**NTSB** National Transportation Safety Board

# Using Collaboration
# to Manage
# Enterprise Risk

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# <u>Outline</u>

**Aviation Collaboration Success Story**

  **- By aircraft manufacturers**

  **- At the industry level**

**Win-win:  Collaboration Can**

  **- Improve safety**

  **- Improve productivity**

  **- Reduce likelihood of unintended**
   **consequences**

**Applicability to Other Industries?**

# The Challenge:  Increasing Complexity

- **More System** *Interdependencies*
  - Large, complex, interactive system
  - Often tightly coupled
  - Hi-tech components
  - Continuous innovation
  - Ongoing evolution

- **Risk Management Issues Are More Likely to Involve** *Interactions Between Parts of the System*



AIRLINES

PILOTS    CONTROLLERS

*The System*

MECHANICS    MANUFACTURERS

INVESTIGATOR

REGULATOR
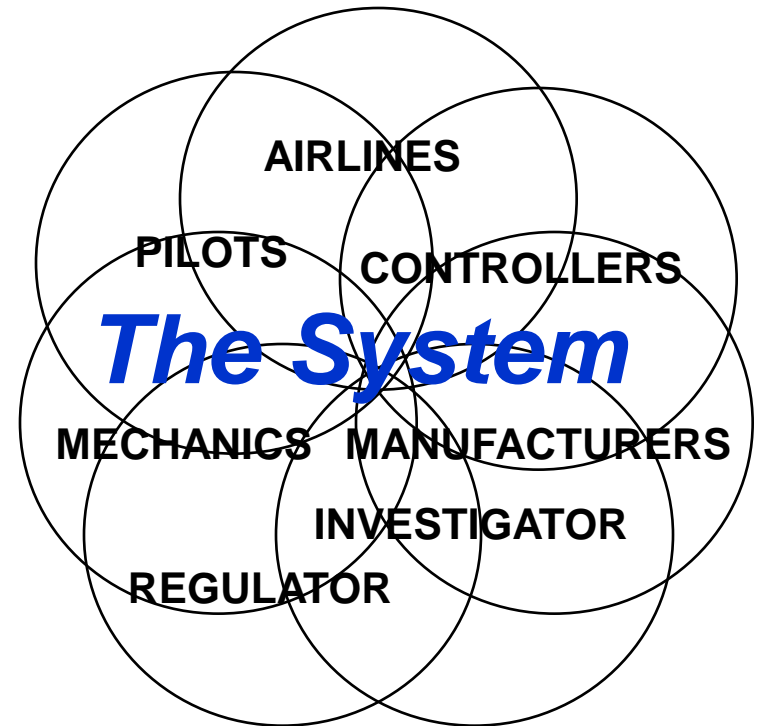
# Effects of Increasing Complexity:

*More* "Human Error" Because

- System More Likely to be Error Prone

- Operators More Likely to Encounter Unanticipated Situations

- Operators More Likely to Encounter Situations in Which "By the Book" May Not Be Optimal ("workarounds")

# The Result:

**Front-Line Staff Who Are**
- **Highly Trained**
- **Competent**
- **Experienced,**
- **Trying to Do the Right Thing, and**
- **Proud of Doing It Well**

**. . . Yet They Still Commit**

# Inadvertent
# Human Errors

# The Solution:  System Think

*Understanding how a change in one subsystem of a complex system may affect other subsystems within that system*

# Objectives:

## Make the System

### (a) Less Error Prone

**and**

### (b) More Error Tolerant

# The Health Care Industry

## *To Err Is Human:*

### *Building a Safer Health System*

**"The focus must shift from blaming individuals for past errors to a focus on preventing future errors by designing safety into the system."**

**Institute of Medicine, Committee on Quality of Health Care in America, 1999**

# Major Paradigm Shift

## How It Is Now . . .

**You are highly trained**

*and*

**If you did as trained, you would not make mistakes**

*so*

**You weren't careful enough**

*so*

**You should be PUNISHED!**

## How It Should Be . . .

**You are human**

*and*

**Humans make mistakes**

*so*

**Let's *also* explore why the system allowed, or failed to accommodate, your mistake**

*and*

**Let's IMPROVE THE SYSTEM!**

# "System Think" via Collaboration

**Bringing all parts of a complex system together to collaboratively**

- **Identify potential issues**

- ***PRIORITIZE* the issues**

- **Develop solutions for the prioritized issues**

- **Evaluate whether the solutions are**

  – **Accomplishing the desired result, and**
  – **Not creating unintended consequences**

