

Aircraft Accident Investigation: On-Site to Safety Recommendations and Policy Changes

Robert Matthews, Ph.D.

**Senior Safety Analyst, FAA (Retired)
Office of Accident Investigation**

Outline

Background

Sense of Scale

Externalities & Changes in Accident Investigation

Investigators: Personal Demands and Rewards

Who's Who in a U.S. Investigation

NTSB "Party Process"

The Investigation Process

Sense of Scale

Size of the U.S. System: still the largest system in the world – by far. One-third of all air carrier takeoffs in the world: 30,000 per day, plus 70,000 GA takeoffs. No other system comes close in scale or complexity.

Sense of Scale in Safety: Start with a well worn phrase: “aviation is safer today than it has ever been.”

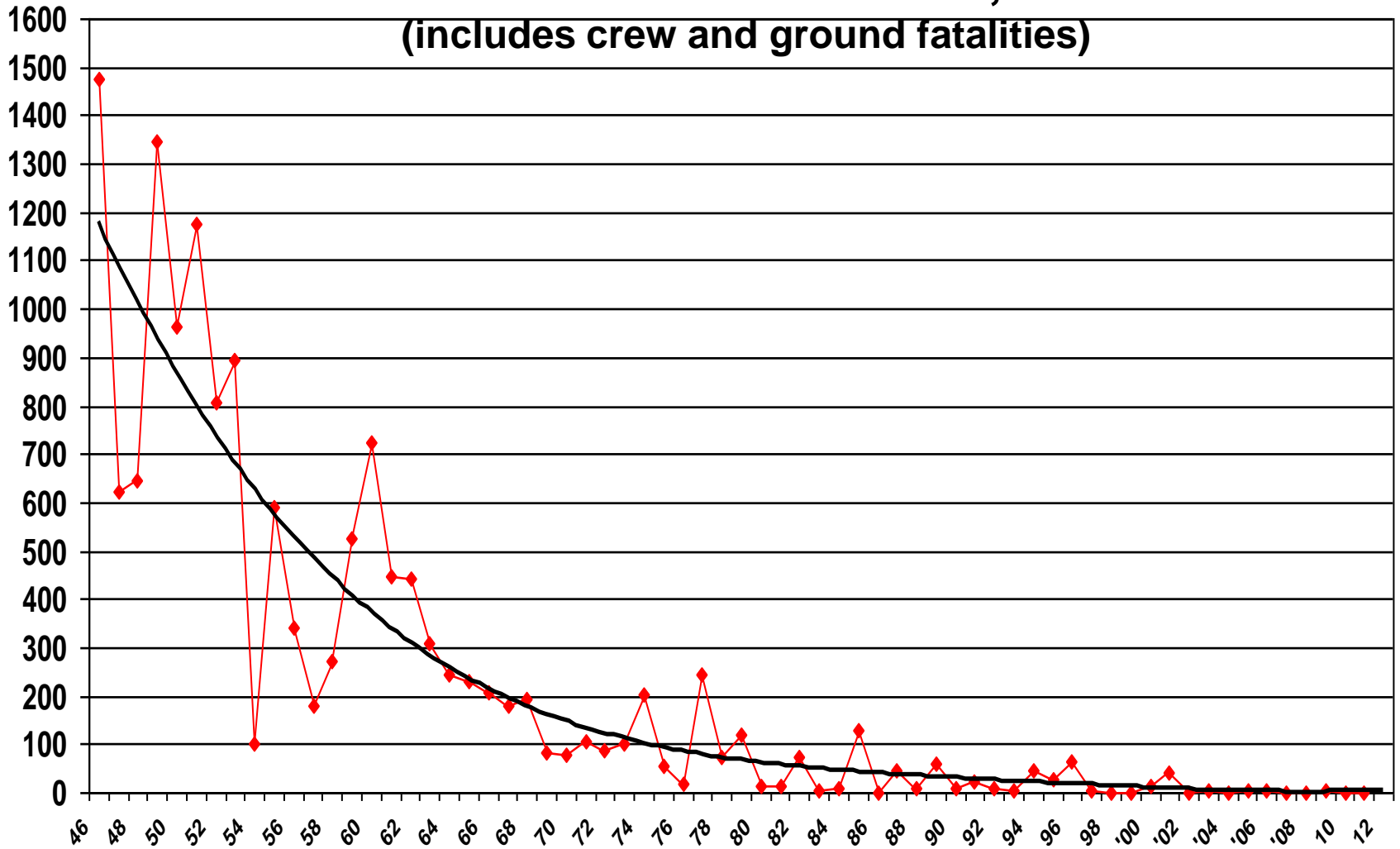
The catch is that this has always been true. It was true 10 years ago, it was true in the 1990s, in the 1980s, the 1970s, and so on.

