



**National
Transportation
Safety Board**

Presentation to 2014 Duke Energy Aviation Safety Seminar

Robert L. Sumwalt, III



NTSB is an independent federal agency, charged by Congress to investigate transportation accidents, determine probable cause, and issue safety recommendations.





Our greatest virtues:
Independence
Credibility

The Board



Mark Rosekind



Chris Hart



Debbie Hersman



Robert Sumwalt



Earl Weener



The Board



Mark Rosekind



Chris Hart



Robert Sumwalt



Earl Weener



The Staff



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The Anatomy of an NTSB Accident Investigation



Breaking News: A plane has crashed.



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NTSB Response Operations Center



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Different Types of NTSB Investigations



Field Investigation

Limited Investigation



Go-Team Investigation

Anatomy of an accident investigation

NOTIFICATION + 2 HOURS



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The Launch



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Arrival on Scene



Boots on the Ground





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The Hunt for ...



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The “Black Boxes”





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Media Briefings



Meeting with Officials



Nightly Progress Meetings



Typically, parties may include:

- FAA (by law)
- Operator
- Airframe manufacturer
- Engine manufacturer
- Major component manufacturer
- Pilot, ATC, maintenance and flight attendant union representatives
- Airport Authorities
- First responders



Anatomy of an accident investigation

MONTH 3 - 4



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Investigative Hearing





Anatomy of an accident investigation

MONTH 12



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Sunshine Meeting



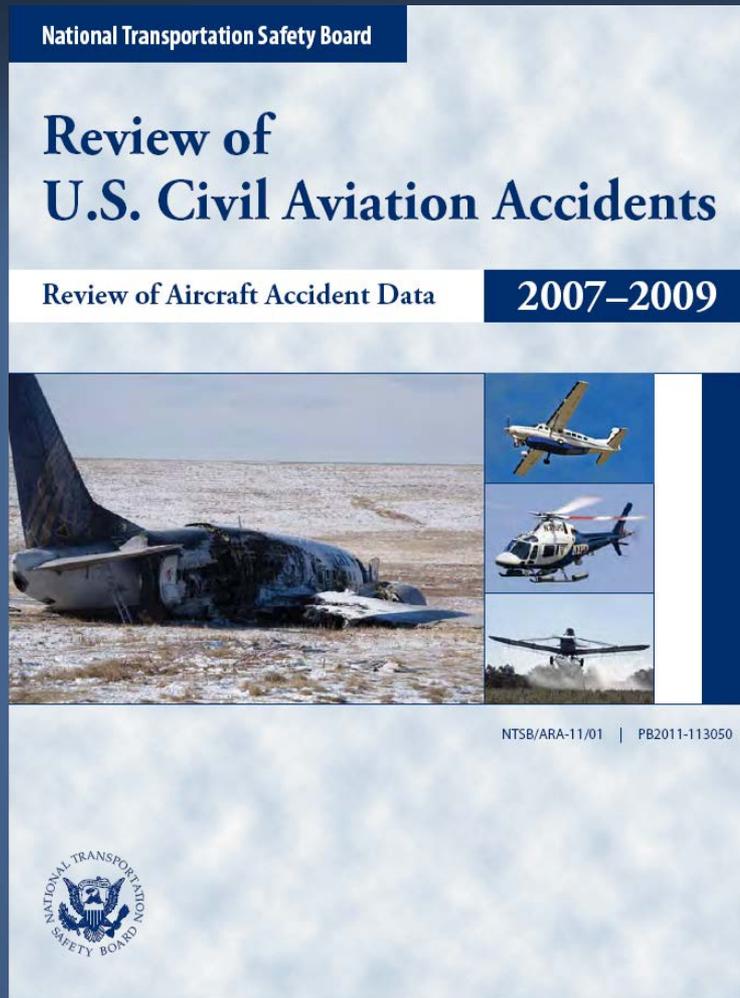
The million dollar question?

- Are you prepared to interface with NTSB if there is an accident involving your organization?



- Do you understand the party system?
- Who will be your party coordinator?
- Are you familiar with NTSB's rules and practices?

Accident Investigations



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



National Transportation Safety Board

Things that keep Robert up at night

- Lack of SOP discipline

USAir 1016

- July 2, 1994
- Charlotte, NC
- 37 fatalities



Failure to follow procedures led to crash, board finds

By CHARLES POPE
Washington Bureau

WASHINGTON — USAir Flight 1016 crashed last year after its pilots blundered into a severe thunderstorm shrouding the Charlotte airport and then responded incorrectly when the threat was recognized, federal safety officials concluded Tuesday.

