Imagine that...

- A member of your family were killed in an airline accident.
- Would you want to know what safety threats had been noted in the airline’s operations?
- make public all of the safety data collected by the airline?
- hold the airline responsible?
- hold the pilot responsible?
- punish the airline and the pilot?

How groups differ from individuals

- Confirmation bias
- Group think
- Institutions create group-level cognitive effects
  - Legal system
  - Elections
  - Teams (surgical, process control, airline, management, software authoring, scientific research, …)
- A fundamental cognitive tradeoff (explore/exploit in the space of interpretations).

Organizational Learning

- If organizations have cognitive properties, can they change those properties as a result of experience?
- How organizations and institutions are reconfigured in response to experience.

Eastern Airlines

- Lockheed L1011 (new autoflight system)
NTSB recommendations

Therefore the Safety Board recommends that the Federal Aviation Administration:

1. Require the installation of a switch for the L-1011 nose wheel light near the nose gear indicator optical sight.
2. Require, near the optical sight, the installation of a placard which explains the use of the system.
3. Require that the altitude select alert light system on the Eastern Airline configured L-1011 airplanes be modified to provide a flashing light warning to the crew whenever an airplane departs any selected altitude by +/- 250 feet, including operations below 2,500 feet.

Tenerife, Canary Islands, March 1977

• Worst aviation accident ever
• Two 747s collide on a foggy runway
• 582 fatalities

Crew Resource Management

• Miami – undetected error
• Tenerife – error detected, but not acted upon.
• The problem is not hard technology, it’s soft technology.
• It’s how the members of the crew interact with one another.

Learning from individual experience

Necessary Conditions for Detecting Error

• Access
• Knowledge or expectation
• Attention
• Perspective
How can we learn from error?

Pilot Experience: Document personalization
- Bring all paperwork home to review the flight
- Annotate own charts and flight manuals
  - Draw attention to the specific numbers and letters
  - Facilitate visual search
- A hand-drawn VNAV approach guide
  - A complex mix of English and Japanese
    - English: callouts, communication with ATC, etc.
    - Japanese: comments, interpretations, tips, etc.

Learning from shared experiences in a community of practice

Pilot-pilot communication
- Hangar flying
  - American Airlines
    - vertical navigation modes study
  - US Airways
    - learning to fly the Airbus A320,
      autothrust policy, secret explorations
  - Home-grown conceptual models
- Bluecoat digest (FMC topics)
  - Continental airlines 737 pilot Bill Bulfer.
- Private Pilot: "I learned about flying from that."

Training: Learning from designed experience

Organizational learning as a control problem
FAA Flight Standards Service

- The Flight Standards Service promotes safe air transportation by setting the standards for certification and oversight of airmen, air operators, air agencies, and designees. We also promote safety of flight of civil aircraft and air commerce by:
  - Accomplishing certification, inspection, surveillance, investigation, and enforcement
  - Setting regulations and standards
  - Managing the system for registration of civil aircraft and all airmen records

FAA Enforcement of the Federal Aviation Regulations

Possible individual learning. Certain organizational learning because the organization without the offender is a different organization.

Enforcement of Airline Company Policy

What’s at risk for the parties?

- Pilots
- Fleet managers/Operators
- Manufacturers
- Regulators
- Unions
- Public/passengers

- Reputation/job
- Safety/performance/profitability
- Reputation/sales
- Effectiveness/funding
- Work conditions/jobs
- Safety/convenience
Ready or protected?:
Airbus autothrust use policies
• A320 autothrust system and protections
• Line pilots’ perspective
  – Need experience (practice) to be ready to perform. Cannot risk being unprepared in the event of system failure.
• Fleet managers’ policies:
  – No dispatch with A/T inop. No flight with A/T disconnected. Cannot risk loss of protections.

Use of FPA for guidance on visual approaches
• Airline: it increases the likelihood of stabilized approaches and successful landings. (reduces probability of go around).
• Manufacturer: it’s an unsafe practice, because there are no criteria for discontinuing if visual contact is lost.

Blame and Shame Culture
• Every accident must be someone’s fault
• The responsible parties must be punished
• Eliminating the “bad apples” will fix the system

Overcoming Blame and Shame

FAA and NTSB
• FAA has the mission to investigate and punish. Examine accidents with intent to enforce existing regulations.
• NTSB was made independent of the FAA to separate investigation from enforcement and regulation. Examine accidents with intent to improve the safety of the system.
• An American invention – the separation is a consequence of an earlier round of organizational learning
• On the basis of accident and incident analysis, NTSB makes recommendations to FAA
• FAA may (or may not) adopt the NTSB’s recommendations
Overcoming Blame and Shame for Airlines

• **Voluntary Disclosure Programs (VDP)** – protection in return for disclosures of violations not known to the FAA by Air Carrier Certificate Holders

Overcoming Blame and Shame for Airlines

• The primary mission of the FAA is to promote aviation safety. To further this mission, the FAA instituted a voluntary ASRP on April 30, 1975, designed to encourage the identification and reporting of deficiencies and discrepancies in the system.

