NTSB National Transportation Safety Board

Lessons Learned re:

Improving Safety While Improving Productivity

Presentation to: Air Charter Safety Foundation

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<u>The Contrast</u>

- Conventional Wisdom:

Programs that improve safety
usually reduce productivity
(and vice-versa)

- Lesson Learned from Proactive Aviation Safety Information Programs:

Safety can be improved in a way that also results in
immediate productivity improvements

Process Plus Fuel Creates A Win-Win

System Think Process

Information From Front Lines

⇨ Improved *Safety*

⇨ *- AND -*

⇨ Improved *Productivity*
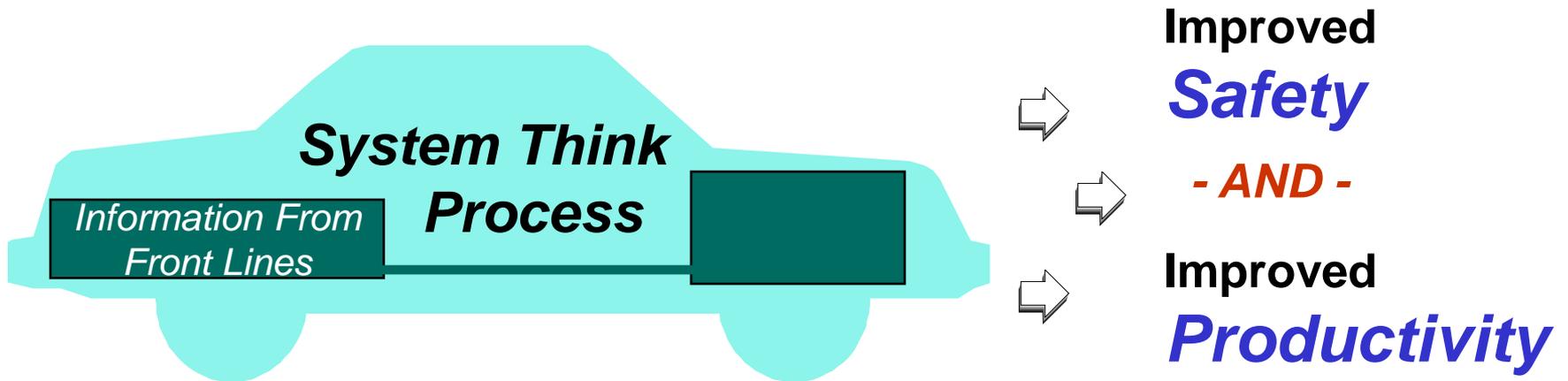
Outline

- **The Context**

- **Importance of Better Information**

- **Importance of "System Think"**

- **Safety Benefits**

- **Productivity Benefits**

- **Aviation Successes and Failures**

- **The Role of Leadership**
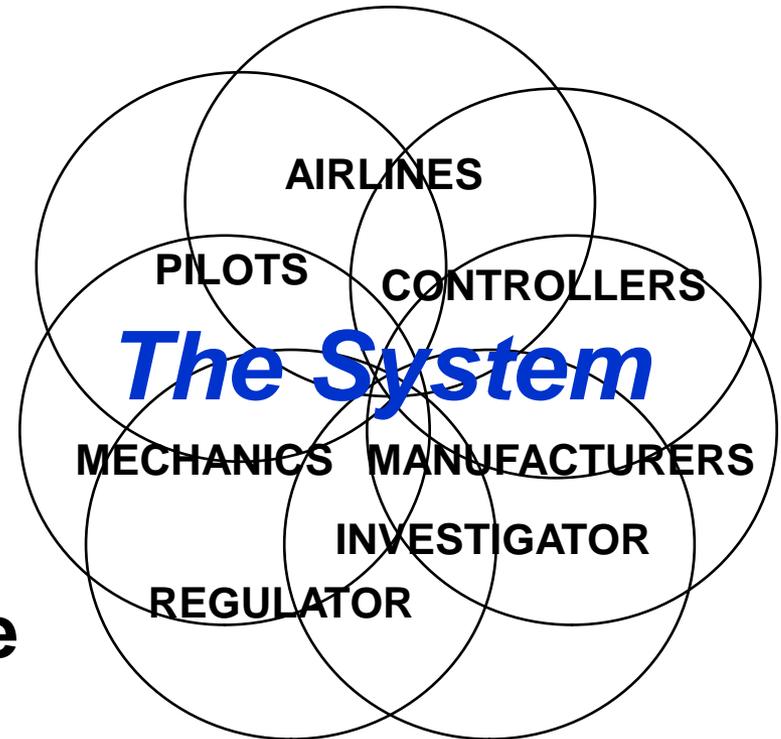
The Context: Increasing Complexity