The picture painted by the Na

APRIL 5, 1995

NO. 95
104TH YEAR
4 SECTIONS
46 PAGES
© 1995 THE STATE

Pilo



cited

in dangerous weather
near situation
measures to escape the wind shear

and complete weather

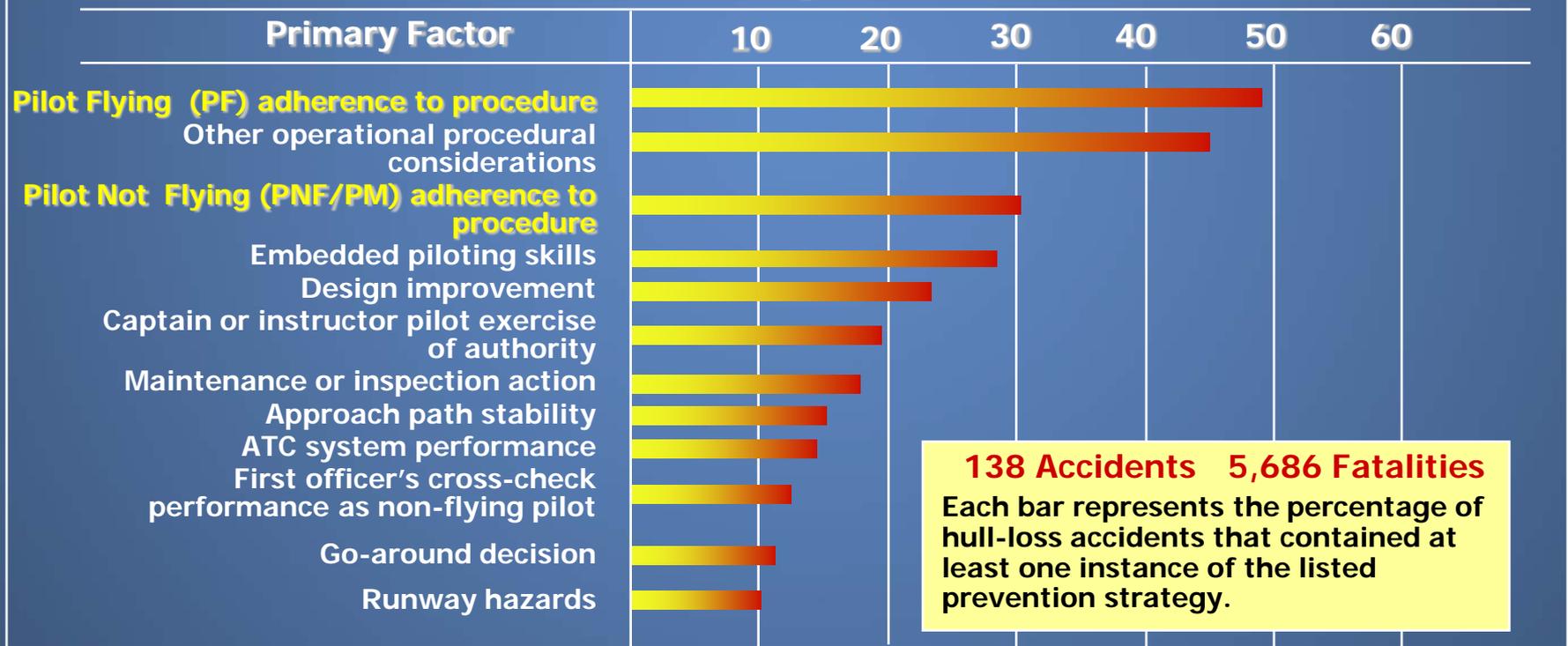
children
advisories

*Failure to follow
procedures led
crash, board*

Accident Prevention Strategies

Hull-loss Accidents over 10 Year Period

Percentage of Accidents



Source: Boeing study of accident prevention strategies

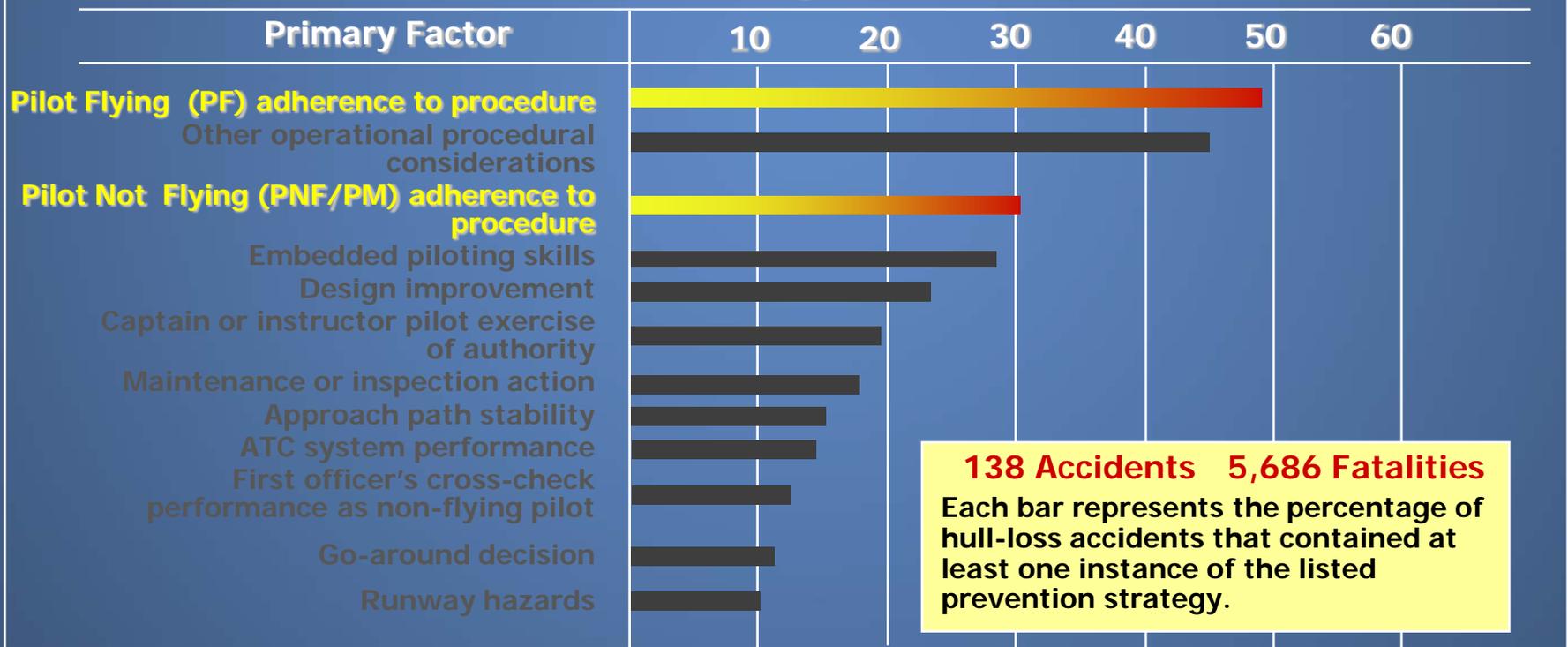


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Accident Prevention Strategies

Hull-loss Accidents over 10 Year Period

Percentage of Accidents



Source: Boeing study of accident prevention strategies



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Why SOPs are not followed

- Organization lacks adequate SOPs
- Organizations don't adhere to their SOPs
- Flight crews intentionally disregard SOPs

Why SOPs are not followed

ORGANIZATION LACKS ADEQUATE SOPS



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“When asked about the flight department's standard operating procedures (SOPs), the chief pilot advised that they did not have any...”

**Atlanta, Georgia
September 14, 2007**

“... the flight department had started out as just one pilot and one airplane, and that they now had five pilots and two airplanes...”

09 14 2007



FAA Advisory Circular AC 120-71A

Advisory Circular



U.S. Department
of Transportation
Federal Aviation
Administration

AC No: 120-71A

Date: 2/27/03
Initiated By: AFS-210