Since the 1920s, fatality rates have fallen by 1/3 to 1/2 every decade. The past decade is exceptional only because the rate of improvement accelerated – by over 90% in the past decade.

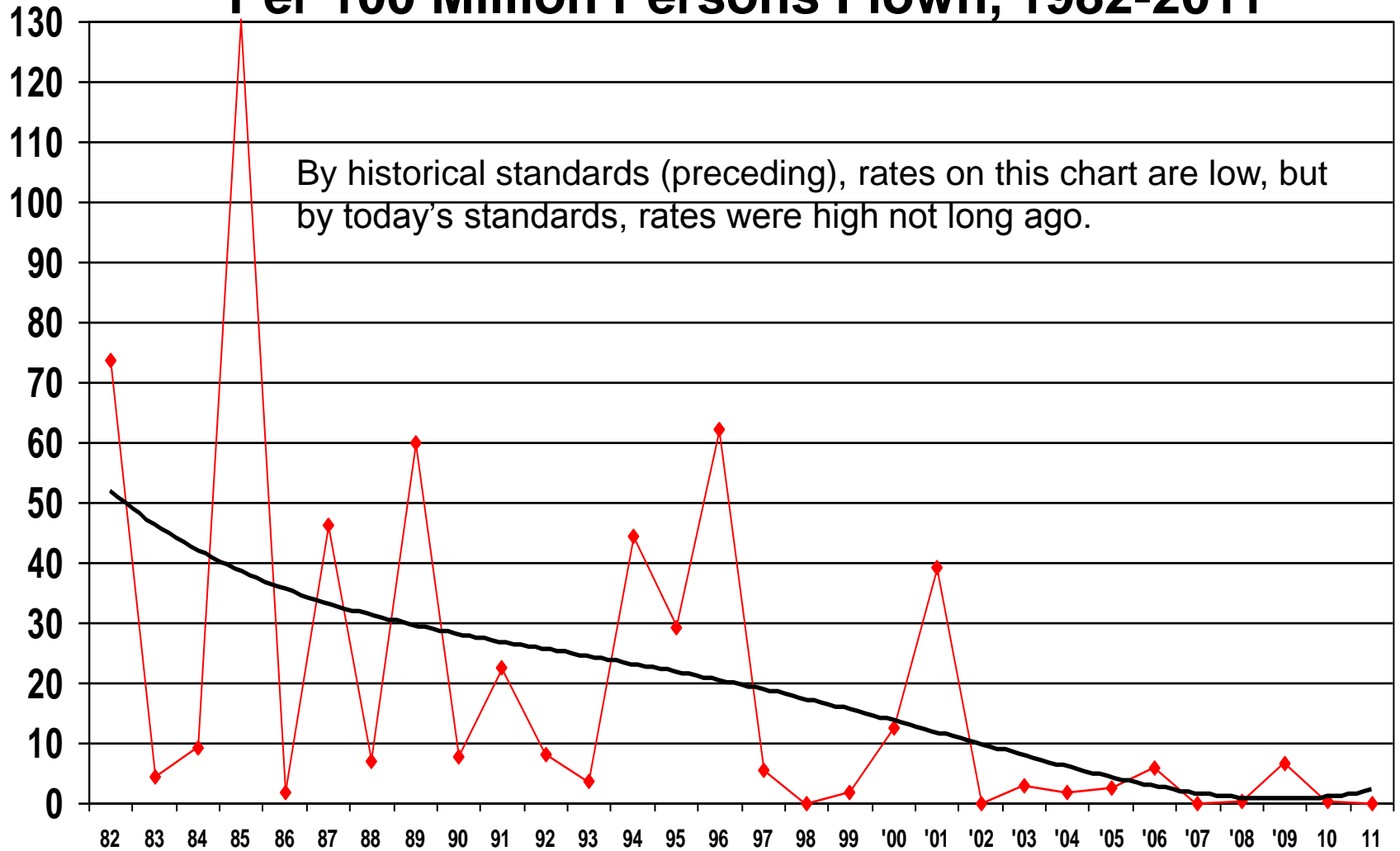
Nevertheless, ignore claims of “the safest system in the world,” whether the claim is made by the U.S., the U.K, Australia, or whomever. In fact it is about a 30-way tie for first.