- **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*

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**

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
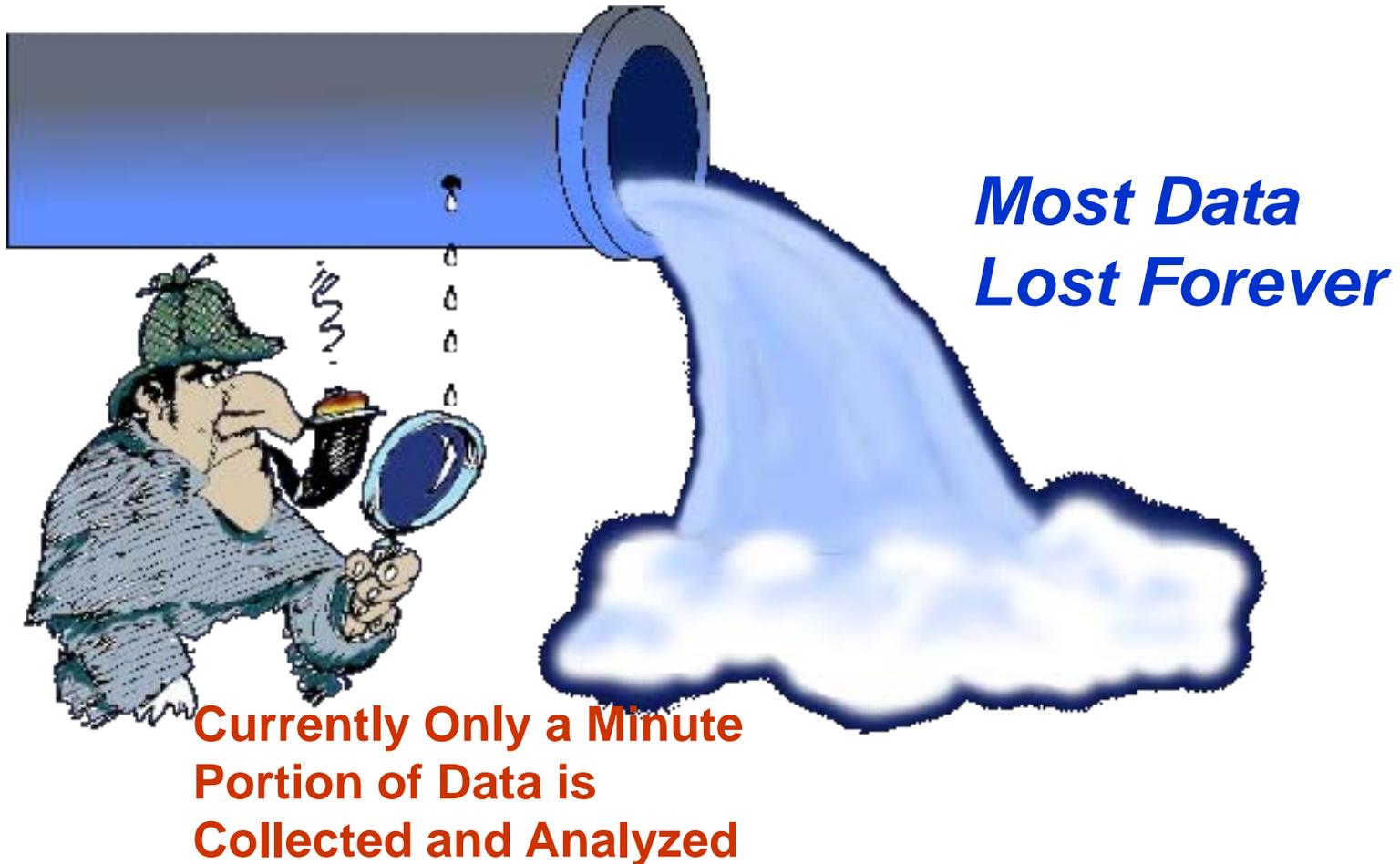
To Err Is Human:

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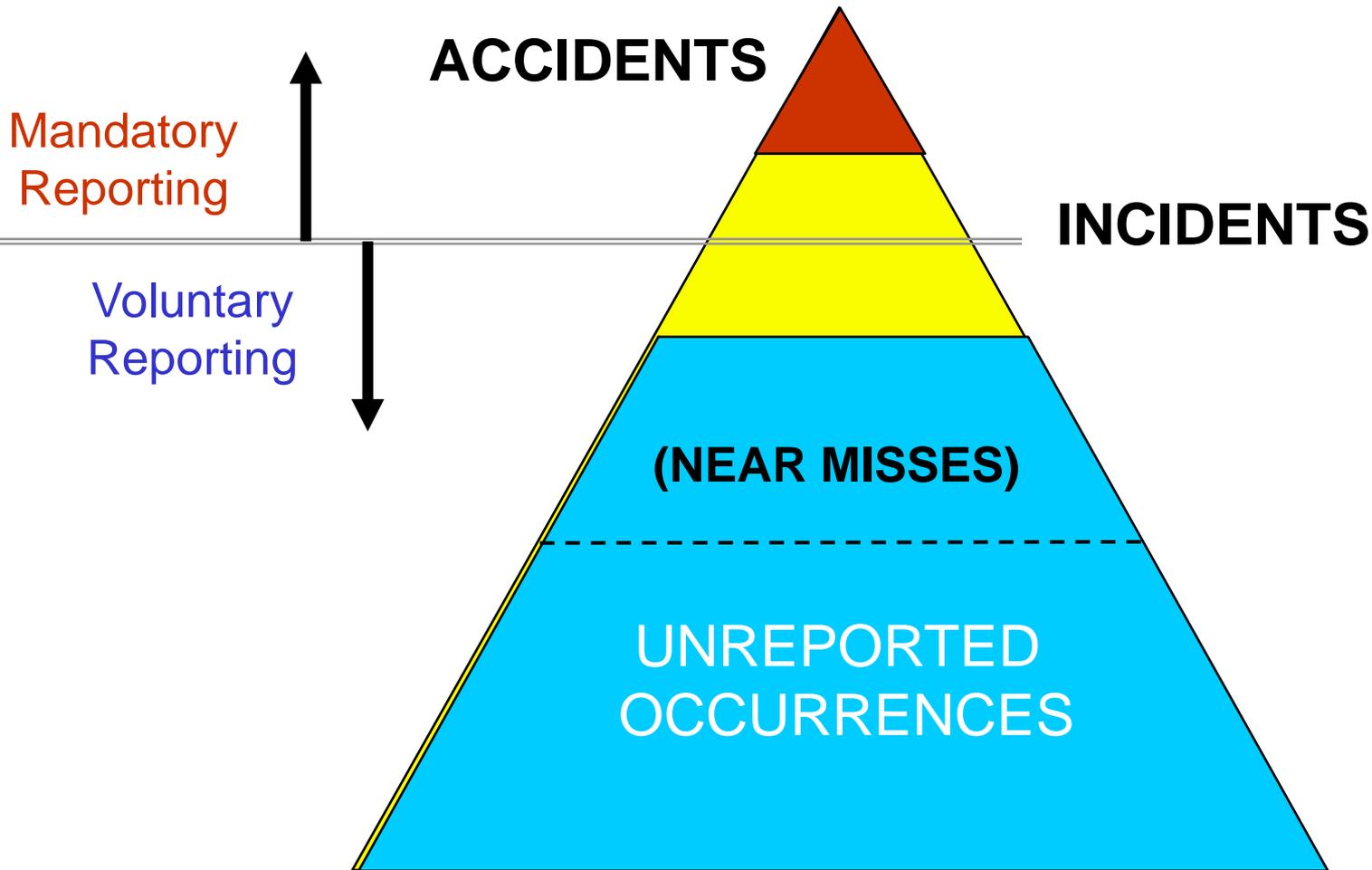
Institute of Medicine, Committee on Quality of Health Care in America, 1999