Subject: STANDARD OPERATING
PROCEDURES FOR FLIGHT DECK
CREWMEMBERS

1. PURPOSE.

a. **General.** Standard operating procedures (SOPs) are universally recognized as basic to safe aviation operations. Effective crew coordination and crew performance, two central concepts of crew resource management (CRM), depend upon the crew's having a shared mental model of each task. That mental model, in turn, is founded on SOPs. This advisory circular (AC) presents background, basic concepts, and philosophy in respect to SOPs. It emphasizes that SOPs should be clear, comprehensive, and readily available in the manuals used by flight deck crewmembers.

b. **Using this Advisory Circular.** This AC is designed to provide advice and recommendations about the development, implementation, and updating of SOPs. Appendix 1, Standard Operating Procedures Template, provides many important topics that should be addressed in SOPs. Stabilized Approach, characterized by a constant-angle, constant-rate of descent ending near the touchdown point where the landing maneuver begins, is among the SOPs specifically identified in this AC and is described in Appendix 2, Stabilized Approach: Concepts and Terms. These and the other appendices represent a baseline and a starting point. Start-up certificate holders and existing certificate holders should refer to the Template in Appendix 1, to Stabilized Approach in Appendix 2, and to the other appendices in developing comprehensive SOPs for use in training programs and in manuals used by their flight deck crewmembers.

