National Transportation Safety Board

The Critical Link between Human Factors and Safety

Robert Sumwalt

Looking back on the past 20 years ...

ALPA strongly supports

- Human factors
- Human-centered design
- High quality training
  - i.e., CRM and AQP
- Operational feedback programs
  - i.e., line audits, incident reporting systems, FOQA, ASAP
- Systems approach to accident and incident investigations

Human factors is a multidisciplinary science that examines the relationship between humans and the systems with which they interact, including…

Ergonomics
Engineering
Psychosocial interactions
Decision-making
TEM
Fatigue
Psychology
Physiology
Human-centered design
Biomechanics
Information processing
National cultural influences
Medicine
Study of organizational issues
Anthropometrics
CRM
Resilience engineering
Automation management
Communications

Aviation Human Performance Investigators

Evan Byrne, Ph.D.

Katherine Wilson, Ph.D.

Bill Bramble, Ph.D.

Sathya Silva, Ph.D.

NTSB Medical Officers

Mary Pat McKay, MD, MPH
Chief Medical Officer

Nicholas Webster, MD
Medical Officer

Potential Sources of Information

72-Hour History

Other Sources

Physical Evidence

Autopsies

Hotel Records

Interviews

Cell Phone Records

AME Records

Toxicological Tests

Other Medical Records

NTSB Investigations Examine the Entire System

The Human(s)

Interface with Machine & Environment

Corporate and Regulatory Environment

TRAINED FOR LIFE: HUMAN-CENTERED APPROACH TO SAFETY

System Safety Order of Precedence*

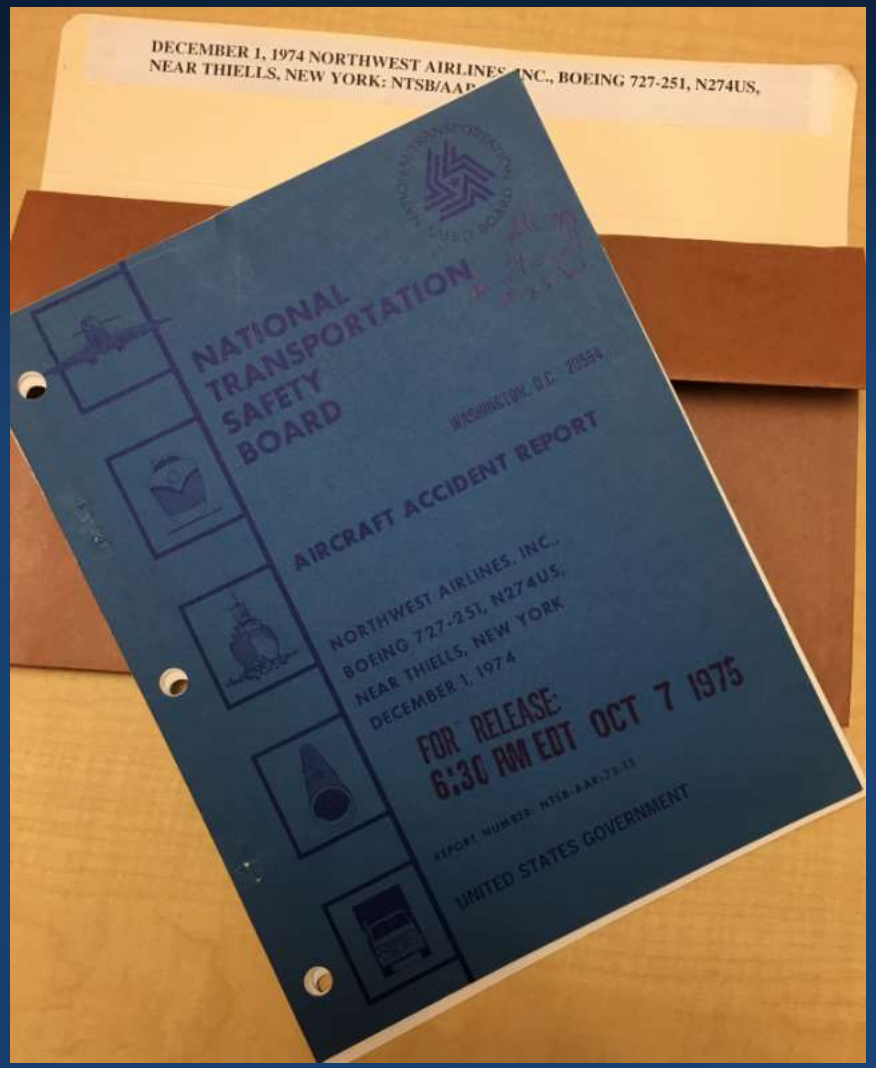
1. Eliminate the hazard through Design/Engineering Features
   - Hazard is corrected and eliminated
2. Incorporate Guards/Safety Devices
   - Guards put up to decrease exposure
3. Provide Warning Devices
   - Warn personnel if you can't eliminate or control the hazard
4. Develop Procedures and Training