# Aircraft Manufacturer "System Think"

**Aircraft manufacturers are increasingly seeking input, from the earliest phases of the design process, from**

- *Pilots*      (*User* Friendly)

- *Mechanics*      (*Maintenance* Friendly)

- *Air Traffic Services*      (*System* Friendly)

# Some System Challenges

- **Cali, Colombia, 1996**

- **Turkish Airlines Flight 1951, 2009**

- **Washington Metro, 2009**

- **Landing on the Hudson, 2009**

- **Air France Flight 447, 2009**

# Inadequate System Think

- **1995 – 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 Include:

- **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*

# Turkish Airlines Flight 1951

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

- **Queries:**
  - Autopilot defaults to same-side altitude information?
  - Tell pilots source of information, let them select?

# Metro, Washington DC

- **The Conditions**
  - Electronic collision prevention
  - Parasitic electronic oscillation
  - Stopped (struck) train became electronically invisible
  - Following (striking) train accelerated
  - Stopped train was on curve



- **Queries:**
  - Train "disappearance" warning in dispatch center?
  - Train "disappearance" warning in following trains?

- **One Lesson Learned:**
  - Over-warning may be worse than *no* warning

# Landing on the Hudson

- **Complete and irreparable failure of both engines after takeoff**

- **No training or checklist, but previous glider experience**



- **Pilots did not know about phugoid damping in software**

- **Phugoid damping did not allow full nose-up alpha**

- **Pilots less able to reduce vertical impact speed**

# Air France Flight 447

- **The Conditions**
  - Cruise, autopilot engaged
  - Night, in clouds, turbulence, coffin corner
  - Pitot tubes blocked with ice
  - Autopilot inoperative without airspeed
  - Alpha protections disabled without airspeed
  - Pilots' responses inappropriate



- **Query**
  - Pilot training re loss of airspeed information in cruise?

# Collaboration at the Aviation System Level?

- **Mid-1990's, U.S. fatal commercial accident rate, although commendably low, had stopped declining**

- **Volume of commercial flying was projected to double within 15-20 years**

- **Simple arithmetic:  Doubling volume x flat rate = *doubling of fatal accidents***

- **Major problem because public pays attention to the *number* of fatal accidents, not the *rate***

# Commercial Aviation Safety Team (CAST)

**Engage _All_ Participants In Identifying Problems and Developing and Evaluating Remedies**

- **Airlines**

- **Manufacturers**

- **Air Traffic Organizations**

- **Labor**
  - *Pilots*
  - *Mechanics*
  - *Air traffic controllers*

- **Regulator(s)**

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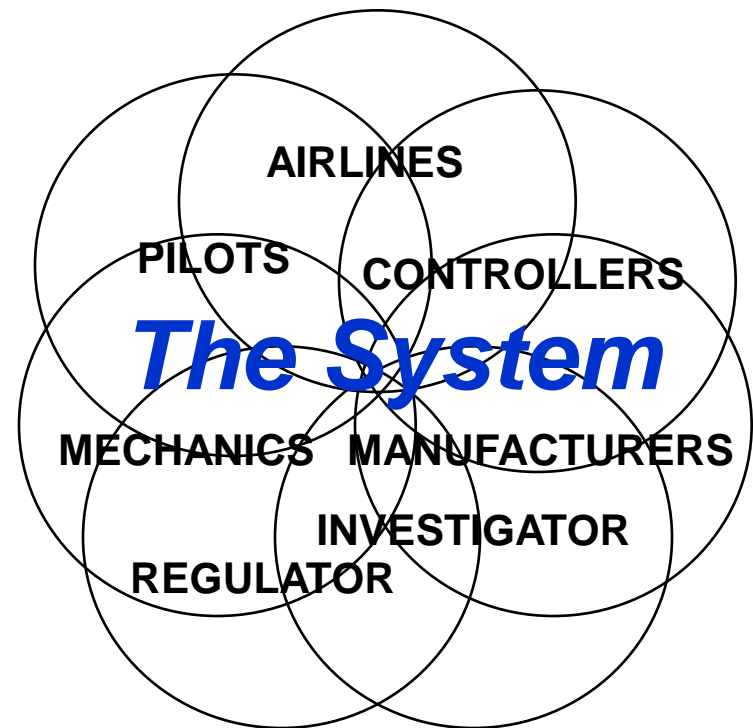
# Collaboration Success Story

**65% Decrease** in Fatal Accident Rate, 1997 - 2007

largely because of

*System Think*

fueled by

*Proactive Safety Information Programs*

P.S. Aviation was already considered *VERY SAFE* in 1997!!

