



**NTSB** National Transportation Safety Board

# Aviation Lesson Learned:

**Better  
Collaboration  
Can Help  
Improve Safety  
*and* Productivity**

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# The Contrast

## - Conventional Wisdom:

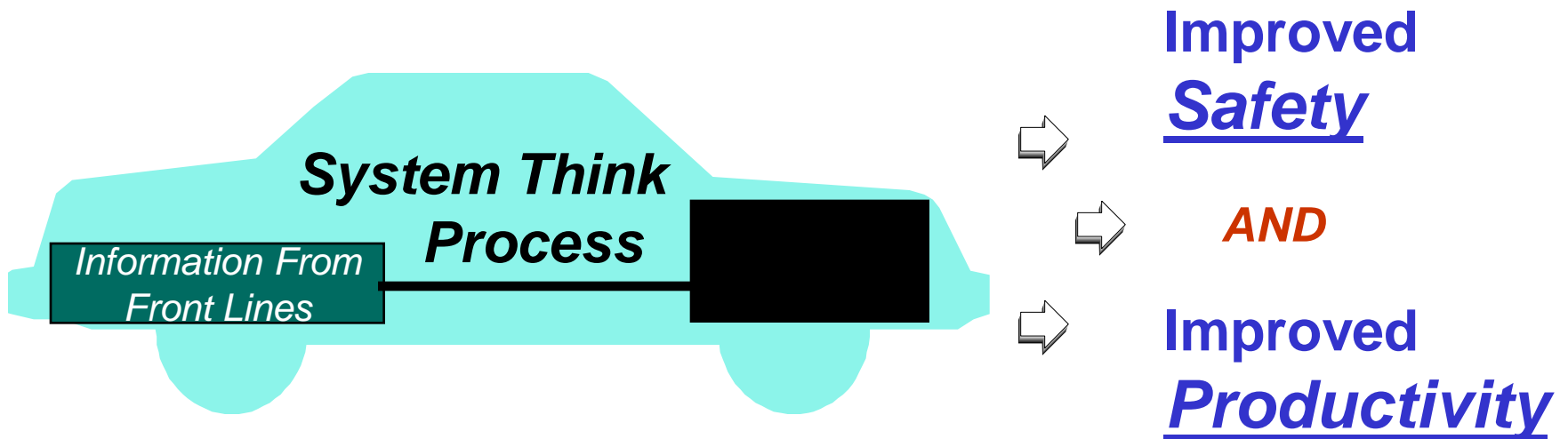
Improvements that reduce risk usually  
*also reduce productivity*

## - Lesson Learned from Proactive Aviation Safety Programs:

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



# Process Plus Fuel Creates a Win-Win



# Outline

- **The Context**
- **Importance of “System Think”**
- **Importance of Better Information**
- **Safety Benefits**
- **Productivity Benefits**
- **Roles of Leadership and Regulator**

# 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***
- Independence
  - Political: Findings and recommendations based upon evidence rather than politics
  - Functional: No “dog in the fight”



# The Context: Increasing Complexity

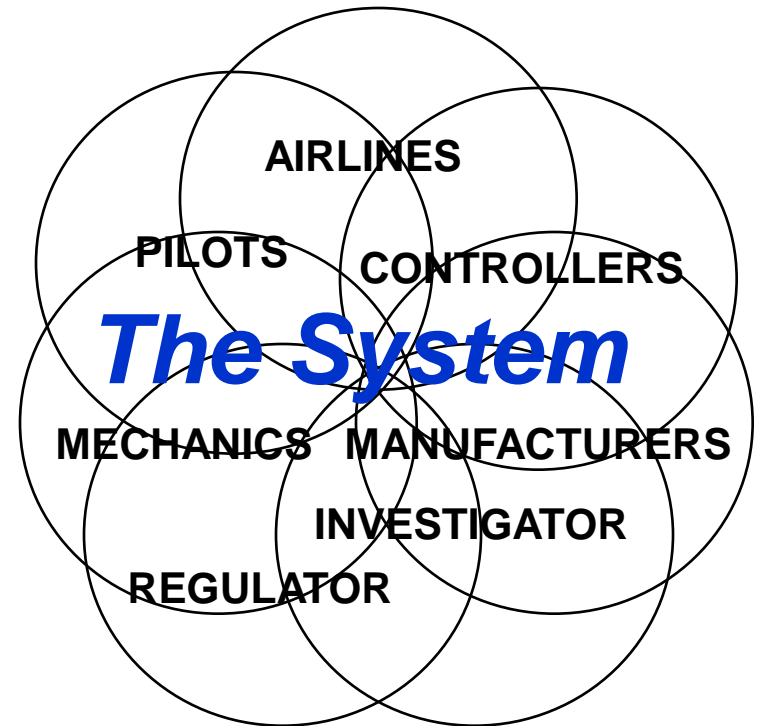
- **More System**

  - *Interdependencies*

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

- **Safety Issues Are More Likely to Involve**

  - *Interactions Between Parts of the System*



# 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***



# **“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**



# When Things Go Wrong

## 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!**

# Fix the Person or the System?

Is the **Person**  
*Clumsy?*

Or Is the  
Problem . . .