c. **What's New in this Advisory Circular.** AC 120-71A revises and supersedes the earlier version, AC 120-71. Many minor changes have been made to improve clarity, accuracy, completeness, and consistency. Two significant changes are the conversion of the term pilot not flying (PNF) to pilot monitoring (PM) and the addition of a related Appendix addressing "Crew Monitoring and Cross-Checking." It is increasingly acknowledged that it makes better sense to characterize pilots by what they are doing rather than by what they are not doing. Hence, pilot flying (PF) remains an appropriate term and is unchanged in this AC. But the term pilot not flying misses the point. Studies of crew performance, accident data, and pilots' own experiences all point to the vital role of the non-flying pilot as a monitor. Hence, the term PM is used liberally (PM) is now widely viewed as a better term to describe that pilot. The term PM is used liberally throughout this AC. In those instances where the older term PNF appears, it should be understood that pilot monitoring (PM) is the preferred meaning.

“SOPs should be clear, comprehensive, and readily available in the manuals used by flight deck crewmembers.”



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**East Coats Jets
Hawker Beechcraft BAe 800
July 31, 2008
8 fatalities**



NTSB finding: East Coast Jets

- “Although as a [charter] operator East Coast Jets is not required to incorporate SOPs in its operations manual, if the company had voluntarily incorporated SOPs into its guidance, it may have supported the accident pilots in establishing cockpit discipline and, therefore, a safer cockpit environment.”

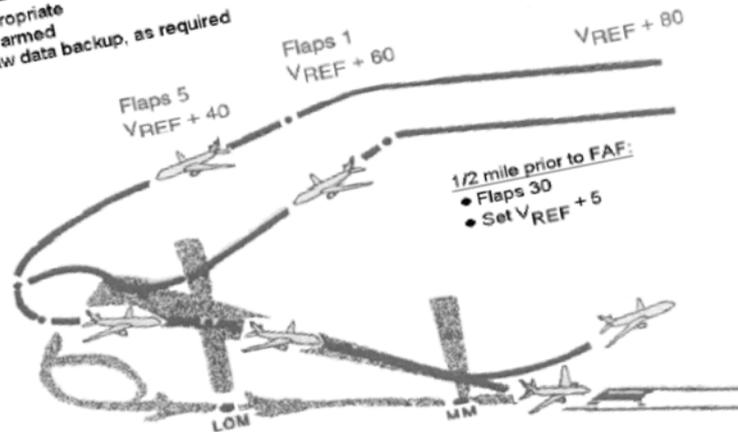


APPROACH PROFILE: LNAV, LOC, or LOC B/CRS

- Complete Approach Briefing
- Complete Preliminary Landing Checklist

When cleared for the approach:

- Select LNAV, LOC, or LOC B/CRS*, as appropriate
- Verify armed
- Set raw data backup, as required



- 2-1/2 miles from FAF:
- Gear down
 - Flaps 20
 - Set $V_{REF} + 20$
- Initiate Landing Checklist

At 1,000' HAT:

- Stabilized Approach

At MDA or MDA Buffer Altitude:

- Set missed approach altitude
- If runway environment is in sight and the aircraft is in a position from which a normal approach to the intended runway can be made, land the aircraft.

- or -

- If runway environment is not in sight, perform a missed approach procedure.

* Aircraft not equipped with B/CRS feature, use LNAV

LNAV, LOC, or LOC B/CRS APPROACH -- ACTIONS and CALLOUTS

Callouts: in "BOLD TEXT" -- Actions: with bullets (•) in plain text		PM
Initial Approach	<p>"FLAPS 1 REF 60"</p> <p>"FLAPS 5, REF 40"</p>	<ul style="list-style-type: none"> • Select flaps 1 • Set command airspeed cursor to V_{REF} 30 + 60, if requested • Select flaps 5 • Set command airspeed cursor to V_{REF} 30 + 40, if requested
2-1/2 miles from FAF	<p>"GEAR DOWN, FLAPS 20, REF 20, LANDING CHECKLIST"</p>	<ul style="list-style-type: none"> • Position gear lever DOWN • Select flaps 20 • Set command airspeed cursor to V_{REF} 30 + 20, if requested • Initiate Landing Checklist
1/2 mile prior to FAF	<p>"FLAPS 30, REF 5"</p> <ul style="list-style-type: none"> • Set/Request MDA or MDA Buffer Altitude 	<ul style="list-style-type: none"> • Select flaps 30 • Set command airspeed cursor to V_{REF} 30 + 5, if requested • Set altitude, if requested

Designates which crewmember performs action or callout

Triggering event

Callout

Action



Why SOPs are not followed

ORGANIZATIONS DON'T ADHERE TO THEIR SOPS



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Cessna 310, N501N
July 10, 2007
Sanford, FL
5 fatalities



Declared Emergency

“Smoke in the cockpit.”

