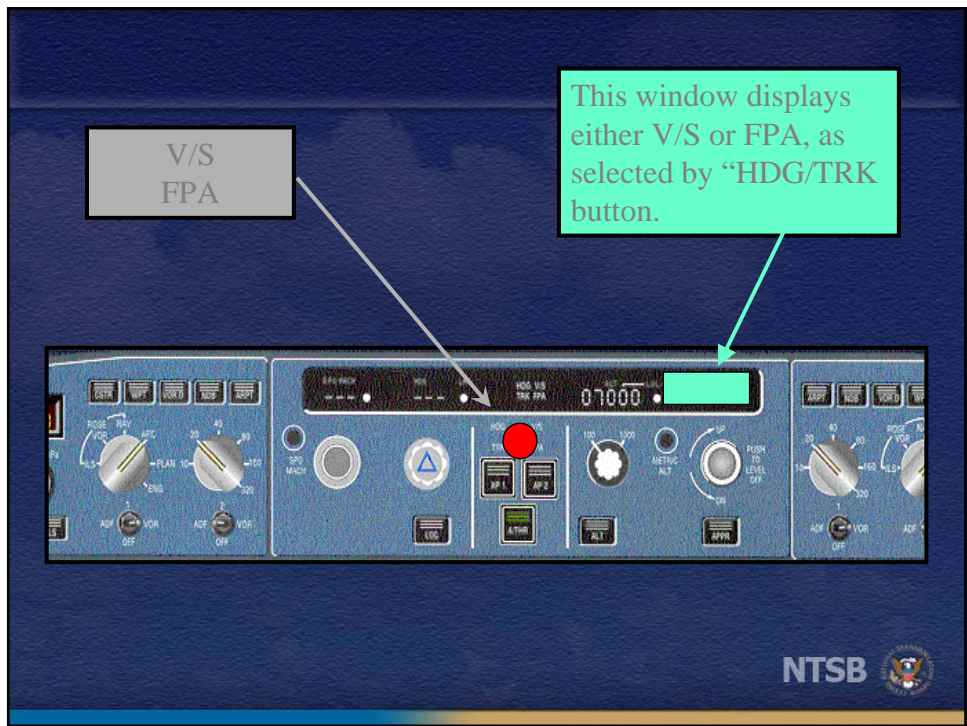
Airbus blamed pilot error in both accidents, but some aviation officials suggested a computer malfunction. The A-320 is the only commercial aircraft that uses computers capable of operating all flight controls.

- Strasbourg, France
- January 20, 1992
- 87 fatalities



- Instrument approach
- Night
- Snowing, overcast, low visibility
- Capt 162 hrs in A320  
F/O 61 hrs in A320
- Crew coordination /communications







## Manufacturer Modifications



Examples:

**3300**

for vertical speed

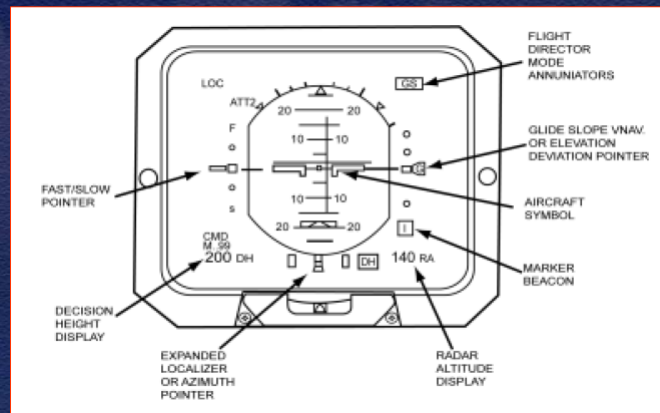
**3.3**

for flight path angle

- Gulfstream G-3, N85V
- On approach to Houston Hobby
- November 22, 2004
- 3 Fatalities



## G-3 at Houston



Note: The diagram shows the glideslope and the fast/slow indicators on the right and left side of the EADI, respectively, which is opposite of the accident airplane's configuration.



- Aircraft had GS indicator on Left side of PFD.
  - Fast/Slow on Right side
- Configuration of other company aircraft flown by accident pilots:
  - 5 had GS on Left
  - 3 had GS on Right
- AC 25-11 (July 16, 1987) recommends that GS indication be located on Right side of display,
  - Accident aircraft was manufactured before this guidance was issued.



## NTSB Analysis

“The pilots most likely mistook the fast/slow indicator for the glideslope indicator throughout the approach sequence.”



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## Safety Order of Precedence

1. Design for Minimum Risk (engineering solution)
  - Hazard is corrected and eliminated
2. Control/Guard Solution
  - Guards put up to decrease exposure
3. Personnel Warning System
  - Warn personnel if you can't eliminate or control the hazard
4. Develop Procedures and Training

- Source: MIL-STD-882D and FAA System Safety Manual

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