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Outline

- NTSB Basics
- Some Future Concerns

NTSB 101

- Independent agency, investigate transportation accidents, all modes
- Determine probable cause(s) and make recommendations to prevent recurrences
- Do not determine blame or liability
- Conduct special studies and investigations
- Assist victims and their families

Independent

- 5 Members
  - Nominated by President, confirmed by Senate
- Political independence
  - Political party balance
  - Member terms are fixed and staggered
  - Requirement for relevant background, expertise
  - Purpose: Conclusions from facts, not politics
- Functional Independence
  - Not a regulator or operator
  - Purpose: Impartial and unbiased investigations

Purpose

– Single focus is ***SAFETY***

– Primary product:
Safety recommendations

– Response to recommendations:
> 80% acceptable

Some Future Concerns

– Pilot professionalism

– Criminalization of accidents

– Increasing automation

Pilot Professionalism

Problem

- Loss of military pilot pipeline
- Military: "Right Stuff" or out

Current Civilian System

- Written test: Knowledge
- Flying test: Skills and knowledge
- *Not tested: Judgment or professionalism*
- *No limit on how many times to take tests*

Abundant Professionalism

- Hudson River landing (2009)
- Gliding to the Azores (2001)
- Sioux City (1989)
- Gimli Glider (1983)

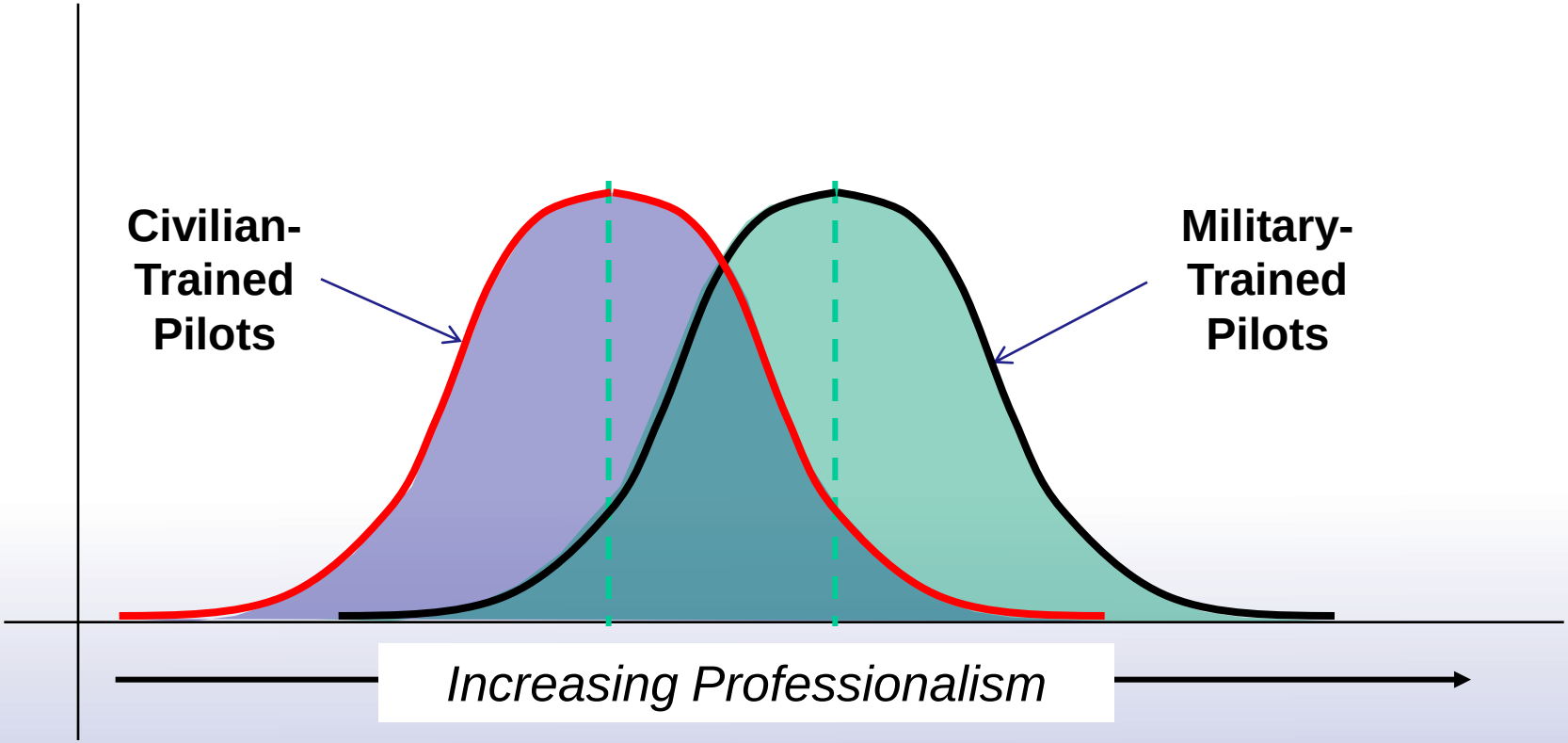
Lack of Professionalism

- Let's try FL 410 (2004)
- Takeoff without runway lights (2006)
- Stick shaker: PULL! (2009)
- Minneapolis over-flight (2009)