The *Step???*



# Enhance Understanding of Person/System Interactions By:

- Collecting,
  - Analyzing, and
  - Sharing
- ## Information

# 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 Source of Information: Hands-On “Front-Line” Employees**

**“We Knew About  
That Problem”**

***(and we knew it might hurt  
someone sooner or later)***



# Next Challenge



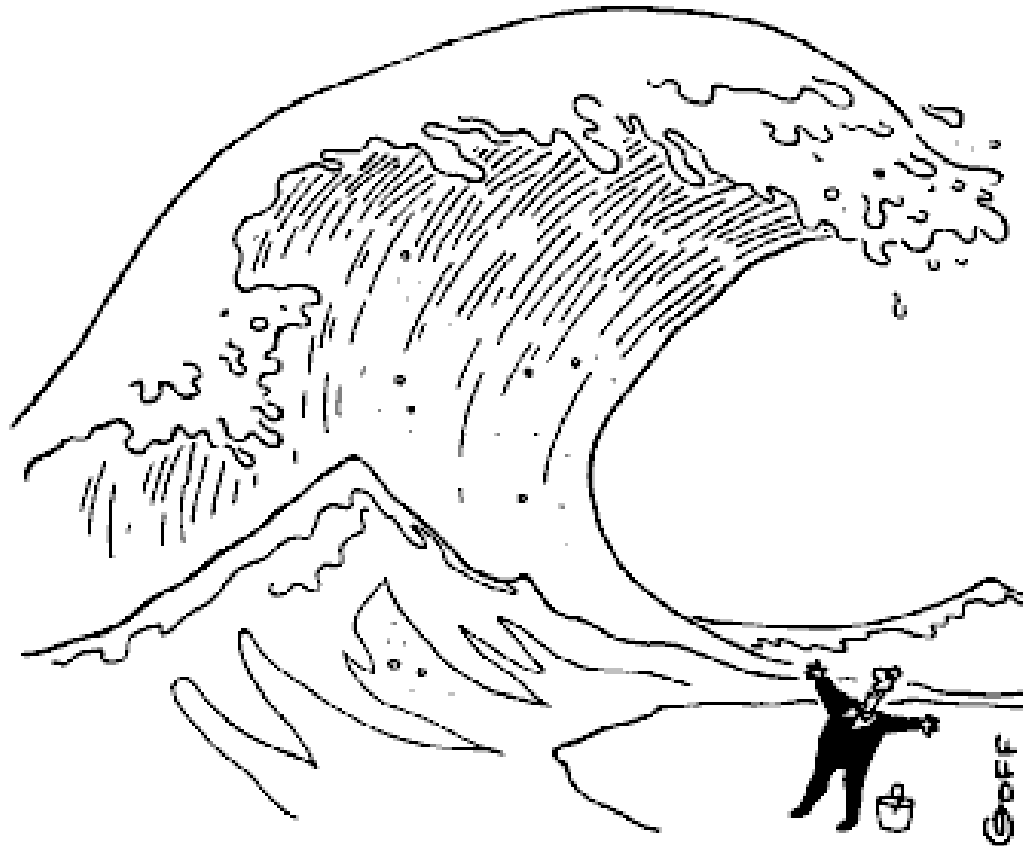
**Legal/Cultural Issues**

**Improved Analytical Tools**

*As we begin to get over the first hurdle, we must start working on the next one . . .*

# Information Overload

© 1996 Ted Goff



"EUREKA! MORE INFORMATION!"