*Also know as "Hierarchy of Controls."

Source: MIL-STD-882E

ROBERT'S HF PREMISE # 1

If you design out the problem, you design out the problem. <duh>


DECEMBER 1, 1974 NORTHWEST AIRLINES, INC., BOEING 727-251, N274US,
NEAR THIELLS, NEW YORK: NTSB/AAR
NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594
AIRCRAFT ACCIDENT REPORT
NORTHWEST AIRLINES, INC.,
BOEING 727-251, N274US,
NEAR THIELLS, NEW YORK
DECEMBER 1, 1974
FOR RELEASE:
6:30 PM EDT OCT 7 1975
REPORT NUMBER: NTSB-AAR-75-13
UNITED STATES GOVERNMENT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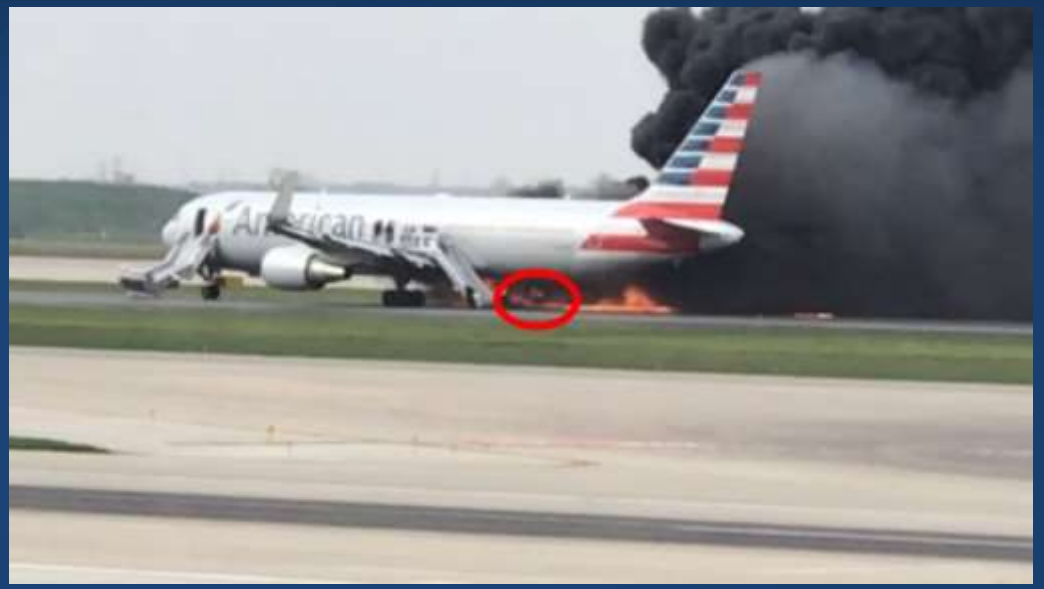
ROBERT'S HF PREMISE # 2

If you design something with enough complexity, don't be surprised if someone can't use it when they really need it.

