**NTSB** National Transportation Safety Board
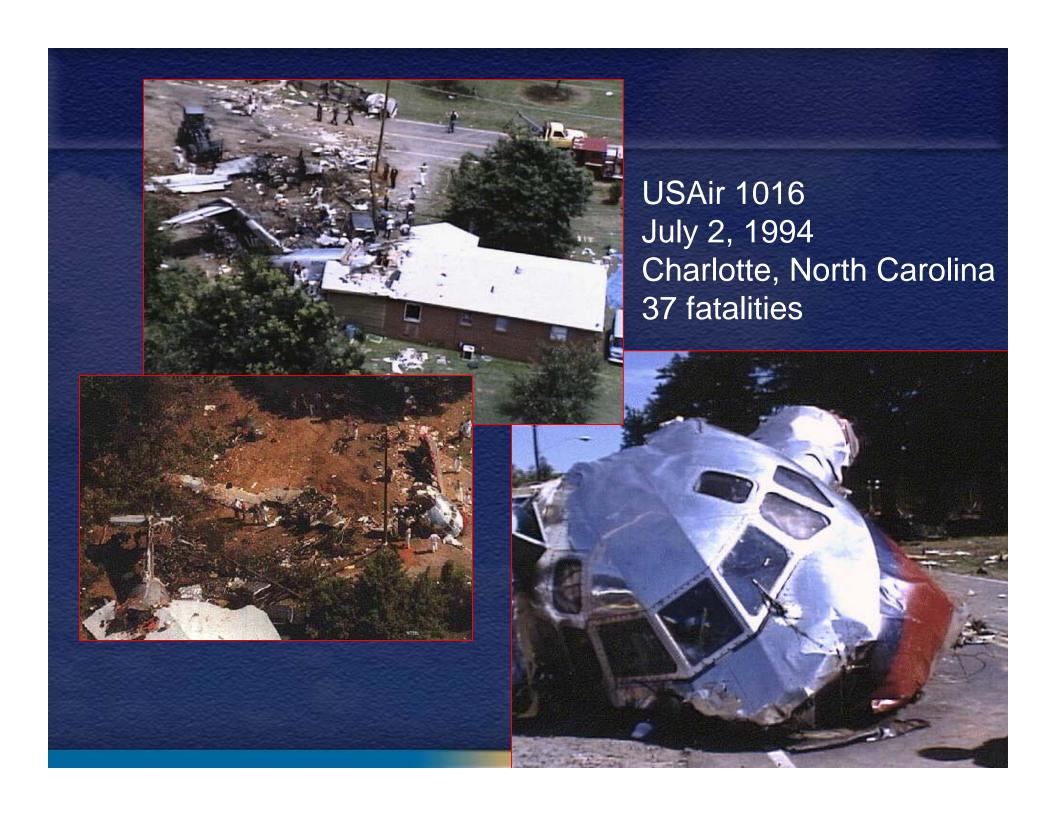
# Standard Operating Procedures:

The backbone of professional flight operations

Robert L. Sumwalt

USAir 1016
July 2, 1994
Charlotte, North Carolina
37 fatalities

APRIL 5, 199

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

# 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

n dangerous weather
hear situation
sures to escape the wind shear

and complete weather

children
advisories

# From an NTSB accident report

"Well-designed cockpit procedures are an effective countermeasure against operational errors, and disciplined compliance with SOPs, including strict cockpit discipline, provides the basis for effective crew coordination and performance."

Crash During Attempted Go-Around After Landing
East Coast Jets Flight 81
Hawker Beechcraft Corporation 125-800A, N818MV
Owatonna, Minnesota
July 31, 2008

aviation

National
Transportation
Safety Board

Accident Report
NTSB/AAR-11/01
PB2011-910401

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# What accident data show

NTSB safety study of 37 crew-caused
air carrier accidents, 1978-1990

- Procedural errors, such as not making required callouts or failing to use appropriate checklists, were found in 29 of the 37 (78%) reviewed accidents
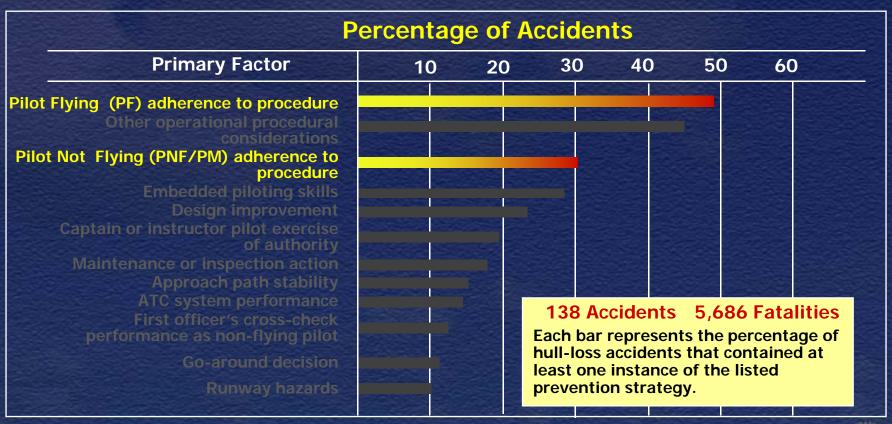


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# What accident data show

- NTSB identified at least 86 accidents involving:
  - lack of adequate procedures, policies, or checklists, or
  - lack of flight crew adherence to procedures, policies, or checklists

These accidents resulted in 149 fatalities.