# From Data to Information

*Tools and processes to convert large quantities of data into useful information*

## Data Sources

Info from front line staff and other sources

**DATA**



**Analysts**

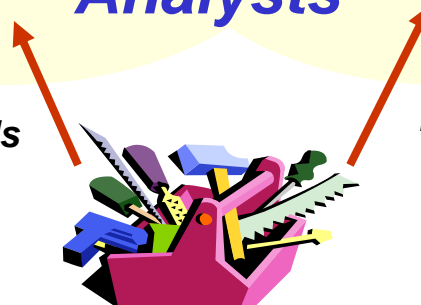
**USEFUL**

**INFORMATION**

## Smart Decisions

- Identify issues
- **PRIORITIZE!!!**
- Develop solutions
- Evaluate interventions

**Tools**



**Processes**

# Aviation Success Story

**83% Decrease** in Fatal Accident Rate,  
1998 - 2007

largely because of  
***System Think***

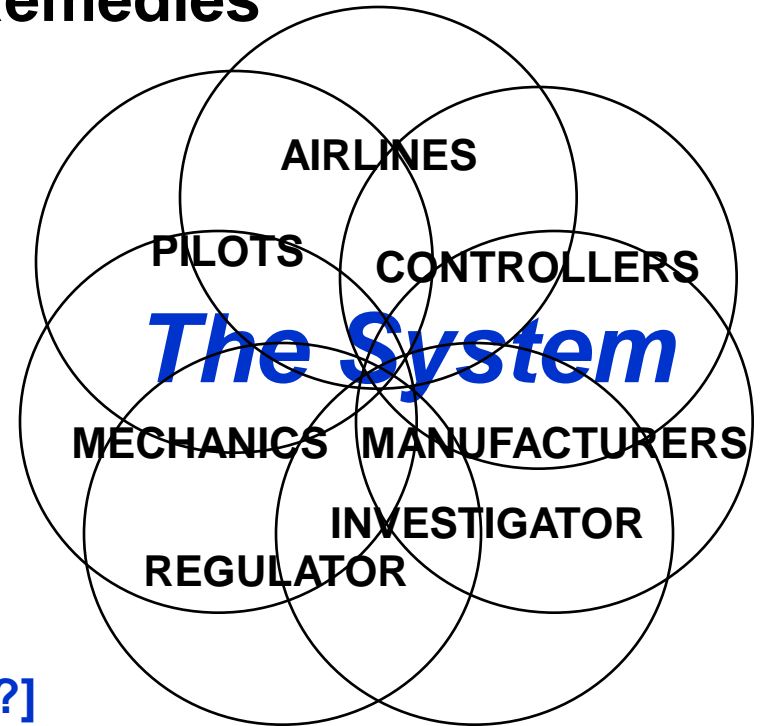
fueled by  
***Proactive Safety  
Information Programs***

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

# Aviation “System Think” Success

Engage All Participants In Identifying Problems and Developing and Evaluating Remedies

- Airlines
- Manufacturers
  - *With the systemwide effort*
  - *With their own end users*
- Air Traffic Organizations
- Labor
  - *Pilots*
  - *Mechanics*
  - *Air traffic controllers*
- Regulator(s) **[Query: Investigator(s)?]**



# Moral of the Story

Anyone who is  
involved in the *problem*  
should be  
involved in the *solution*



# 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 interventions because everyone had input, everyone’s interests considered
  - Prompt and willing implementation
  - Interventions evaluated . . . *and tweaked as needed*
  - Solutions probably more effective and efficient
  - Unintended consequences much less likely

# Challenges of Collaboration

- Human nature: “I’m doing great . . . *the problem is everyone else*”
- Participants may have competing interests, e.g.,
  - Labor/management issues
  - May be potential co-defendants
- Regulator probably 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



# Applicability of Collaborative Approach:

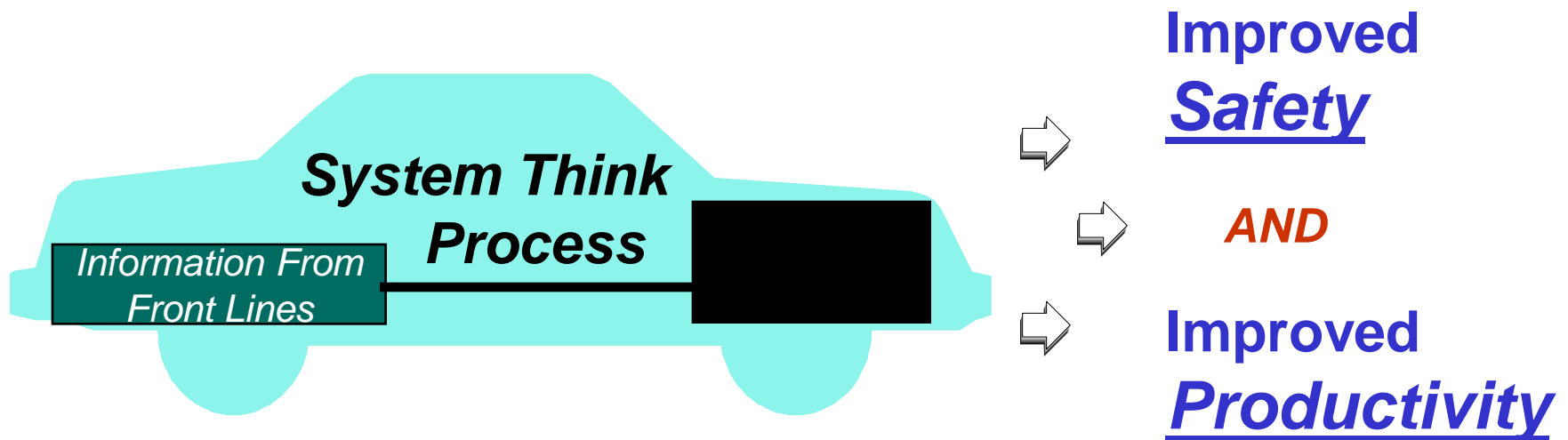
- **Entire Industry**
- **Company (Some or All)**
- **Type of Activity**
- **Facility**
- **Team**