Current System Data Flow

Most Data Lost Forever

Currently Only a Minute Portion of Data is Collected and Analyzed

Heinrich Pyramid

ACCIDENTS

Mandatory
Reporting

INCIDENTS

Voluntary
Reporting

(NEAR MISSES)

UNREPORTED
OCCURRENCES

Major Source of Information: Hands-On "Front-Line" Employees

"We Knew About That Problem"

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

Legal Concerns That Discourage Collection, Analysis, and Sharing

- **Public Disclosure**

- **Job Sanctions and/or Enforcement**

- **Criminal Sanctions**

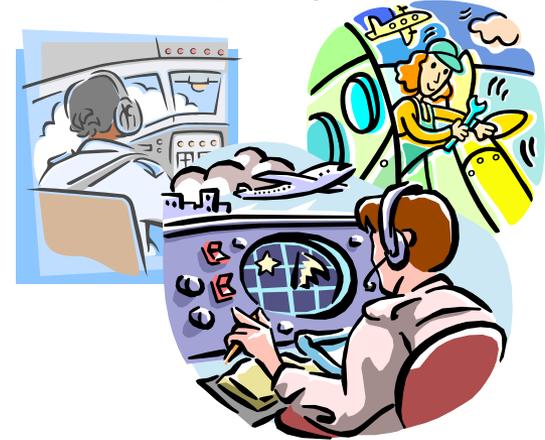- **Civil Litigation**

Typical "Cultural" Barrier

CEO

"Safety First"

Middle Management

"Production First"

Front-Line Employees

"Please the Boss First…
THEN Consider Safety?"

Next Challenge

Legal/Cultural Issues
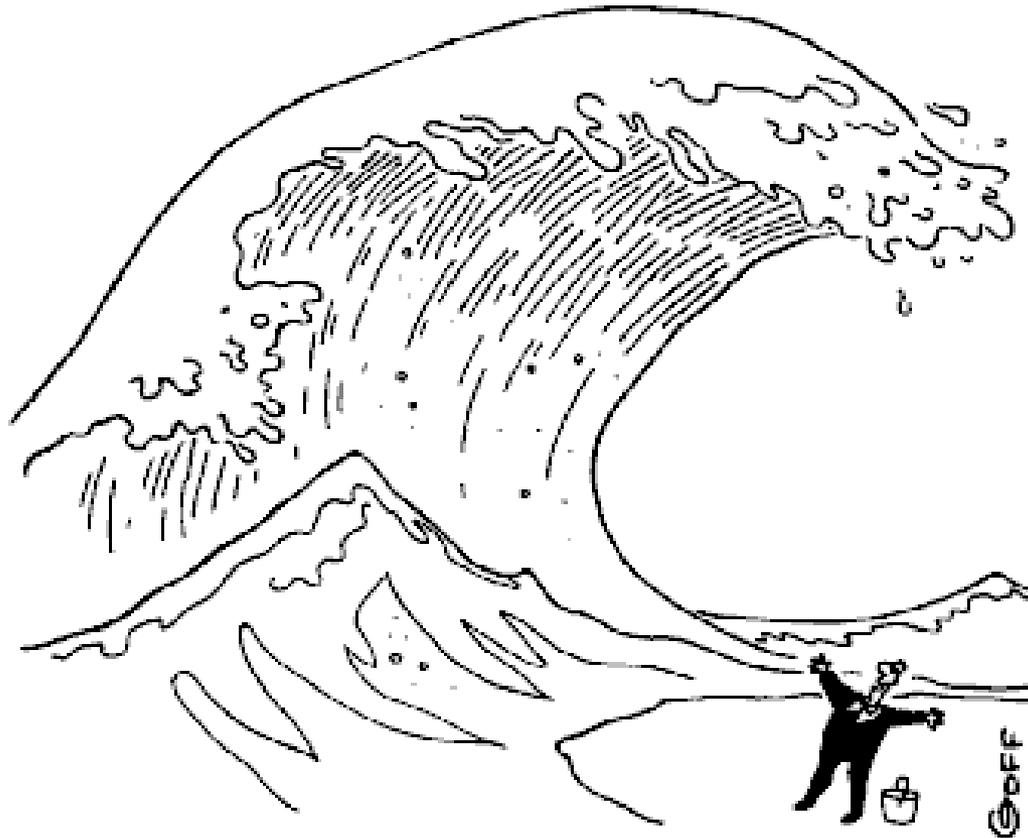
Improved Analytical Tools