“Shutting off radios, elec.”



Maintenance Discrepancy Entry

AIRCRAFT: N501N	DATE: 07-09-07	-ACTT	
MAINTENANCE WRITE-UP		-ACTL	
Entered By: ACT	Location: DAB	<input type="checkbox"/> Repaired	<input type="checkbox"/> Replaced
		<input type="checkbox"/> Released- Could Not Duplicate	<input type="checkbox"/> Loaner Installed
RADAR WENT BLANK DURING CRUISE FLIGHT. RECYCLED - NO RESPONSE... SMELL OF ELECTRICAL COMPONENTS BURNING		Corrective Action:	
TURNED OFF UNIT - PULLED RADAR C.B. - SMELL WENT AWAY. -			
RADAR INOP			

“SMELL OF ELECTRICAL COMPONENTS BURNING”

Organizations don't follow their SOPs

- 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



Stated the NTSB:

- “This is contrary to industry guidance for SOPs indicating that procedures should be written the way the organization intends to operate, and once the procedures are in place, the organization makes every effort to operate that way.”



Stated the NTSB:

- “[The organization] enabled the accident by failing to have adequate procedures in force to prevent such an event and/or by failing to ensure compliance with the procedures they did have in place.”



Lautman-Gallimore Study

- Found that having a strong commitment to standardization and discipline were among the “key elements of safe operations” observed in a Boeing study.
- “Cockpit procedural language is tightly controlled to maintain consistency and to avoid confusion from non-standard callouts Callouts and responses are done verbatim”



Why SOPs are not followed

FLIGHT CREWS INTENTIONALLY DISREGARD SOPs



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Comair Airlines Flight 5191

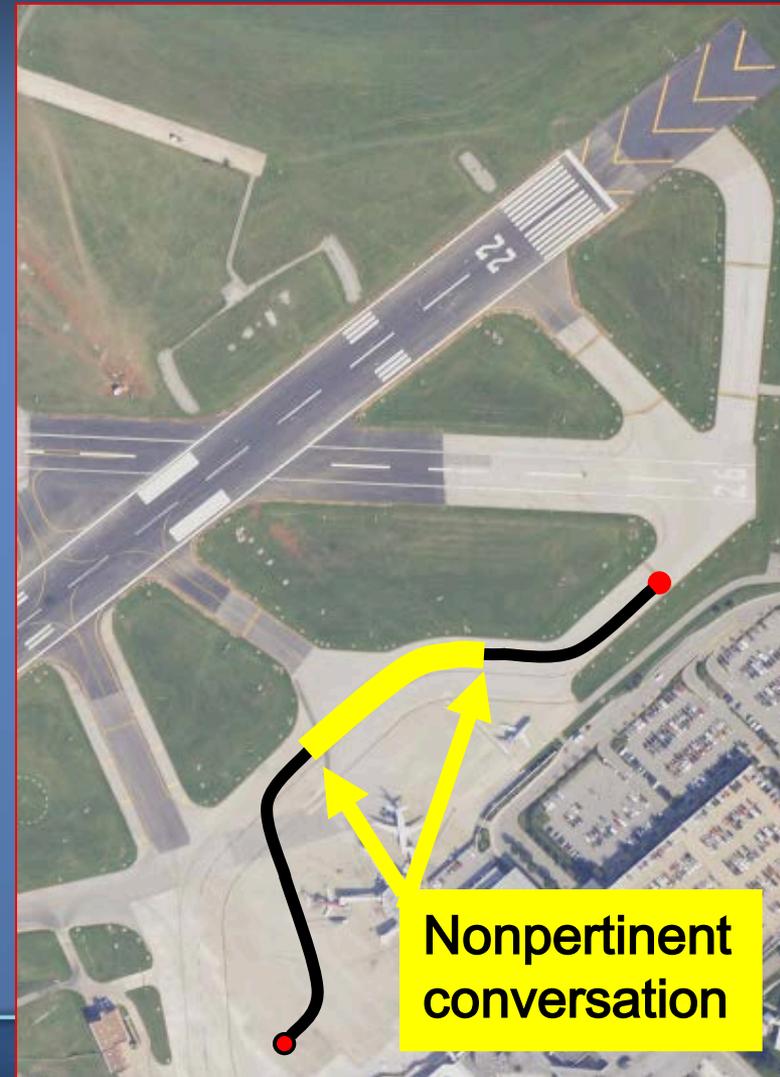
Lexington, Kentucky

- Bombardier CRJ
- 49 Fatalities
- First officer severely injured
- Wrong runway attempted takeoff