American 383, October 28, 2016

Rejected takeoff



Evacuation


BOEING
AMERICAN AIRLINES, INC
AA
SIN
HAN5258
D06919


LIFT HANDSET
DOOR 1 L 11
DOOR 1 RC 21
DOOR 2 R 22
DOOR 4 L 13
DOOR 4 R 23
FA ALL CALL 55
PILOT CALL 31
PA ALL 49
3 CHIME COCKPIT#3
4 CHIME COCKPIT#4
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4 5 6
7 8 9
* 0 #
PASSENGER ADDRESS
PUSH TO TALK
RESET
AMERICAN AIRLINES, INC
AA
SIN
HAN 5294
D11#4

ROBERT'S HF PREMISE # 3

If you don't account for human error, you, yourself, have made a very basic human error.

National Transportation Safety Board

Loss of Control at Takeoff

Frisco, Colorado
July 3, 2015
CEN15MA290

NTSB Finding

- “The design of Airbus Helicopters dual-hydraulic AS350-series helicopters did not account for the possibility of pilot error in configuring the tail rotor hydraulic circuit …”

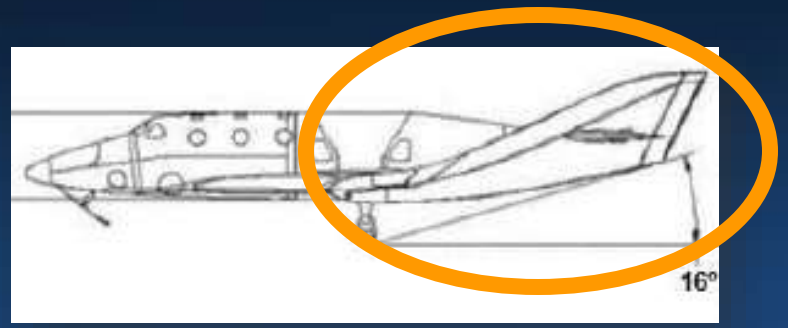
In-Flight Breakup During Test Flight

October 31, 2014

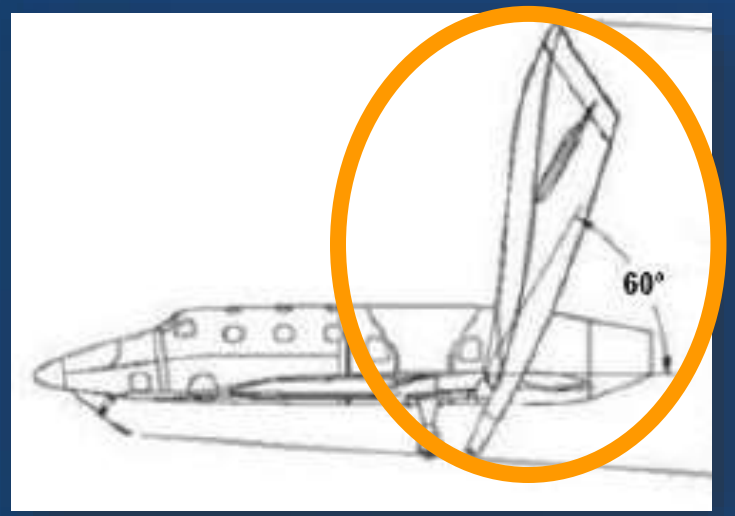
SpaceShipTwo


N348MS
N339SS
N348MS

SpaceShipTwo Feather System



Feather retracted



Feather extended

Feather Lock Handle

Feather Locked

