



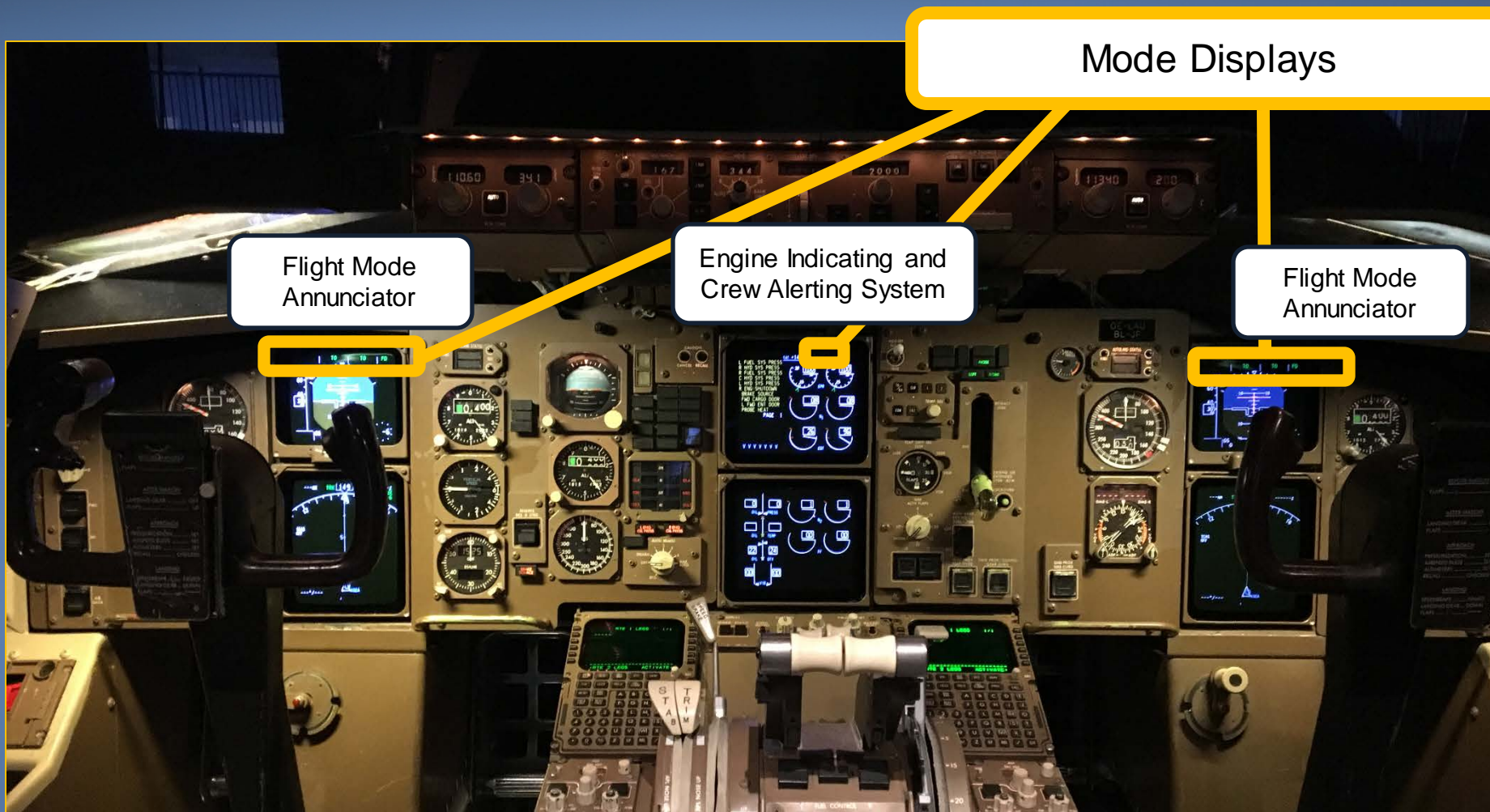
# National Transportation Safety Board



Source: Jehan M. Ghouse, [www.airliners.net](http://www.airliners.net)

Atlas Air Inc., Flight 3591  
Boeing 767-375BCF  
Trinity Bay, Texas  
February 23, 2019  
Human Performance  
Presentation

