National Transportation Safety Board

Emerging Challenges and Opportunities For Accident Investigators

Chairman Christopher A. Hart

Presentation to the International Accident Investigation Forum, Singapore, April 20, 2016

Topics

- NTSB Basics
- Increasing Automation: Good News, Bad News
- Accident Investigation IT Advances
- Family Assistance Basics

NTSB 101

- Independent federal agency, investigate transportation mishaps, all modes
- Determine probable cause(s) and make recommendations to prevent recurrences
- Primary product: Safety recommendations
  - Favorable response > 80%
- *SINGLE FOCUS IS SAFETY*

NTSB Characteristics

- Independence
  - Political: Findings and recommendations based upon evidence rather than politics
  - Functional: No “dog in the fight”
- Transparency
  - Enables public to know facts on which NTSB conclusions and recommendations are based

Increasing Automation

- When it *malfunctions:*
  - Increasing complexity increases likelihood that operators will not fully understand the system
  - Increasing reliability increases likelihood that operators have never seen a given malfunction before, even in training
  - Ability of operator to
    - Know that automation has malfunctioned?
    - Recover successfully?
- When it approaches total automation and is working *properly:*
  - Adverse impact on professionalism?

Examples

- Amsterdam, Holland (2009)
- Rio to Paris (2009)
- Landing on the Hudson (2009)
- San Francisco (2013)

Amsterdam, Holland, 2009

- 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, 2009

- 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?

Landing on the Hudson, 2009

- Bird ingestion, both engines failed
- "Dead-stick" landing into river
- Unknown to pilot, phugoid damping software restricted nose-up movement during "landing" flare
- Result: Higher vertical impact speed, fuselage damage and flight attendant injury

Asiana 214 at SFO, 2013

- The Conditions
  - Landing SFO Rwy 28L, >11,000 feet
  - VFR, negligible wind, 1128 PDT
  - ILS glide slope transmitter inoperative
  - Attempted manual landing
  - Unaware that autothrottle was not maintaining speed
  - Became low and slow, go-around attempted too late, struck seawall
  - 3 fatalities
- Queries:
  - Pilots adequately trained about system?
  - Inadequate warning re loss of automatic speed control?
  - Inadequate CRM?
  - Inadequate maintenance of manual skills?

Approaching Total Automation: Undercutting Professionalism?

- Typical Subway Automation
  - Starts the train out of the station
  - Observes speed limits, avoids collisions
  - Stops the train in the next station
  - Opens the doors
- Operator
  - Closes the doors
- Issues
  - Work for pay, rather than for job well done?
  - Job satisfaction/professionalism?

Some Helpful IT Advances

- UAS as investigative tools
- Laser scanning
- Underwater search
- Cameras
  - Bystanders
  - Surveillance and security
  - Onboard

Unmanned Aerial Systems (UAS) as Investigative Tools – Multi-Modal

- Can provide otherwise unavailable point of view from many angles
- Portable: package for site imaging and analysis fits in a backpack
- Enables 3D analysis, view from any angle

Laser Scanning

- Enables very precise overview of overall accident scene
  - Combine with UAS for aerial perspective?
- Also enables very precise measurement and 3D reproduction of vehicles to determine deformation

El Faro -- Challenges

- 737 foot cargo ship lost in a hurricane
- All 33 crewmembers lost
- More than 15,000 feet of water
- VDR not yet found
- Limited access to physical evidence

ROV and AUV

- Remotely operated vehicle (ROV), powered by a tether (longer duration)
- Autonomous underwater vehicle (AUV)
  - Mobility not limited by tether
  - Not affected by surface conditions
  - Deployment time limited by battery charge

(ATSB using both in search for MH 370)

Second Search for VDR

- Now that debris field is located, we hope that the AUV's greater range of motion and lack of effect from surface conditions will locate VDR
- *Stay tuned!*