The Training Challenge

- Initial training must:
  - Develop knowledge and skills
  - Be evaluated by more than just (eventually) passing knowledge and skill tests
  - Also develop and instill good judgment and professionalism
- Recurrent training must:
  - Continue to develop and strengthen all of the above

Need to Shift the Bell Curve



Criminalization

- Systems are getting more complex
- Most accidents involve good people trying to do the right thing
- Human error: Immediate response is to *PUNISH!*
- Issue: Best way to stop error that is *inadvertent*?

Undesirable Results

Possibility of criminalization:

- Chills willingness of front-line employees to participate in proactive information programs
- Hinders mishap investigations
- Reduces likelihood of investigating or addressing system issues

Recent Examples

- Concorde, Paris, France (2000)
- GOL 1907, Brazil (2006)
- Asiana 214, San Francisco (2013)?

Concorde

- Chain of Events
  - Takeoff
  - Piece of metal on runway from previous airplane
  - Main gear tire shredded after hitting piece of metal
  - Fragments from tire hit wing, punctured fuel tank
  - Leaking fuel caught fire

GOL 1907

- Chain of Events
  - Aircraft eastbound, FL 370, per international convention
  - Assigned route turned westbound at navigation waypoint
  - Go to even thousand (FL 380 or 360)?
  - Pilots tried unsuccessfully to contact controllers, so remained at FL 370
  - Transponder on “Standby” (for long time), hence
    - Airplane invisible to ATC
    - Airplane also invisible to TCAS in other airplanes
  - Both airplanes navigating with GPS
- Theory
  - Pilot’s foot on footrest hit transponder “Standby” button

Automation

- Increasing complexity increases likelihood that operators will not completely understand the system
- Increasing reliability increases likelihood that operators have never seen a given malfunction before, even in training

Examples

- Strasbourg, France (1992)
- Cali, Colombia (1995)
- Amsterdam, Holland (2009)
- Rio to Paris (2009)
- San Francisco (2013)?

Strasbourg, France

- Risk Factors
  - Night, mountainous terrain
  - No ground radar
  - No ground-based glideslope guidance
  - No airborne terrain alerting equipment

- Very Sophisticated Autopilot
- Autopilot Mode Ambiguity

Human Factors Challenge

- "3.2" in the window, *with a decimal*, means:
  - Descend at a *3.2 degree angle (about 700 fpm at 140 knots)*
- "32" in the window, *without a decimal*, means:
  - Descend at *3200 fpm*

Clue: Quick Changes in Autopilot Mode Frequently Signal a Problem

Flight data recorder readout program could have helped safety experts identify this problem

Cali, Colombia

- Risk Factors
  - Night
  - Airport in deep valley
  - No ground radar
  - Airborne terrain alerting limited to “look-down”
  - Last minute change in approach
    - More rapid descent (throttles idle, spoilers)
    - Hurried reprogramming
- Navigation Radio Ambiguity
- Spoilers Do Not Retract With Power

Recommended Remedies:

- Operational
  - *Caution re last minute changes to the approach!!*
- Aircraft/Avionics
  - Enhanced ground proximity warning system
  - Spoilers that retract with max power
  - Require confirmation of non-obvious changes
  - Unused or passed waypoints remain in view
- Infrastructure
  - Three-letter navigational radio identifiers
  - Ground-based radar
  - Improved reporting of, and acting upon, safety issues

Note: All but one of these eight remedies address system issues

Amsterdam, Holland

- The Conditions
  - Malfunctioning left radar altimeter
  - Pilots selected right side autopilot
  - Aircraft vectored above glideslope
  - Autothrust commanded throttles to idle
  - Unknown to pilots, right autopilot using left radar altimeter
  - Pilot unsuccessfully attempted go-around

- Queries:
  - Should autopilot default to same side altimeter?
  - More clarity re source of information? Ability to select?

Rio to Paris

- The Conditions
  - Cruise, autopilot engaged
  - Night, in clouds, turbulence, coffin corner
  - Ice blocked pitot tubes
  - Autopilot and autothrust inoperative without airspeed
  - Alpha protections disabled
  - Pilots' responses inappropriate
- Queries:
  - Pilot training re loss of airspeed information in cruise?
  - Importance of CRM – pilot knowing other pilot's actions?
  - Pilot training re manual flight at cruise altitude?

Conclusion

In order to continue improving safety, the industry must address issues of professionalism, criminalization, and automation

Thank You

Questions?