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

Information Overload

"EUREKA! MORE INFORMATION!"

© 1996 Ted Goff

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

Prioritization: The Most Difficult Step

How Many *Other Pressing Issues* (If Any) Were Being Addressed When:

- **NASA** responded inadequately to previous events of separated foam that struck the orbiter during launch

- **Concorde** manufacturer and operators responded inadequately to previous tire disintegrations during takeoff

- **Ford and Firestone** responded inadequately to previous tire failures and rollovers in Ford Explorers

- The **intelligence community** responded inadequately to reports about people who wanted to learn to fly – but not how to land – in an airliner flight simulator

Missing Element – The Harsh Glare of Hindsight

Aviation Success Story

65% Decrease in Fatal Accident Rate, 1997 - 2007

largely because of
## *Proactive*
Safety Information Programs

plus
System Think

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)?]**

AIRLINES

PILOTS CONTROLLERS

The System

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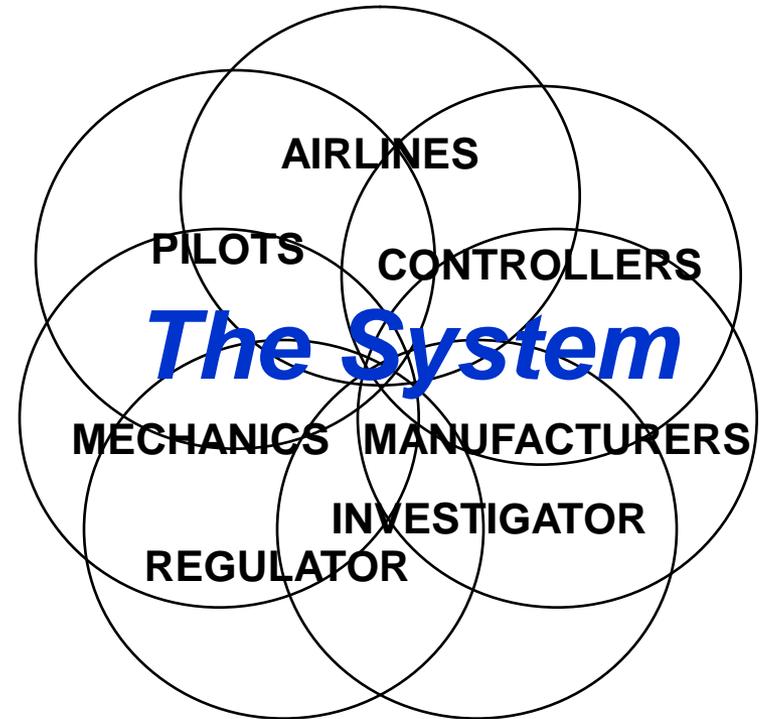
Manufacturer "System Think" Success

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

- Pilots   (*User* Friendly)

- Mechanics   (*Maintenance* Friendly)

- Air Traffic Services   (*System* Friendly)