U.S. Air Carrier Fatalities Per 100 Million Persons Flown, 1946-2011

(includes crew and ground fatalities)



U.S. Air Carrier Fatalities Per 100 Million Persons Flown, 1982-2011



Externalities in the Process

In a major accident, everyone wants to know what happened right away; lots of pressure in complex events (Air France, AAL 587)

Media: talking heads are on TV right now telling us what happened, why, & what needs to be done - before anyone knows a thing. Some commentators are solid (Greg Feith, Bob Francis, John Cox, Steve Wallace) but some are clueless or worse (Jim Hall, Mary Schiavo, Vernon Gross).

Sensational accidents can blow FAA out of the water: press, Congress, families - - “who did it?” “We need new rules.”

Agency and industry politics.

Random quality of political appointees or certain career officials at NTSB, FAA or DOT, sensationalized press, or congressional grandstanding.

Major Changes in Accident Investigation

Most significant is the frequency of major accidents – Maytag Repairman?

Communication: cell phones and e-mail; instant TV coverage.

More and more of the investigation takes place in the lab.

How FAA & industry use the knowledge gained from investigations - track risk with very detailed analysis of flight data from normal flights integrated with ATC track data to monitor the presence of problems that we know are precursors to accidents, or to analyze new risks, such as:

- Unstable approaches (on glideslope, localizer & speed at 1,000 feet);
- Precise 3-dimensional location and frequency of TAWS or TCAS alerts;
- Runway remaining at specific speeds after touchdown;
- Threshold crossing height or de-rotation time after touchdown.
- Time elapsed before applying brakes or reverse thrust after touchdown;
- Use of nosewheel steering at speeds above 20 to 30 knots;
- Systems monitoring;
- Many, many more.

Investigators: Personal Demands & Rewards

Start with the good news: intrinsically rewarding. May sound trite, but you really might help save some lives.

Work (mostly) with knowledgeable, interesting & committed people from all over the world.

Salary: you will not become wildly rich, but you will be well paid.

See the world (good news and bad news). Can range from major cities or even the occasional resort area to sites that are physically or politically dangerous.

- Personal security
- Challenging terrain
- Blood-borne Pathogens
- Shredded Metal or Hazardous Materials
- Some grim sites: not as common as folklore might suggest, but

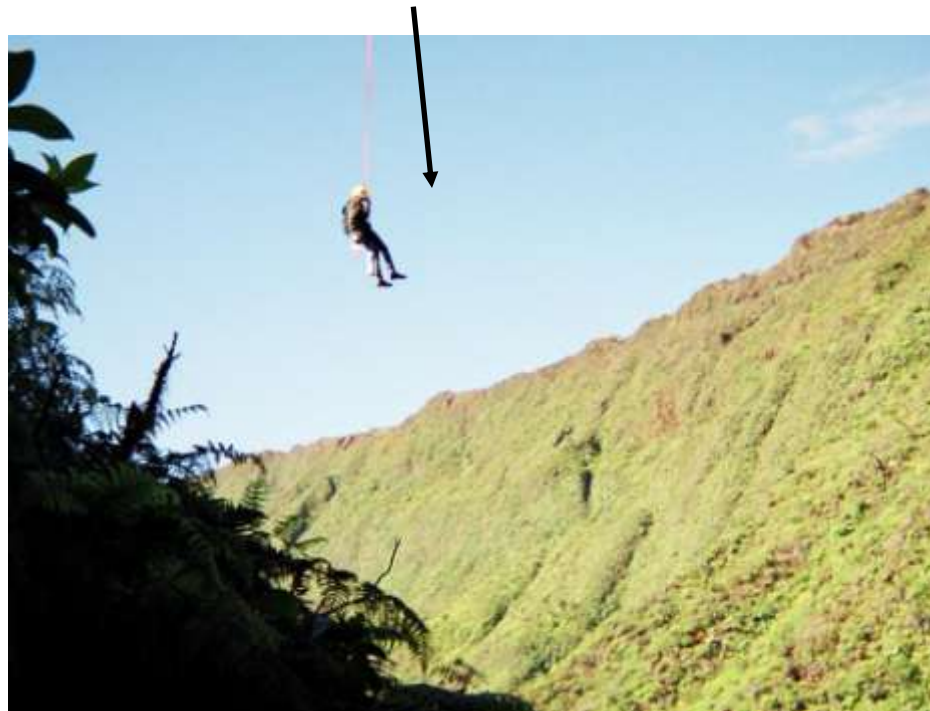
Can disrupt normal, family life.

Macho culture (independent of gender, but changing), &

Dark humor - - defensive.

**7/03: Waialeale, Part 135
Air Tour in Bell 206B;
down low (below the
rim) to give folks a
“good look” & struck
crater wall. (4 fatal)**

Sole access to the site.