# Major Paradigm Shift

- Old: The regulator identifies a problem, develops solutions
  - Industry skeptical of regulator's understanding of the problem
  - Industry fights regulator's solution and/or implements it begrudgingly

- New: Collaborative "System Think"
  - Industry involved in identifying problem
  - Industry "buy-in" re solution because everyone had input, everyone's interests considered
  - Prompt and willing implementation
  - Solution probably more effective and efficient
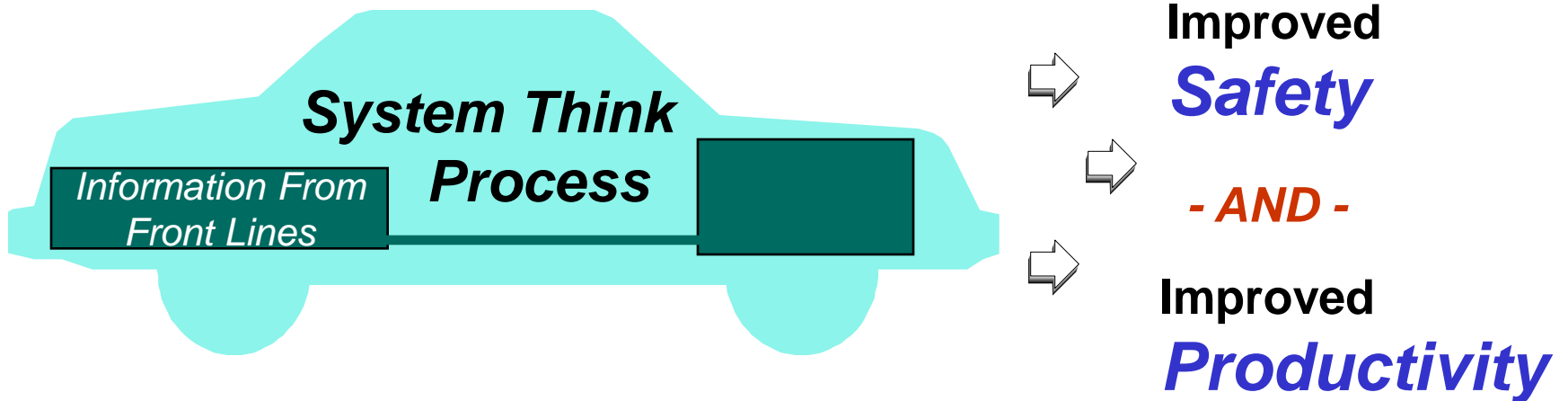  - Unintended consequences much less likely

# Challenges of Collaboration

- Human nature: "I'm doing great . . . *the problem is everyone else*"

- Differing and sometimes competing interests
  - Labor-management issues between participants
  - Participants are potential adversaries

- Regulator not welcome

- Not a democracy
  - Regulator must regulate

- Requires all to be willing, in their enlightened self-interest, to leave their "comfort zone" and think of the System

# Icing on the Cake:  A Win-Win

**System Think Process**

Information From Front Lines

Improved *Safety*

- *AND* -

Improved *Productivity*

# The Pleasant Surprise

## - Conventional Wisdom:

**Improvements that reduce risk usually *also reduce productivity***

## - The Reality:

**Risk reduction programs are usually a *NON-STARTER* if they hurt productivity**

## - Lesson Learned from the CAST process:

**Risk can be reduced in a way that also results in *immediate productivity improvements***

# The Role of Leadership

- Demonstrate Safety Commitment . . .
*But Acknowledge That Mistakes Will Happen*
- Include "Us" (*e.g.*, System) Issues,

Not Just "You" (*e.g.*, Training) Issues
- **Make Safety a Middle Management Metric**
- Engage Labor Early
- Include the *System* --
Manufacturers, Operators, Regulator(s), and Others

- Encourage and Facilitate Reporting
- Provide *Feedback*
- Provide Adequate *Resources*
- *Follow Through* With Action

# How The Regulator Can Help

- Emphasize importance of System issues *in addition to* (*not instead of*) worker issues

- Encourage and participate in industry-wide "System Think"

- Facilitate collection and analysis of information
  - Clarify and announce *policies for protecting information and those who provide it*
  - Encourage other industry participants to do the same

- Recognize that *compliance* is very important, but the *mission is reducing systemic risk*

# Aviation Win-Win:
# <u>Transferable to Other Industries?</u>

- Other Transportation Modes

- Nuclear Power

- Chemical Manufacturing

- Petroleum Refining

- Financial Industries

- Healthcare

- Others

# **Thank You!!!**



*Questions?*