Separate Investigation from Enforcement

• The FAA determined that the ASRP effectiveness would be greatly enhanced if the receipt, processing, and analysis of raw data were accomplished by NASA rather than by the FAA. This would ensure the anonymity of the reporter and of all parties involved in a reported occurrence or incident and, consequently, increase the flow of information necessary for the effective evaluation of the safety and efficiency of the system.
Immunity Policy

- The effectiveness of this program in improving safety depends on the free, unrestricted flow of information from the users of the NAS.
- Based on information obtained from this program, FAA will take corrective action as necessary to remedy defects or deficiencies in the NAS.
- FAR prohibits the use of any reports submitted to NASA under the ASRS (or information derived therefrom) in any disciplinary action, except information concerning criminal offenses.
Flight Operational Quality Assurance (FOQA)

- The collection of objective data, without human intervention can allow dangerous trends to be identified and intervention steps taken to prevent accidents.
- The law, lawyers and the litigation process, may appear to be interfering with the worthy safety goals of FOQA.
- However, the freedoms of a democratic society can only be protected when the competing legal rights of all parties involved are protected.

FOQA Data

- Objective data collected from airplane sensors.
- High sample rate on all of the parameters sampled by the “black-box” (flight data recorder), plus many more.
- Example data: the number of overly hard landings performed in one month, the duration of engine over temperature conditions, or how many times an unusually high descent rate was used on an approach.

FOQA worries: inhibitions to the free flow of information

- That the FOQA data will be used by the FAA for enforcement actions against pilots and carriers;
- That the data, once turned over to the FAA, will be made available to the media, litigants and the public, under The Freedom of Information Act ("FOIA");
- That data will be acquired by subpoena during the discovery process in civil lawsuits and be used to establish liability;
- Notice the interactions of the internal FOQA loop with other information loops.

Immunity for the Airline and for pilots

- The FAA will not use the operator’s FOQA data for enforcement purposes except for criminal and deliberate acts.

FDM: risk management technologies may create new risks

- Operators manage operational risk by monitoring pilot activity. A learning loop.
- Union manages risk of damage to pilots’ careers by guaranteeing that the data are "de-identified"
- Public may sue for access to data to establish negligence. Another learning loop.

FOQA learning loops
Manufacturer’s Safety Programs
- Operational incident reporting
- Maintenance incident reporting

NASA Aviation Safety Program
- Developed CRM
- Created ASRS
- Crew Rest requirements

A network of feedback loops in commercial aviation
- FAA rule making
- NTSB investigations
- Airline internal safety programs
- Airline and Manufacturer training
- NASA research projects
- Manufacturer incident reporting programs
- Pilot Unions’ Safety committees
- Individual pilots

Organizational Learning Loops

Many nations lack organizational learning capability

The global aviation system is changing. Will our learning loops be up to the task?
Organizational learning

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Technology and Ontology

- Are we ready to perceive the important properties of the global aviation system?
- The value of video
- The symbolic danger of video
- Controlling the ontology

Beyond the spoken word, “final the rudder is…”

Police expert providing the jury a new ontology in the first Rodney King Trial

Trajectories

- Democratic institutions for healthy organizational learning
  - FOIA, whistleblowers, bill of rights
  - FAA’s two stage rule making process
- What information should (not) go where, when, and in what form?
- Who is accountable to whom and for what are they accountable?
- How should this be decided?
**Trajectories: What should we value?**

- Diversity of institutionally supported loops
- Quality and commitment to understanding process
- Separation of analysis from enforcement
  - To protect sources of information
    - ASRS (pilot report/FAA enforcement)
    - Unions FOQA (pilot behavior/Airline personnel actions)
  - To protect the perspective on the information in the loop
    - NTSB/FAA (understand accident causes/punish the perpetrators)

**Organizational learning**

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**Analysis**

- Analysis as institutional memory
  - Constructed
  - Selective
- Technologically induced amnesias
  - Recording technology, coding schemes, observational frameworks
- How can theory grow to keep up with the changes in the global system?

**Organizational learning**

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**Intervention: the hard part**

- What processes create interventions?
- What sorts of interventions are needed?
  - From now on, the primary challenges are human and social.
- What are the consequences of interventions?
  - Alphabet soup of piecemeal fixes and additions

**With thanks to...**

Barbara Holder and Curt Graeber
Carlos Arroyo
Guy Boy
Jean-Pierre Daniel
Sidney Dekker
Don Gunther
Michel Jouanneaux (ret.)
Jean Pariès
Rick Travers
Enforcement action in Mexico