Crew Actions

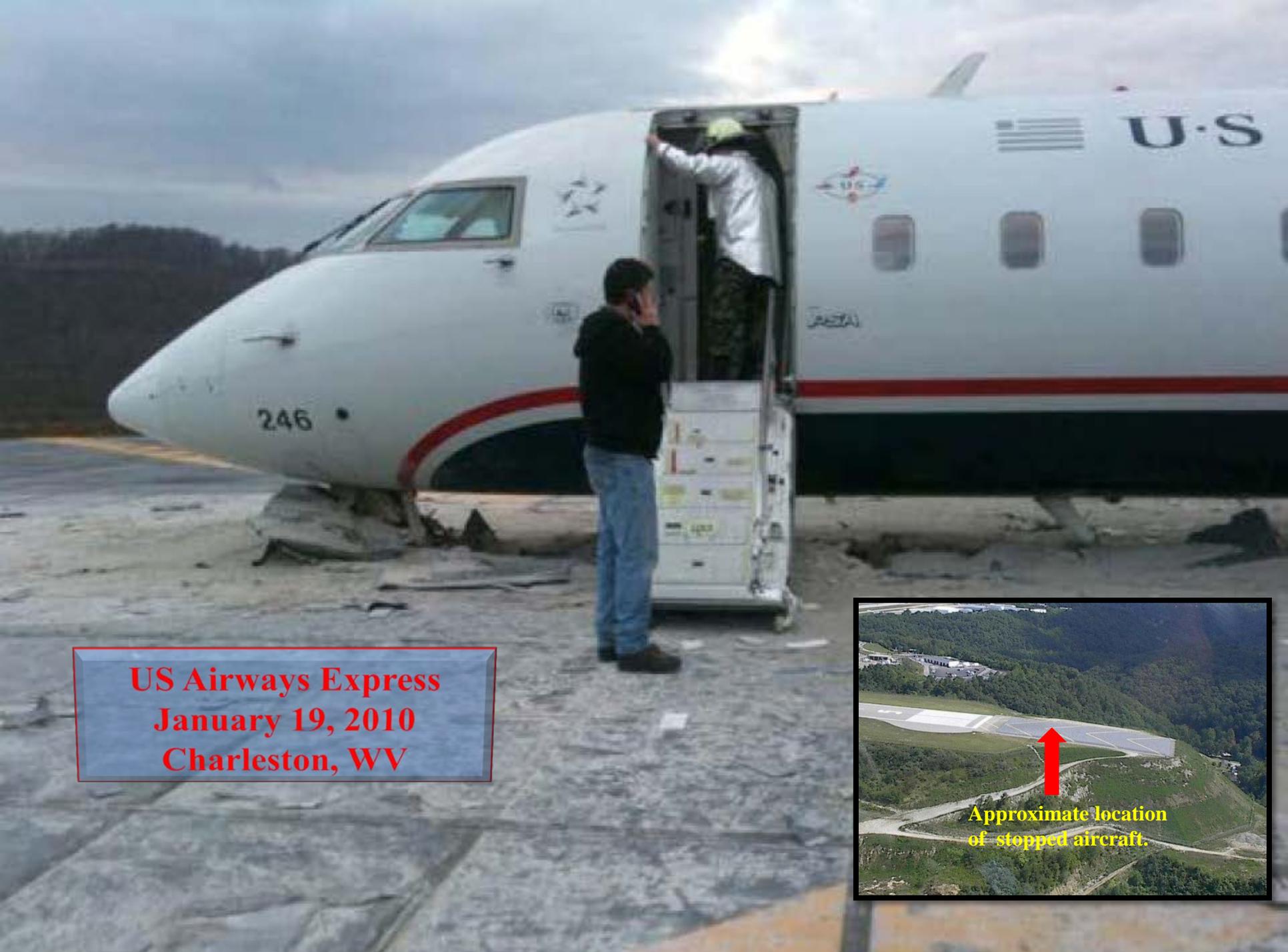
- Noncompliance with sterile cockpit rule
 - 40 of the 150 seconds during taxi were violations of sterile cockpit rule
- Distraction likely contributed to loss of positional awareness



NTSB Finding

- “The flight crew’s noncompliance with standard operating procedures, including the captain’s abbreviated taxi briefing and both pilots’ nonpertinent conversation, most likely created an atmosphere in the cockpit that enabled the crew’s errors.”





