



Inflight Loss of Control Prevention in Commercial and General Aviation

Richard P. Morris
Fowler White Burnett, P.A.



2014 AIA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL



What is Loss of Control?

- Airplane Upset
 - Pitch attitude greater than 25 degrees nose up;
 - Pitch attitude greater than 10 degrees nose down;
 - Bank angle greater than 45 degrees; or
 - Within the above parameters, but flying at airspeeds inappropriate for the conditions.
- Loss of Control in Flight (LOC-I)
 - A categorization of an accident or incident resulting from a deviation from the intended flightpath



2014 AIA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL



Upset Training Requirement

- Airline Safety and FAA Extension Act of 2010
 - Public Law 111-216, signed August 1, 2010
- Sections 202 through 217 address safety concerns
- 49 U.S.C. sec. 44701. General requirements



2014 AIA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL

Sec. 208, NTSB Recommendations

... require part 121 air carriers to provide flight crewmembers with ground training and flight training or flight simulator training—

(A) to recognize and avoid a stall of an aircraft or, if not avoided, to recover from the stall; and

(B) to recognize and avoid an upset of an aircraft or, if not avoided, to execute such techniques as available data indicate are appropriate to recover from the upset in a given make, model and series of aircraft

2014 IJA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL

NTSB Safety Recommendations

- A-70-21, May 1, 1970 recommended training in recovery from unusual attitudes following 1968 crash
- FAA responded, "It is inconceivable to require training maneuvers which would place a large jet airplane in a nose high, low airspeed, high angle-of-bank situation"

2014 IJA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL

NTSB Safety Recommendations

- A-72-152 recommended use of simulators to require pilots to demonstrate ability to recover from unusual attitudes
- FAA responded that it did not believe that simulators were capable of simulating flight beyond normal flight envelope of the aircraft

2014 IJA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL

NTSB Safety Recommendations

- A-92-20 recommended recurrent training and proficiency programs for instrument-rated pilots, including recognition and recovery from unusual attitudes
- FAA responded recovery from unusual flight attitudes already on private pilot examination



2014 AIA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL

NTSB Safety Recommendations

- A-93-72 recommended requiring that commuter air carriers perform hazardous training, testing, and checking maneuvers
- FAA required Part 135 air carriers to receive same level of training as Part 121



2014 AIA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL

NTSB Safety Recommendations

- A-96-120 issued October 18, 1996 following several B737 incidents
- Recommended Part 121 and 135 operator training in recognition of and recovery from unusual attitudes and upset maneuvers, including while controlled by automatic flight systems
- FAA: "many operators are providing training"



2014 AIA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL

Accidents

- Comair 3272 – Monroe, MI, 1/9/97
- American 587 – Belle Harbor, NY, 11/12/01
- Continental 3407 – Buffalo, NY, 2/12/09
- Air France 447 – Brazil, 6/1/09



2014 AIA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL

Continental 3407 – NTSB A-10-10-34

- Fatigue risks
- Stall Training
- Stick Pusher Training
- Simulator Fidelity Requirements



2014 AIA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL

FAA Actions

- NPRM 1/12/09 for training in recognizing and recovering from sudden or unexpected aircraft upsets for Part 121 operators
- Supplemental NPRM 5/20/11
- Final Rule 11/12/13
 - Section 121.423, Pilot: Extended Envelope Training
 - Section 121.424, Pilots: Initial, transition and upgrade flight training
- A-96-120 (10/18/96) Closed 6/13/14



2014 AIA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL

Air France 447

- Brazil, June 1, 2009



2014 IJA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL



02:10:07 UTC

Left PF0

ECAM Messages

Right PF0

Left engine

Thrust Levers

Right engine

Air France 447

2014 IJA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL



02:11:45 UTC

Left PF0

ECAM Messages

Right PF0

Left engine

Thrust Levers

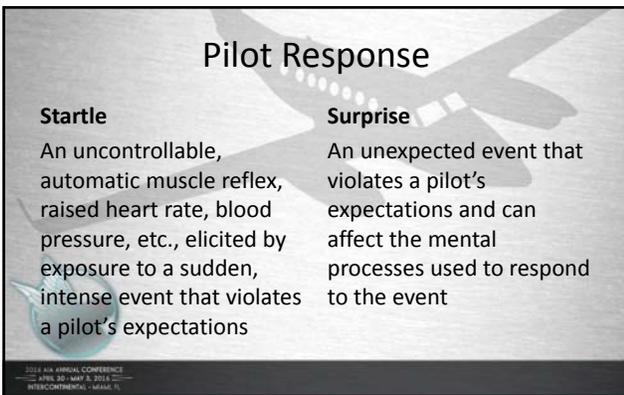
Right engine

Air France 447

"We lost all control of the aeroplane we don't understand we've tried everything"