# Crew Mode Awareness



# Flight Crew Mode Awareness

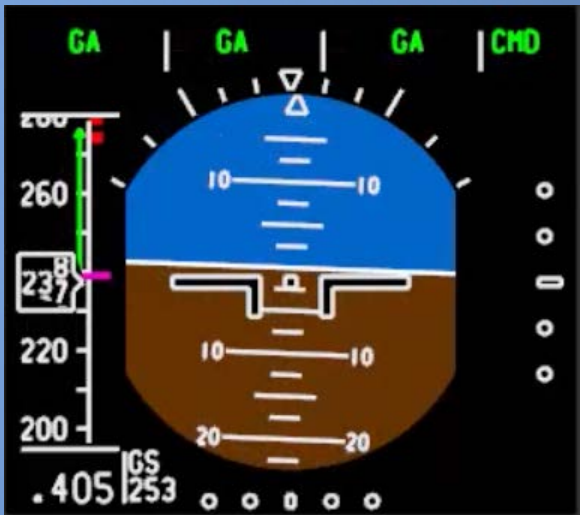
A



B



C



# Crew Mode Awareness

- Pilots can miss displayed mode changes
- Crew did not:
  - Acknowledge mode change
  - Select different mode
  - Verbalize anything unexpected was happening
- Crew lacked awareness of mode change

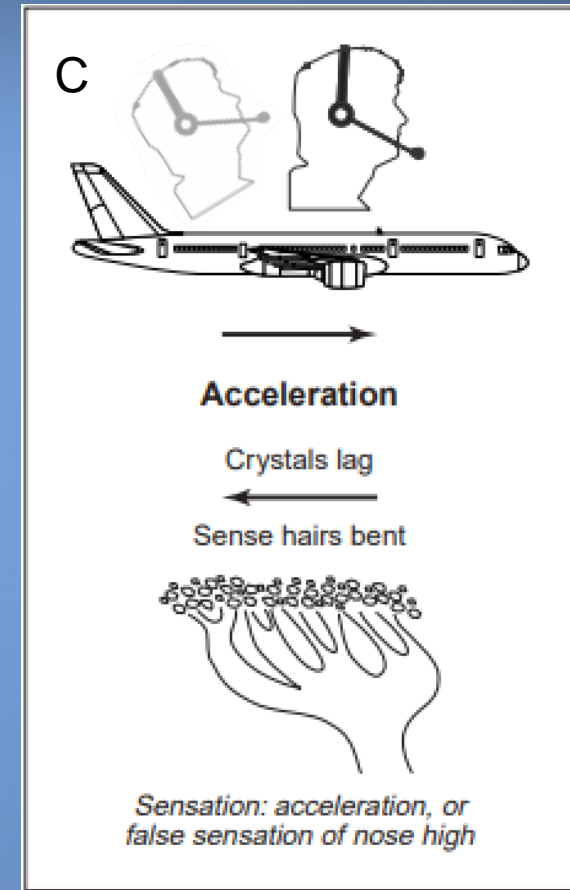
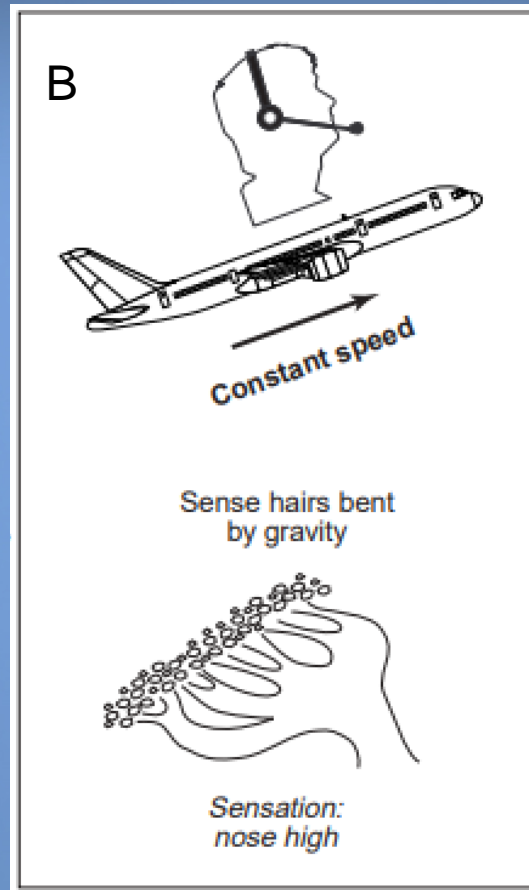
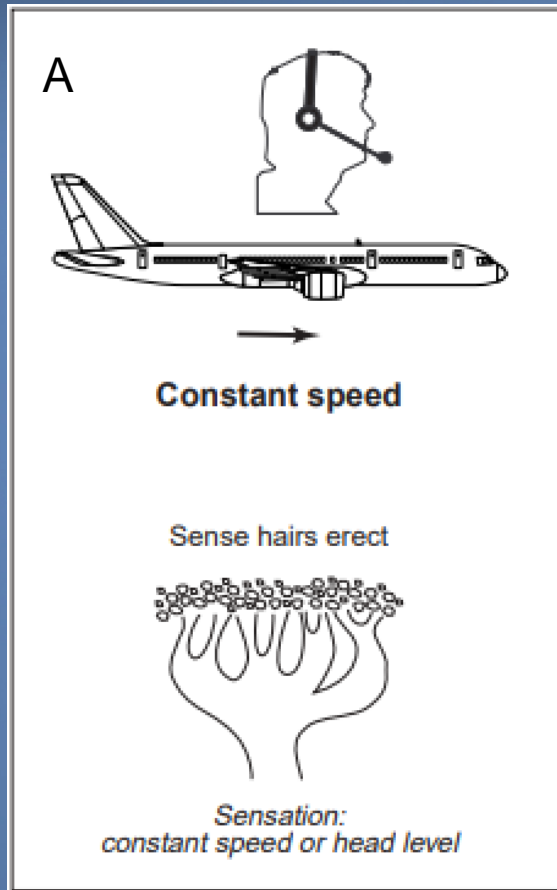
# First Officer's Response