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# Accident Prevention Strategies

## Hull-loss Accidents over 10 Year Period

### Percentage of Accidents

| Primary Factor | 10 | 20 | 30 | 40 | 50 | 60 |
|---|---|---|---|---|---|---|

**Pilot Flying  (PF) adherence to procedure**

Other operational procedural considerations

**Pilot Not  Flying (PNF/PM) adherence to procedure**

Embedded piloting skills

Design improvement

Captain or instructor pilot exercise of authority

Maintenance or inspection action

Approach path stability

ATC system performance

First officer's cross-check performance as non-flying pilot

Go-around decision

Runway hazards

**138 Accidents   5,686 Fatalities**

Each bar represents the percentage of hull-loss accidents that contained at least one instance of the listed prevention strategy.

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
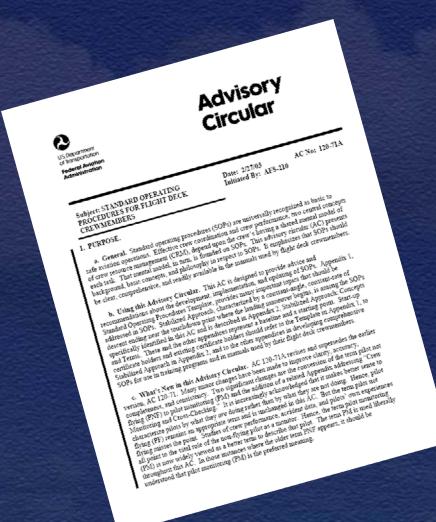
- Flight crews intentionally disregard SOPs

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Why SOPs are not followed

# ORGANIZATION LACKS ADEQUATE SOPS

"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..."

# FAA Advisory Circular AC 120-71A



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

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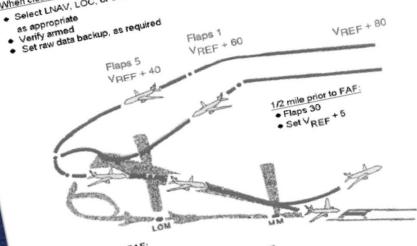8 fatalities

# 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."

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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

Flaps 1
V REF + 60

V REF + 80

Flaps 5
V REF + 40

1/2 mile prior to FAF:
- Flaps 30
- Set V REF + 5

LOM                    MM

2-1/2 miles from FAF:
- Gear down
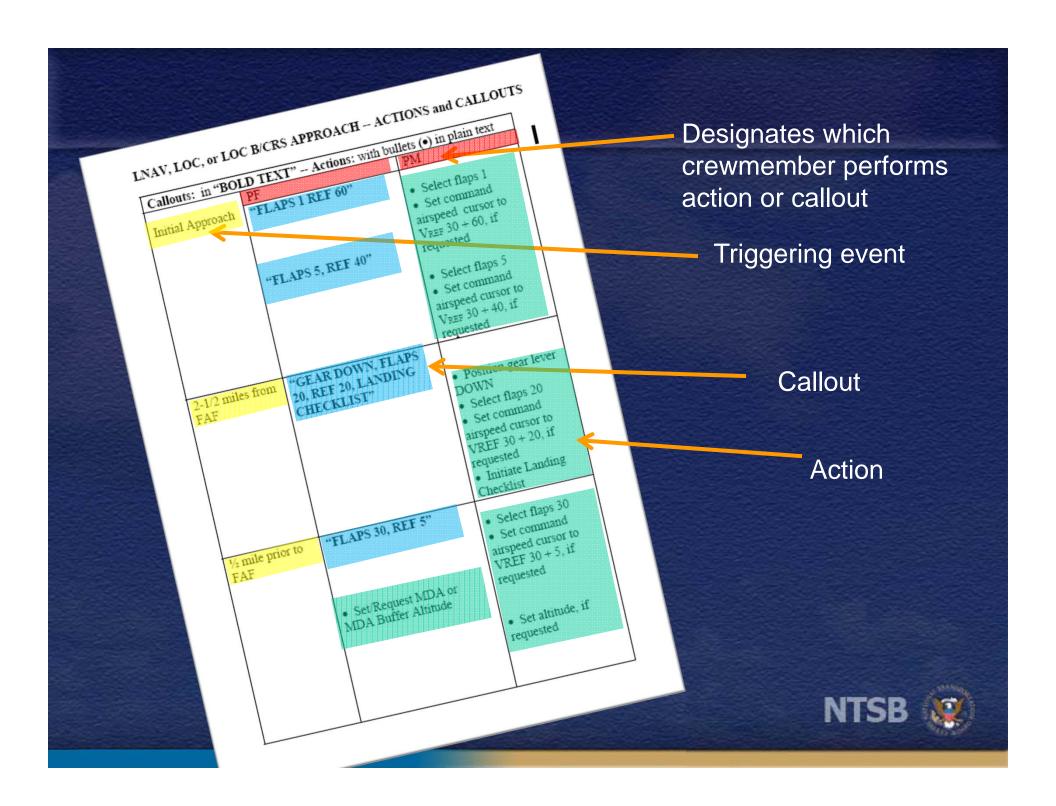- Flaps 20
- Set V REF +20
- Initiate Landing Checklist