Failure:
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

Major Benefit: $avings*

Significantly More
**Than Savings From
Mishaps Prevented**
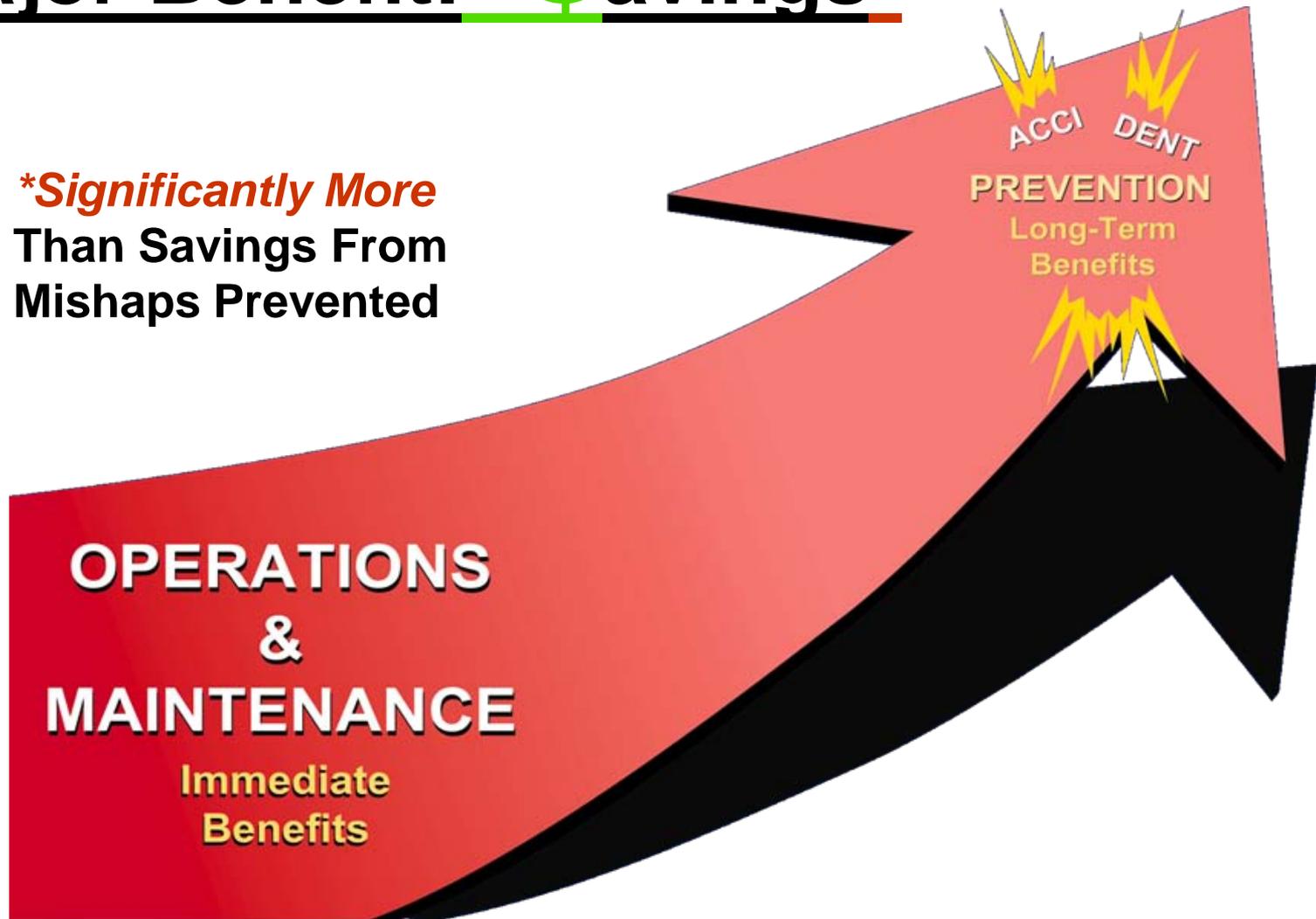
Not Only Improved Safety,
But Improved Productivity, Too

- **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

Safety *Well* Done

2. Management decides remedies unilaterally

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

- 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

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

- Same costly results as No. 2, above

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

Safety *Poorly* Done

Safety *Well* Done

4. Implementation is last step

Evaluation after implementation

- *No measure of how well remedy worked (until next mishap)*

- *No measure of unintended consequences (until something else goes wrong)*

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

Thank You!!!

Questions?