- Expected airplane to level off at 3,000 ft
- When airplane stopped descending, first officer retracted speedbrakes
- Likely sensed a change and reacted without fully assessing situation

# First Officer's Response

- As forward acceleration increased, first officer:
  - Pushed forward on control column
  - Reduced airplane's pitch
- Inputs consistent with pitch up illusion (somatogravic illusion)

# Somatogravic Illusion



Source: Flight Safety Foundation. 1997. *Human Factors and Aviation Medicine*, 44(6): 5.

# First Officer's Response

- Exclaimed “where’s my speed” and “we’re stalling
- Attention fully absorbed by misleading sensations
- Continued pushing forward on control column



# Captain's Response

- Had been setting up for the approach and communicating with ATC
- Delayed his recognition of changes in airplane state
- Delayed intervention is common in cases of pilot subtle incapacitation

# Captain's Response

- Likely experienced startle and surprise
- Asked what was happening, but first officer made only panicked statements
- Failure to assume positive control likely resulted from the ambiguity, stress, and time-limited nature of situation

# Spatial Disorientation Accidents Involving Somatogravic Illusion

- 1994 – DC-9 Charlotte, North Carolina
- 2000 – A-320 Muharrag, Bahrain
- 2006 – A-320 Sochi, Russian Federation
- 2010 – A-330 Tripoli, Libya
- 2013 – CRJ-200 Kyzyltu, Kazakhstan
- 2013 – B737-500 Kazan, Russian Federation
- 2016 – B737 Rostov-on-Don, Russian Federation

# Auto GCAS Technology

- Department of Defense (DoD) developed automatic ground collision avoidance (auto GCAS) technology for fighter aircraft
- DoD researching for Lockheed C-130
- Adaptation of auto GCAS to civil transport category airplanes could reduce accidents

# Pilot Selection and Performance Measures

- First officer repeatedly overwhelmed by novel, complex, or unexpected situations
- Atlas instructors attributed his difficulties to external circumstances or low confidence
- Long history of significant performance difficulties indicative of low aviation aptitude

# Pilot Selection and Performance Measures

- Airlines need systematic, scientifically-based approach to pilot selection
- Airlines would benefit from:
  - Improved pilot selection and performance measures
  - Clearinghouse of deidentified selection data to improve and validate pilot selection strategies



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