Local Fire Chief upon reaching
the scene: "It basically ran right
into the mountain."

Daily search for debris & evidence



Sniper with Heat Stroke



**Valujet, Everglades;
5/11/96 (Oxygen Canisters);
110 Fatal**

**USAir at Pittsburgh, 8 Sept. 1994 (132 fatal)
Rudder blow-down from 6,000 feet. Impacted 80
degrees nose-down at 440 knots; nothing left!**



Who's who in an investigation in the U.S

Both NTSB & FAA are required by law to investigate accidents. Only the US requires both an independent investigative authority and the regulator to investigate accidents.

NTSB determines probable cause & makes safety recommendations; most are addressed to FAA but some to industry & others (EMS & HHS).

The premise is that we need an independent investigative authority to avoid having the regulator investigate itself in accidents where the regulator's performance may be an issue.

FAA investigates accidents to identify & act on issues related to FAA responsibilities in aircraft certification, FAA facilities, FAA procedures or performance, adequacy of regulations or operating specifications, enforcement actions, etc.

The premise is that FAA may identify issues that need not or can not wait a year or more for a final report, and FAA may (and often does) address internal issues that are not part of the NTSB report.

In GA accidents, especially non-fatal accidents, FAA often is the only Federal agency on site. If so, NTSB typically takes the FAA report, may add information (or not), & then makes a judgment about probable cause. FAA is on site in 96% of all cases and NTSB is on site in about 14% of all cases.

In many Part 121 accidents or fatal GA accidents, both agencies are on scene. In those cases, under MOU, NTSB owns the site. (FAA culture tells FAA investigators “we do not want to see your smiling face on TV.”)

The point here is that each agency investigates accidents under its own statutory authority & to fulfill its own statutory obligations. (This is not always clearly understood even by employees of each agency.)

The Party System

NTSB operates under a “party” system, in which parties with unique expertise may participate in an investigation. This may include the airline, manufacturers (aircraft, avionics & engine) unions (pilots, mechanics, flight attendants), etc. In most countries, such parties might be consulted (might), but are not part of the investigation team.

The NTSB premise is simple: no one knows a Boeing or an Airbus aircraft like Boeing and Airbus. Some countries see this as inviting the fox into the hen house, but NTSB firmly enforces its requirement of full cooperation, or the representative is sent home – not in the company’s interest.

Except for FAA’s participation (required by law), NTSB exercises complete discretion on who is and who is not a party.

International Accidents

The country in which an accident occurs is the investigating authority. However, the country of the operator and the country that certificated the aircraft are entitled to participate, and ICAO “encourages” an invitation to countries with a large number of citizens on board.

In the MD-11 Swiss Air accident, Canada owned the accident but the US and Switzerland were entitled to participate and France was invited.

In foreign investigations involving US operators or US-certified aircraft, NTSB is the accredited US representative, per international practice, as the independent investigator. However, FAA participates as a “technical advisor” to NTSB.

This can cause confusion or even resentment because in most countries the regulator is explicitly excluded from the site (the 777 accident at Heathrow).

The Process

Normally, the first people to know that an aircraft has crashed are local fire and police departments or an FAA ATC facility, all of whom have access to the NTSB Communications Center and the FAA Com Center. Unless TV beats these folks to it, they are usually the first source of notification.

Each Com Center advises the other to ensure that both agencies have been notified as quickly as possible. In FAA, the Com Center immediately passes information onto the Office of Accident Investigation's Duty Room or, if it is off-hours, calls the investigator who has the duty that night, regardless of the time. NTSB works much the same way internally.

If the accident appears to be a minor air carrier or a non-fatal GA accident, NTSB likely delegates its authority to FAA, and FAA in turn usually delegates it to a local field office, where the investigation is run by an FAA Inspector as collateral duty.

If it is a fatal GA accident, FAA still might delegate it to a field office and NTSB might (or might not) send a regional investigator.

If an accident involves an air carrier impact or appears to involve selected issues of concern to either FAA or NTSB, a national “Go Team” is launched. Those “selected issues” will involve at least the following:

- Air tour or helicopter EMS accidents;
- Any jet involved in a significant event;
- Any aircraft recently entering the fleet;
- Any component or system that either FAA or NTSB is tracking, such as a particular aircraft (Lancair or Zodiac) or a particular engine (Lycoming crankshafts or Trent 900-1000), etc.

Launching a “Go Team”

When a major airline accident occurs, much of the initial information often is inaccurate (likely fatalities, tail number, aircraft type, etc.).