2014 IJA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL



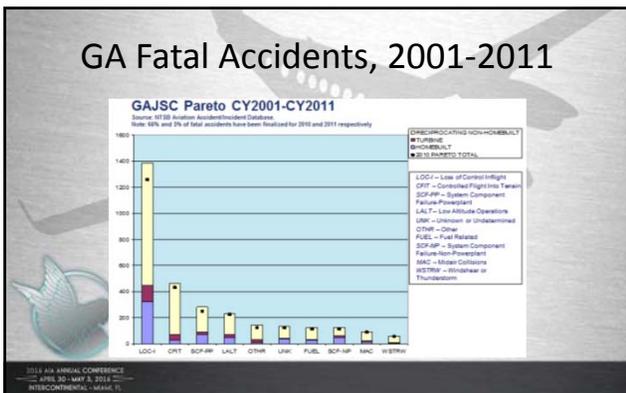






- ### Global Effort
- 2011 – FAA ARC, ICAO, EASA
 - 2012 – LOCART initiative
 - 2014 – ICAO Manual on Aeroplane UPRT
 - Identified ineffective/contributory existing practices in recovery from approach-to-stall
 - Effective recovery requires reduction in AoA
 - 2015 – IATA Guidance Material and Best Practices for Implementation of UPRT
- 2014 IATA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL, MIAMI, FL

- ### General Aviation
- GAJSC re-established January 2011
 - LOC Final Report, September 2012
- 2014 IATA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL, MIAMI, FL

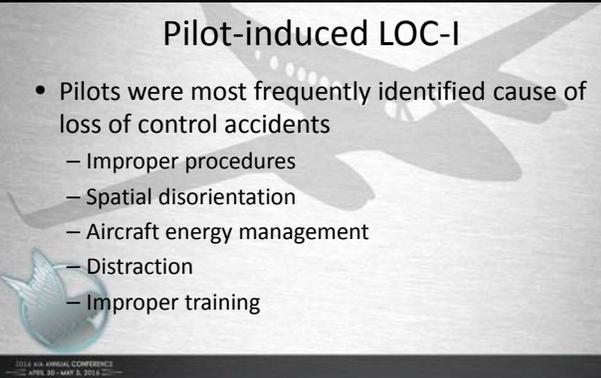


- ### GA Safety Enhancements
- Angle of Attack (AoA) Indicators
 - Not widely used
 - Develop public education campaign
 - Develop cost-effective AoA installations for new and existing designs, and retrofit for existing fleet
 - Reduce regulatory roadblocks (AoA and Autopilot)
 - Reduce Over Reliance on Automation
 - Transition Training
- 2014 AIA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL

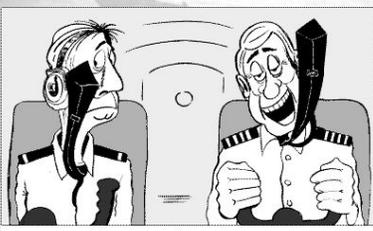
- ### NTSB Most Wanted 2015-2016
- Prevent Loss of Control in Flight in General Aviation
 - 47 percent of fatal fixed-wing GA accidents between 2008 and 2014 with 1,210 fatalities
 - Pilots should:
 - Be prepared to recognize stall characteristics and warning signs, and be able to apply appropriate recovery techniques before stall onset.
 - Be honest with themselves about their knowledge level of stalls, and their ability to recognize and handle them.
 - Use effective aeronautical decision-making techniques and flight risk assessment tools during both preflight planning and inflight operations.
 - Manage distractions so that they do not interfere with situational awareness.
 - Understand, properly train, and maintain currency in the equipment and airplanes they operate.
 - Take advantage of available commercial trainer, type club, and transition training opportunities.
 - Realize stall characteristics can vary with aircraft loading and are usually worse at aft CG (center of gravity)
- 2014 AIA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL

Pilot-induced LOC-I

- Pilots were most frequently identified cause of loss of control accidents
 - Improper procedures
 - Spatial disorientation
 - Aircraft energy management
 - Distraction
 - Improper training



2014 IATA ANNUAL CONFERENCE
APRIL 30 - MAY 5, 2014
INTERCONTINENTAL - MIAMI, FL



Always trust your instruments, son

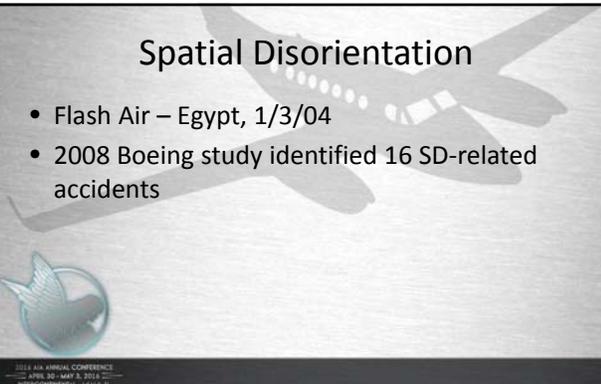
Always trust your instruments, son



2014 IATA ANNUAL CONFERENCE
APRIL 30 - MAY 5, 2014
INTERCONTINENTAL - MIAMI, FL

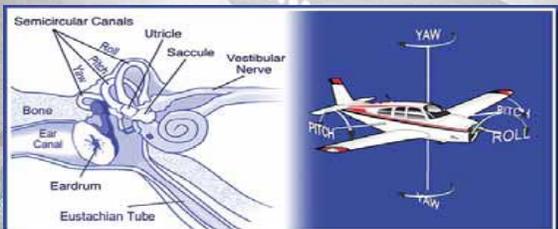
Spatial Disorientation

- Flash Air – Egypt, 1/3/04
- 2008 Boeing study identified 16 SD-related accidents



2014 IATA ANNUAL CONFERENCE
APRIL 30 - MAY 5, 2014
INTERCONTINENTAL - MIAMI, FL

Semicircular Canals



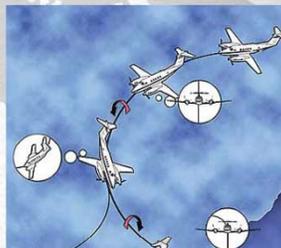
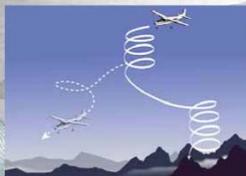
2014 IJA AIRMAIL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL

Vestibular Illusions

- Sub-threshold roll – roll rate below 5°/second below detection threshold
- Somatogравic illusion

2014 IJA AIRMAIL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL

Graveyard spin/spiral



2014 IJA AIRMAIL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL

Ongoing and Future Initiatives

- UPRT required for Part 121 operators
- Flight Simulator Training Devices
- Angle of Attack Indicators
- 14 CFR Part 23 changes
- Drone notification, awareness, and avoidance
- Insurance and training partnerships
- Contractual obligations

2016 IIA ANNUAL CONFERENCE
APRIL 30 - MAY 5, 2016
INTERCONTINENTAL - MIAMI, FL

UPRT for Part 121 Air Carriers

- FAA AC120-109A: Stall Prevention and Recovery Training
- FAA AC120-111: Upset Prevention and Recovery Training
- Both encourage all airplane operators, pilot school and training centers to use guidance

2016 IIA ANNUAL CONFERENCE
APRIL 30 - MAY 5, 2016
INTERCONTINENTAL - MIAMI, FL

Flight Simulator Training Devices

- 14 CFR Part 60, effective May 31, 2016, requires compliance by March 12, 2019 with new technical standards for:
 - Full stall and stick pusher maneuvers
 - Upset recognition and recovery maneuvers
 - Maneuvers in airborne icing conditions
 - Takeoff and landing in gusting crosswinds
 - Bounced landing recovery maneuvers