# Manufacturer “System Think” Success

**Aircraft Manufacturers are Increasingly Seeking Input, Throughout the Design Process, From**

- ***Pilots*** (***User*** Friendly)
- ***Mechanics*** (***Maintenance*** Friendly)
- ***Air Traffic Services*** (***System*** Friendly)

# Process Plus Fuel Can Produce An Amazing Win-Win



***P.S. Collaboration also significantly reduces the likelihood of unintended consequences!***

# **Not Only Improved Safety, But Improved Productivity, Too**

- **Ground Proximity Warning System**
  - **S: *Reduced warning system complacency***
  - **P: *Reduced unnecessary missed approaches, saved workload, time, and fuel***
- **Flap Overspeed**
  - **S: *No more potentially compromised airplanes***
  - **P: *Significantly reduced need to take airplanes off line for **VERY EXPENSIVE (!!) disassembly, inspection, repair, and reassembly*****

**But Then . . .**

**Why Are We**

**So Jaded in The Belief That**

***Improving Safety***

***Will Probably***

***Hurt The Bottom Line??***

# Costly Result\$ Of Safety Improvements Poorly Done

## Safety *Poorly* Done

1. Punish/re-train operator
  - *Poor workforce morale*
  - *Poor labor-management relations*
  - *Labor reluctant to tell management what's wrong*
  - *Retraining/learning curve of new employee if "perpetrator" moved/fired*
  - *Adverse impacts of equipment design ignored, problem may recur because manufacturers are not involved in improvement process*
  - *Adverse impacts of procedures ignored, problem may recur because procedure originators (management and/or regulator) are not involved in improvement process*

## Safety *Well* Done

Look beyond operator,  
also consider system  
issues

# Costly Result\$ Of Safety Poorly Done (con't)

## Safety *Poorly* Done

### 2. Management decides remedies unilaterally

- *Problem may not be fixed*
- *Remedy may not be most effective, may generate other problems*
- *Remedy may not be most cost effective, may reduce productivity*
- *Reluctance to develop/implement remedies due to past remedy failures*
- *Remedies less likely to address multiple problems*

### 3. Remedies based upon instinct, gut feeling

- *Same costly results as No. 2, above*

## Safety *Well* Done

Apply “System Think,” *with workers*, to identify and solve problems

Remedies based upon evidence (including info from front-line workers)

# Costly Result\$

## Of Safety Poorly Done (con't)

### Safety *Poorly* Done

4. Implementation is last step

- *No measure of how well remedy worked (until next mishap)*
- *No measure of unintended consequences (until something else goes wrong)*

### Safety *Well* Done

Evaluation after implementation

### Conclusion: Is Safety Good Business?

- *Safety implemented poorly can be **very costly (and ineffective)***
- *Safety implemented well, in addition to improving safety more effectively, can also **create benefits greater than the costs***



# 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 the 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*

# Suggested Beta Test

- **Select troublesome area**
  - Nagging problem for many years
  - Many interventions have been tried, not successful
  - Likelihood that problems are systemic, not just people
  - Collaboration as effort to address the system problems
  - Less defensiveness because not focused on single event
- **Select collaborative corrective action group**
  - All who have a hand in the process
  - Manufacturers?
  - Operators?
  - Regulators?
  - Others?



# **Note HRO Characteristics**

- **Preoccupation with failure**
- **Reluctance to simplify interpretations**
- **Sensitivity to operations**
- **Commitment to resilience**
- **Deference to expertise**
- **Note Also: Collaborative process can be applied at any macro or micro level at which there is a system issue, just as HRO principles can be applied at any appropriate macro or micro level**

# Conclusions

- ***Safety programs that improve the bottom line are more likely to be sustainable***
- ***Collaboration can help generate safety programs that also improve productivity while improving safety***



Thank You!!!



*Questions?*