FAA starts with the airline to verify the tail number, get the passenger manifest and flight crew names, and then starts pulling pilot and airplane maintenance records, known issues related to the aircraft make-model and engines, etc. NTSB is copied on all this information.

Simultaneously, FAA & NTSB advise each other about who will be each agency’s Investigator in Charge (IIC) and which of the 5 politically appointed members of the Board is going. That Member will be the Federal spokesperson at the scene.

Also simultaneously, FAA advises its Hangar 6 staff at DCA to prepare an FAA aircraft for departure (usually a G-IV or Lear 60).

Launching a “Go Team”

Based on the preliminary information, NTSB & FAA determine the specialty skills each will want right away or at least have instantly available if needed.

NTSB will appoint senior staff specialists to chair required “Working Groups” for the investigation, while FAA will pull specialists from its Engine Directorate in Boston, its Large Aircraft Directorate in Seattle, Cabin Safety Specialists, operations specialists, etc.

NTSB also will secure hotel space near a site, complete with meeting rooms.

Generally, the DC crowd, including NTSB, is advised when to be at Hangar 6 and everyone else is to get on an airplane as quickly as possible. (Seats on the FAA aircraft are at a premium for a major launch.)

On site, the process starts with an Organization Meeting where NTSB reviews basic rules of the road, including what will get you sent home.

Also organizes Working Groups, which may include:

Operations (details of the accident flight);

Structures (airframe wreckage, impact attitudes, etc.);

Power plants (engines and props);

Systems (hydraulic, electrical, flight controls, etc.);

ATC (Reconstruction of ATC radar data and transcripts);

Weather (data from NWS, area media and witnesses);

Human Factors (crew performance & interaction, work environment, crew training, medical histories, FAA tox tests, equipment design, etc.);

Survival (impact forces, injuries, evacuation, & emergency response); and

CVR and FDR (at headquarters).

May spend several days or weeks on site. Days are long and each closes with an Information Meeting where each team presents a factual report.

Off-Site

Working groups follow up at appropriate locations (perhaps Toulouse or Seattle for aircraft issues, New England or the UK for engine tear-down, etc.).

CVR team meets at NTSB and transcribes the entire recording. Very difficult work, as every phrase, chime or “clunk” may be debated, depending on the quality of the tape, clarity of speech, cockpit noise, etc.

FAA always participates and, depending on the case, the pilots’ union, manufacturer or airline may participate.

FDR also is read out at NTSB. Again, FAA always participates. Working Groups then can use the information and simulations that result from the FDR analysis.

The Report and Recommendations

Working Groups submit final factual reports to the NTSB IIC. NTSB staff then drafts a report, with its own analysis of events (presumably with some respect to input by various parties).

NTSB also unilaterally determines “probable cause” and adds any recommendations it deems appropriate.

A draft report usually (not always) is circulated among parties for comment, and the Board likely will hold a public hearing (often a three-ring circus).

A final report then is submitted to the 5 Board Members for consideration. Causes can be changed by the Board during this phase, as the Board, not the staff, officially and often in fact determines the cause.

Recommendations usually are issued after the Board’s meeting, but can be released at any time during the investigation.

Most recommendations are addressed to FAA – change a regulation, promulgate a new one, change an FAA policy, or what have you.

Recommendations are transmitted by letter to the FAA Administrator under the signature of the NTSB Chairman, and all subsequent communication is done at the same level. Each agency closely tracks every recommendation.

FAA's Office of Accident Investigation manages the process in FAA by forwarding the recommendation to the appropriate line organization, then reviews draft replies to ensure that they at least pass a laugh test.

Depending on how controversial an issue is, a recommendation might generate extensive in-house analysis and debate in FAA - - or not. Historically, FAA implements 92% of NTSB recommendations, perhaps with modest changes that NTSB accepts.

In some cases, FAA may have been trying to accomplish something for years, but lacked political support to get it done. Recommendations may even be informally suggested to NTSB staff by FAA staff. Other times, not so positive. Quality varies in both directions.

Accepted changes are implemented by any of several mechanisms.

Rulemaking, complete with NPRM, public comment, cost-benefit review by DOT and OMB, etc. (several years, at best).

Emergency rulemaking.

Airworthiness Directives (much faster) to require replacement or inspection of some item on a particular aircraft model or group of models.

Advisory Circulars to suggest a change by operators. This is advice, not a requirement - - can be regulation by stealth.

Changes to air carriers' operating specifications

Internal changes to FAA inspectors' work programs or to ATC practices, or adding a specific task to Principal Inspectors' responsibilities.

Questions or Comments?