Lock

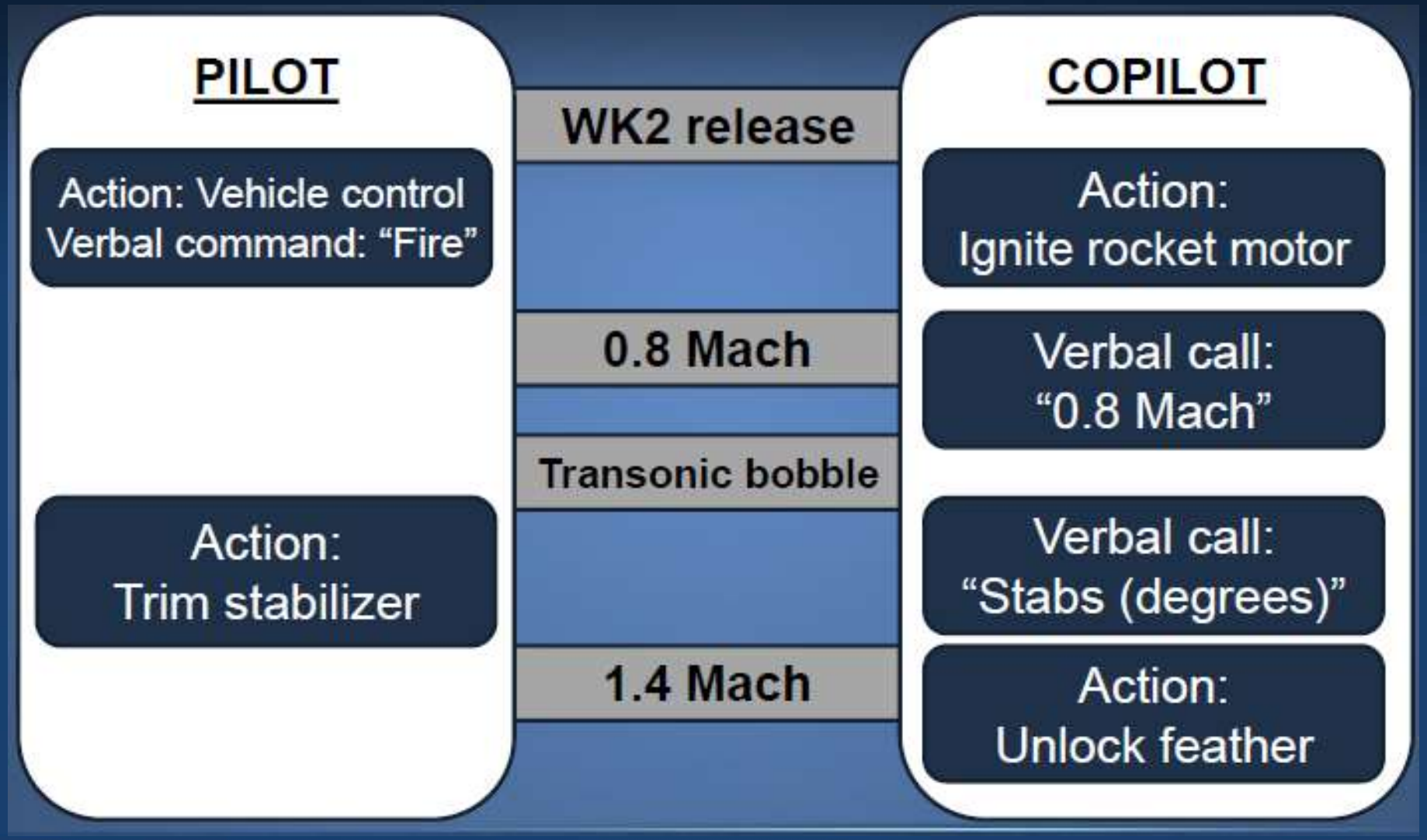
Unlock

Feather Unlocked

The investigation found

- High emphasis on making sure feather was unlocked at 1.4 Mach.
  - Cockpit visual and aural alerting
  - Training and procedures
  - Mission abort if not unlocked by 1.8 Mach
- Not great concern placed on low speed unlocking.
  - Relied on pilots to do it right

Specified Flight Crew Procedures



- A single-point mechanical failure with catastrophic consequences would be unacceptable.
- However, Scaled Composites failed to consider that a single human error could be catastrophic.

NTSB Finding

"By not considering human error as a potential cause of uncommanded feather extension on the SpaceShipTwo vehicle, Scaled Composites missed opportunities to identify the design and/or operational requirements that could have mitigated the consequences of human error during a high workload phase of flight."

NTSB Recommendation

Develop and issue human factors guidance for use during the design and operation of crewed vehicles.


NATIONAL TRANSPORTATION SAFETY BOARD
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