2016 IIA ANNUAL CONFERENCE
APRIL 30 - MAY 5, 2016
INTERCONTINENTAL - MIAMI, FL

Angle of Attack

Flight Simulator Capabilities

Warning value	Normal flight	Approach to stall	Stall
Longitudinal control	Insensitivity to pitch attitude, no lights or stall warnings, absence of stall	Highlights, warnings and advisory by holding AoA	Reverts to minimum selection of AoA, addition of AoA display in
Lateral control	Insensitivity to effects of maneuvers or stall	Insensitivity of electronic stall control system	Prevention of departure, complex stall handling (wing-rock)
Power	Little impact on power generation	Depending on aircraft class, may better increase fuel	
Engine thrust/propeller/operation	Variable	Variable, constant	Prevent additional development

2014 AIA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL

Angle of Attack Indicators

- Approval of Non-Required Angle of Attack (AoA) Indicator Systems, 14 CFR Part 21.8(d)
 - AoA manufacturer requests letter of approval
- Must be a stand-alone unit and not interface with a certificated system, or conflict with aircraft stall warning
- Must display: “not for use as a primary instrument for flight”

2014 AIA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL

14 CFR Part 23 Changes

- Airworthiness Standards for Normal, Utility, Acrobatic and Commuter Category Airplanes
 - Max. 19 passengers and max. weight <19,000lbs
- NPRM issued 3/14/16, public comments close 5/13/16
- FAA holding public meetings May 3 and May 4

2014 AIA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL

Part 23 LOC Changes

- FAA identified 74 stall or LOC accidents, Jan-08 to Dec-13
- Add requirements to Sections 23.200 and 23.215
- Propose requiring warnings to improve pilot awareness of stall margins, e.g. AoA or energy awareness, or envelope protection systems with forward force when speed and attitude approach stall

2014 AIA ANNUAL CONFERENCE
APRIL 30 - MAY 8, 2014
INTERCONTINENTAL - MIAMI, FL

Attack of the Drones

- FAA Annual Aerospace Forecast anticipates increase in overall air travel
- UAS sales growth from 2.5 million in 2016 to 7 million in 2020
 - Hobbyists 1.9 million to 4.3 million
 - Commercial 600,000 to 2.7 million
- Section 333 Exemption altitude to 400 feet

2014 AIA ANNUAL CONFERENCE
APRIL 30 - MAY 8, 2014
INTERCONTINENTAL - MIAMI, FL

Drone Sightings

- FAA receives more than 100 a month
- Various altitudes and distance from both commercial and general aviation aircraft
- 2011 study of 71 LOC-I business aviation accidents found 63% occurred below 1,000 feet (takeoff and approach/landing)

2014 AIA ANNUAL CONFERENCE
APRIL 30 - MAY 8, 2014
INTERCONTINENTAL - MIAMI, FL

Center for the Study of the Drone

- 58% within 5 miles of an airport
- 36% “Close Encounters” within 500 feet
- 36% involved multi-engine jet aircraft (80% commercial passenger)
- 24 within 50 feet
- 11 evasive maneuvers

New York/Newark	43
Los Angeles/Long Beach	25
Dallas/Addison	18
San Diego	15
Orlando	13
Houston	11
Miami	10
Philadelphia	9
Santa Ana	9
Atlanta	8
Chicago	8
Seattle	7

Data: Incident reports between August 01, 2012 and January 31, 2015. Credit: The Center for the Study of Drone at Penn State.

2014 AIA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL

92% reported above 400 feet

2014 AIA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL

Insurance and UPRT Partnerships

- SwissRe and APS in Phoenix, AZ
 - premium rebates up to \$25,000 for training costs
- USAIG and APS in Phoenix, AZ or Dallas, TX
 - complimentary tuition for 2-day/3-flight course
- QBE and Flight Research in Mojave, CA
 - Underwriting incentives and 5% no-claim bonus at end of policy year
- Global Aerospace and Calspan in Buffalo, NY
 - Dividends up to 10.5% of premiums and subsidize 25% of cost per pilot training

2014 AIA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2014
INTERCONTINENTAL - MIAMI, FL

UPRT or URRT

- Emphasize Prevention or Recognition
- Importance of Instructors
 - Simulator capabilities
 - Avoid negative transfer of training
 - Activating startle/surprise response
- Litigation Issues



2016 IIA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2016
INTERCONTINENTAL - MIAMI, FL

Thank you



2016 IIA ANNUAL CONFERENCE
APRIL 30 - MAY 3, 2016
INTERCONTINENTAL - MIAMI, FL