**US Airways Express
January 19, 2010
Charleston, WV**



**Approximate location
of stopped aircraft.**

Probable cause

- “...the flight crewmembers’ unprofessional behavior, including their non-adherence to sterile cockpit procedures by engaging in non-pertinent conversation, which distracted them from their primary flight-related duties and led to their failure to correctly set and verify the flaps.”



Intentional non-compliance leads to other problems

- LOSA data revealed that, compared to crews who followed SOPs, crewmembers who intentionally deviated from procedures:
 - averaged making three times more errors
 - mismanaged more errors
 - found themselves in more undesired aircraft situations.



Recommendations for

OBTAINING BETTER COMPLIANCE



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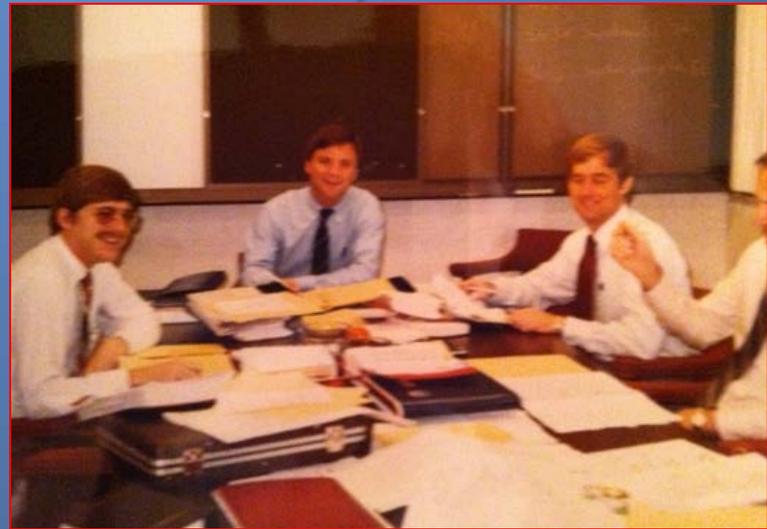
Begin by

- Realizing that well-designed SOPs are essential for safety
- Making a strong commitment for procedural compliance to be a core value of the organization
 - simply having the procedures is not enough
 - religiously following them – and insisting they be followed – must be a way of doing business.



Then

- Go through all manuals, checklists, and procedures.
- Change those that that don't work, are not clear, are outdated, and/or are not followed.



If people aren't following it...

change it.