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

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

Callouts: in "BOLD TEXT" -- Actions: with bullets (•) in plain text

| | PF | PM |
|---|---|---|
| Initial Approach | "FLAPS 1 REF 60" | • Select flaps 1<br>• Set command airspeed cursor to $V_{REF}$ 30 + 60, if requested |
| | "FLAPS 5, REF 40" | • Select flaps 5<br>• Set command airspeed cursor to $V_{REF}$ 30 + 40, if requested |
| 2-1/2 miles from FAF | "GEAR DOWN, FLAPS 20, REF 20, LANDING CHECKLIST" | • Position gear lever DOWN<br>• Select flaps 20<br>• Set command airspeed cursor to VREF 30 + 20, if requested<br>• Initiate Landing Checklist |
| ½ mile prior to FAF | "FLAPS 30, REF 5" | • Select flaps 30<br>• Set command airspeed cursor to VREF 30 + 5, if requested |
| | • Set/Request MDA or MDA Buffer Altitude | • Set altitude, if requested |

Designates which crewmember performs action or callout

Triggering event

Callout

Action

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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."



Pictures from Terry A. Boyd

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# Maintenance Discrepancy Entry

# 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 <u>company business</u>
  - Accident flight was a <u>personal flight</u>
- PIC must possess ATP
  - PIC <u>did not</u> possess ATP
- Last 3 maintenance discrepancies had not been addressed

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# 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
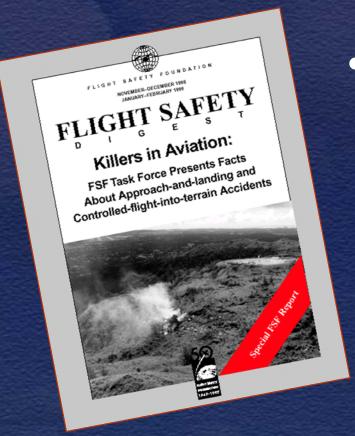
# FLIGHT CREWS INTENTIONALLY DISREGARD SOPS

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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."



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# Intentional non-compliance affects safety

- Intentional crew non-compliance was a factor in 40% of the worldwide accidents reviewed.
  - R. Khatwa & R. Helmreich

# 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 3 times more errors
  - mismanaged more errors
  - found themselves in more undesired aircraft situations.

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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 <u>having</u> the procedures is not enough
  - religiously <u>following them</u> – and insisting they be followed – must be a way of doing business.

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# 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 Harnesses …..SECURED**
**Take Off Briefing………COMPLETE**
**Transponder ……..**

**CHECKLIST**

**Shoulder Harnesses ….FASTENED**
**Take Off Briefing………COMPLETE**
**Transponder ………...…………..ON**

**CHECKLIST**

**Shoulder Harnesses ……………ON**
**Take Off Briefing………COMPLETE**
**Transponder ……..……………ON**

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# 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

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 and names and phone numbers for marine life specialists in Texas

- Listed instructions for how to deal with seals, sea otters, and walruses
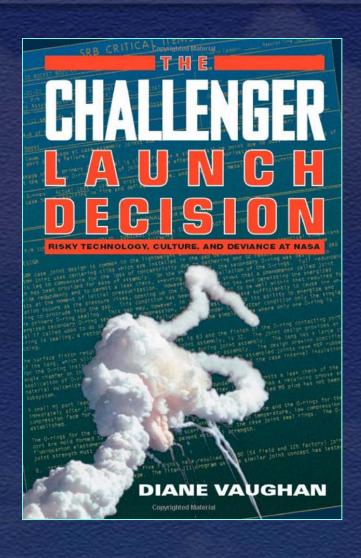  - **None of these mammals even live in the Gulf of Mexico**

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# 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.

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# Avoid "Normalization of Deviance"



THE CHALLENGER LAUNCH DECISION

RISKY TECHNOLOGY, CULTURE, AND DEVIANCE AT NASA

DIANE VAUGHAN

- 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.