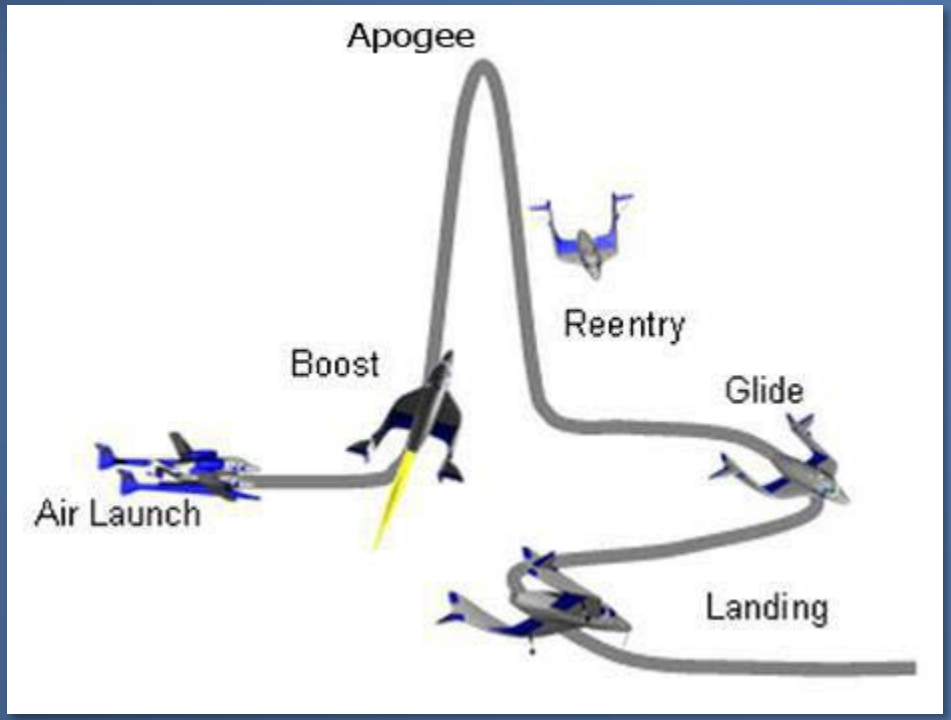
New Data Sources: 747 Crash, Bagram (2013)

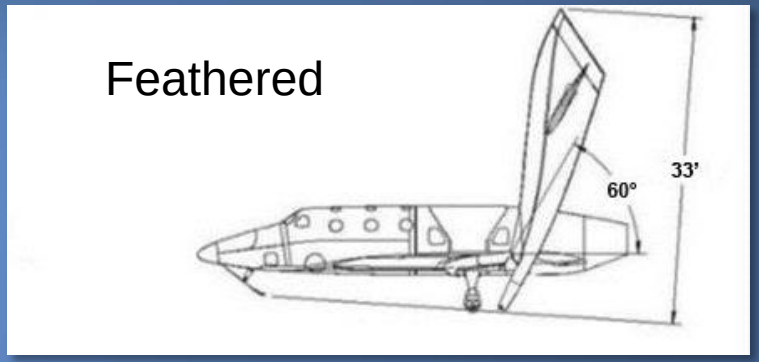
- Crash followed steep climb and stall
- Loss of control due to improperly secured large vehicles

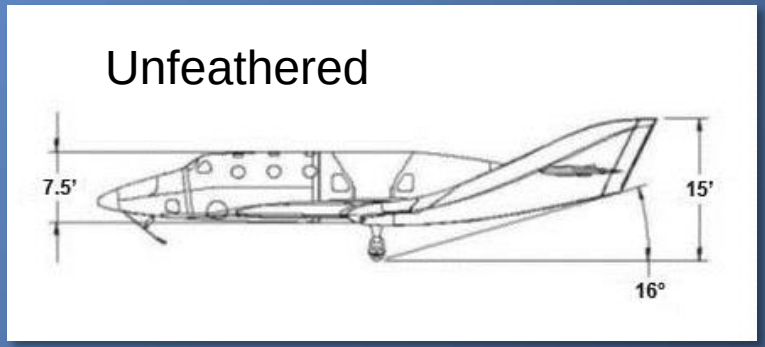
Bagram: Dash-Cam and Surveillance Camera

- No data to FDR, CVR, after rotation
- Investigation greatly aided by dash-cam in truck that happened to be passing by
- This source would not have been available only a few years ago
- Dash-cam view went viral soon after the crash
- Also aided by airport surveillance cameras

SpaceShipTwo: Mission Profile







NTSB

Onboard (Inward Facing) Camera

- By the second day on scene, we released very detailed factual information about the pilots' actions
- Investigation took only nine months

Aircraft Accident of the Future

- Information at downlink site
- No need to find onboard recorders
- Investigations more focused, quicker
- Challenge: Control of information release

Family Assistance: Family Member Concerns

- Notification and Involvement
  - What happened? Is my family member involved?
- Victim Accounting
  - Where is my loved one?
- Information and Resources
  - How do I get information and support?
- Personal Effects
  - Where are their belongings?

In the U.S.: NTSB Responsibilities

- Coordinate with federal, state, local agencies and air carrier
- Facilitate victim recovery and identification
- Provide investigative information to families
- Oversee air carrier response
- Monitor for attorney solicitation
- Monitor for no-impede clause violations

Air Carrier Responsibilities

- Sufficient resources and training
- Provision of manifest
- Family notification
- Travel and care of family members
- Personal effects
- Equal treatment of crew, passengers, ground fatalities

ICAO Family Assistance Initiatives

- 2001: ICAO Circular 285: Guidance on Assistance to Aircraft Accident Victims and Their Families
- 2010-2011: Circular 285 revision task force
- 2012-2013: Assistance to Aircraft Accident Victims Policy Task Force
- March 2013: Council passes Policy document
- December 2013: Manual published
- February 2015: ICAO High-Level Safety Conference
- June 2015: Annex 9 Amended
- Several countries (including Australia, China, Japan, South Korea) now have family assistance legislation

Thank You!!

Questions?