CHECKLIST

Shoulder HarnessesSECURED

Take Off Briefing.....COMPLETE

Transponder

CHECKLIST

Shoulder HarnessesFASTENED

Take Off Briefing.....COMPLETE

TransponderON

CHECKLIST

Shoulder HarnessesON

Take Off Briefing.....COMPLETE

TransponderON

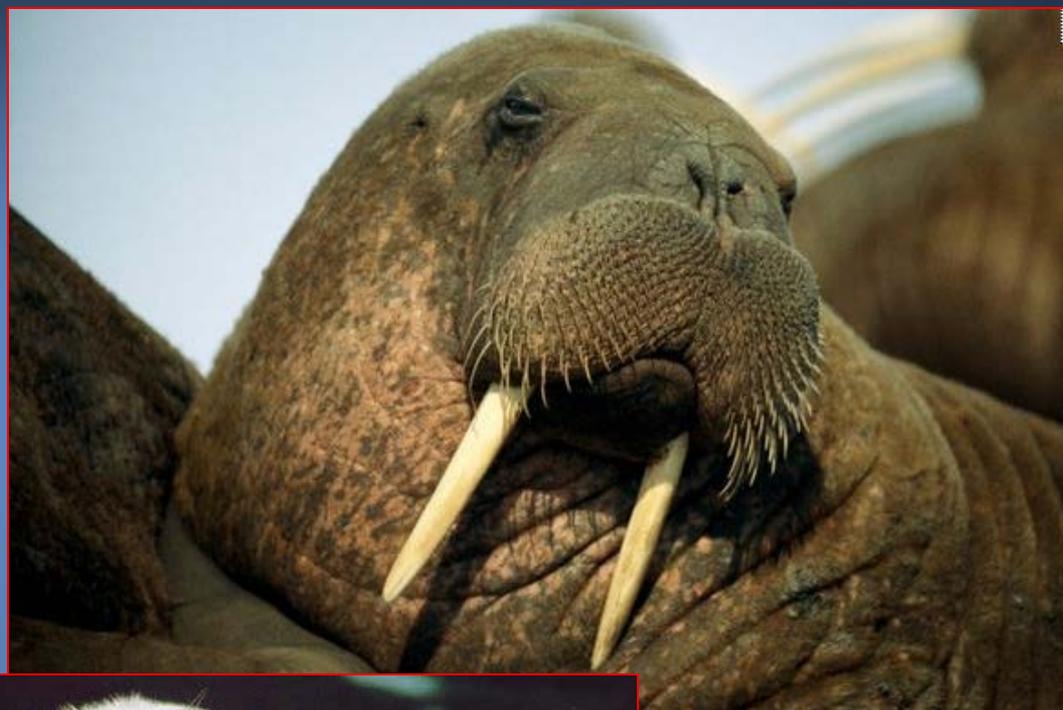


Establishing a culture of procedural compliance

- Procedures must not be developed in a vacuum - they must have the input of those who are expected to use them.
- Also, it is critical that crewmembers understand the reason for the procedures.
- Avoid seals, sea otters, and walruses.
- Avoid “Normalization of deviance”
- Avoid selective compliance



Avoid seals, sea otters, and walruses



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Avoid seals, sea otters, and walruses



Deepwater Horizon



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Avoid seals, sea otters, and walruses

Deepwater Horizon



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Avoid seals, sea otters, and walruses

BP Spill Response Plan for that Specific Location:

- Listed a wildlife specialist at University of Miami
 - He left University of Miami 20 years earlier
 - Died 4 years before the plan was even *published*
- Listed incorrect names and phone numbers for marine life specialists in Texas
- Listed instructions for how to deal with seals, sea otters, and walruses
 - **None of these mammals even live in the Gulf of Mexico**



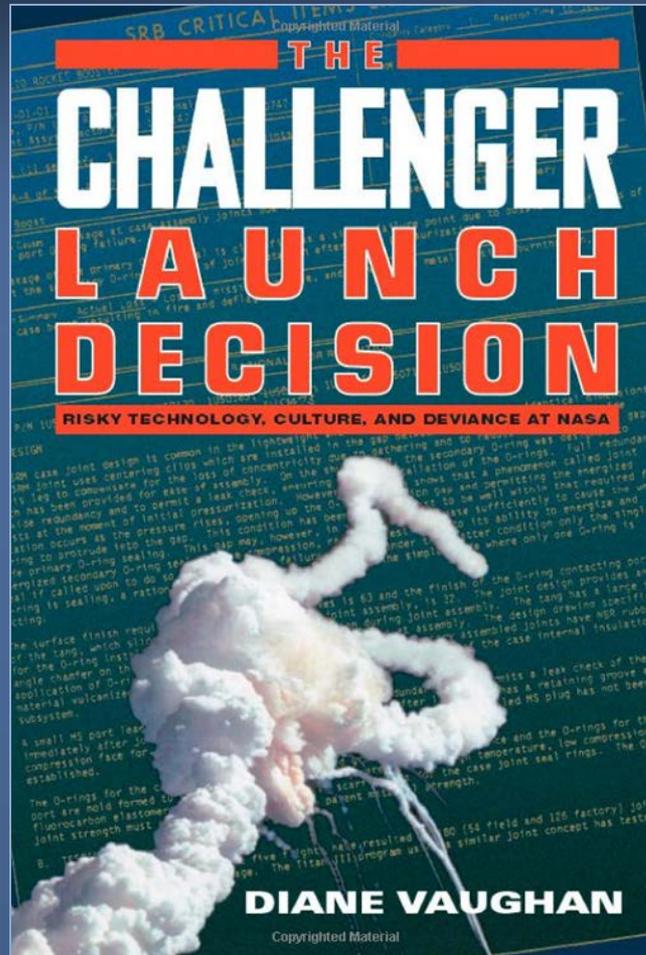
Avoid seals, sea otters, and walruses

In other words...

Make sure your procedures reflect
the way you intend to operate,
and then operate that way.



Avoid “Normalization of Deviance”



- Normalization of Deviance: When not following procedures and taking “short cuts” and becomes an accepted practice.



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Avoid Selective Compliance



- “That is a stupid rule.”
- “I don’t have to comply with that one.”





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Check for compliance

- Audit flight crews for compliance

“What gets measured gets done.
What gets measured and fed back gets done well.
What gets rewarded gets repeated.”

– John E. Jones

- The goal is precision – not perfection.



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