NTSB National Transportation Safety Board

Collaboration:

Improving Safety

in

Complex Industries

Presentation for:

Moving 21st Century Organizations Toward Higher Reliability

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The Pleasant Surprise

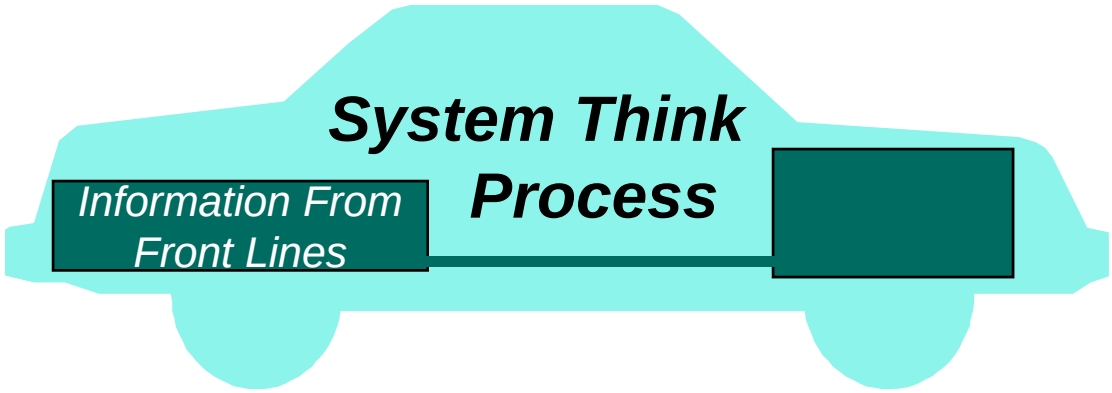
- Conventional Wisdom:

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

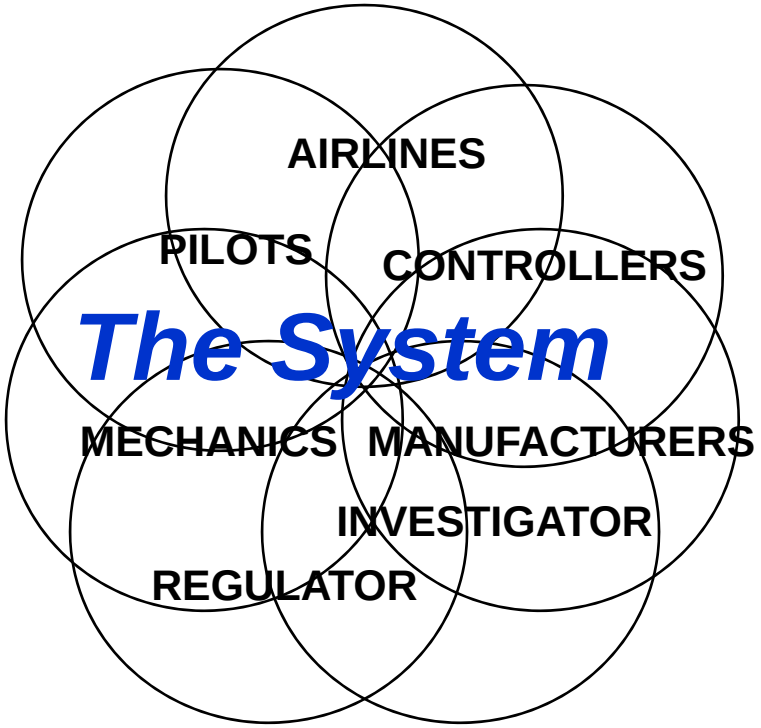
Process Plus Fuel Creates A Win-Win



Improved
Safety
- AND -
Improved
Productivity

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

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

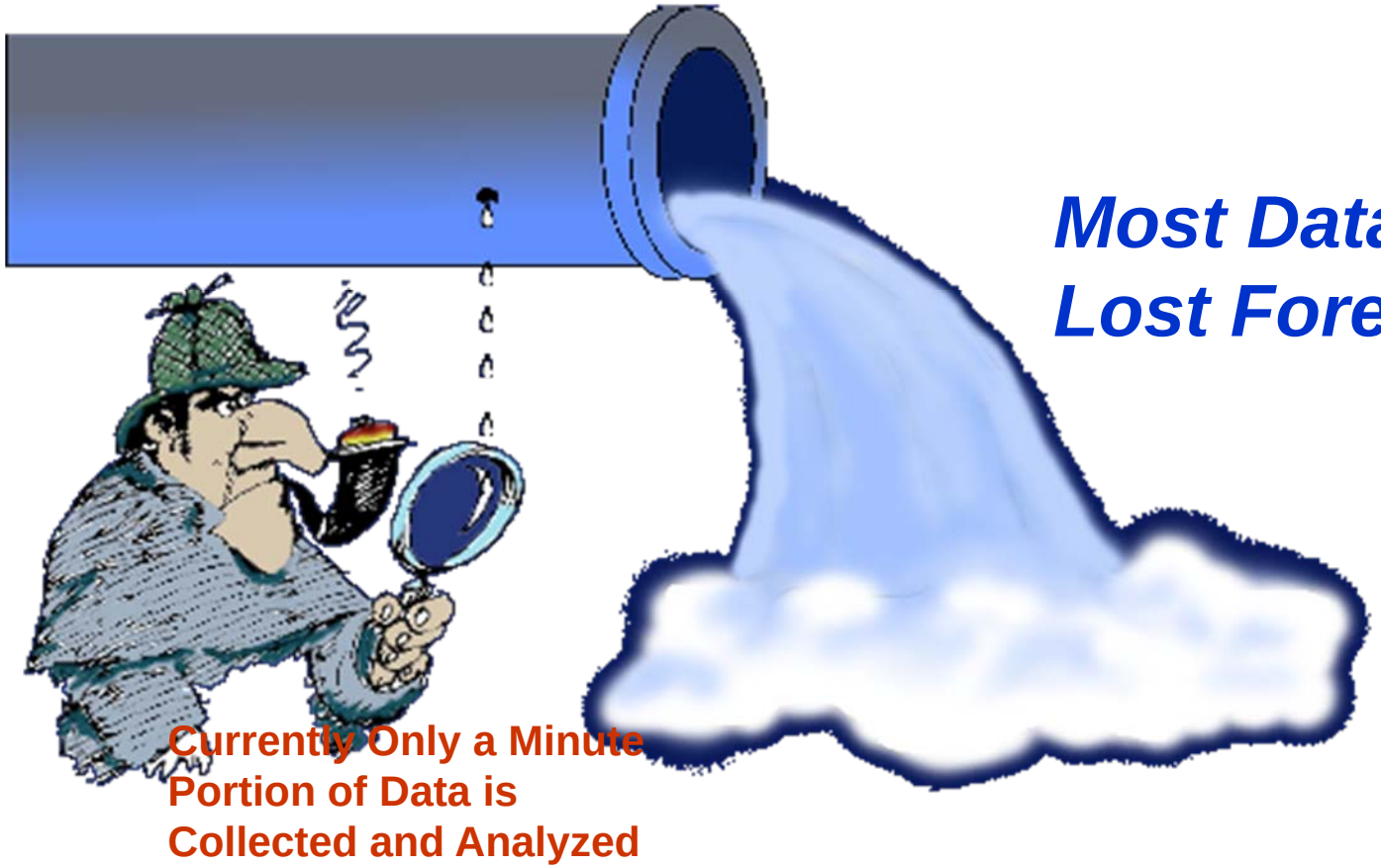
To Err Is Human:

Building a Safer Health System

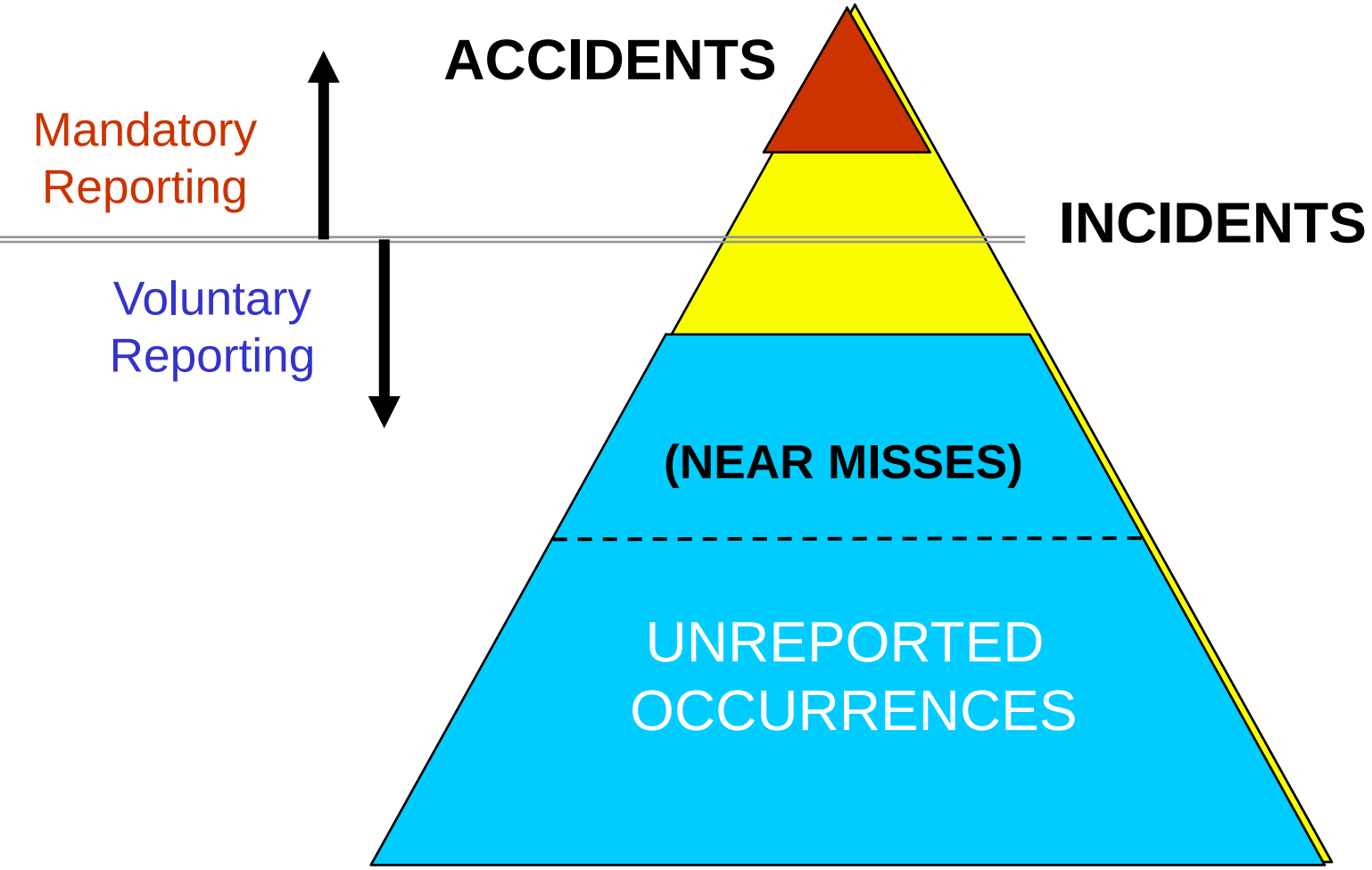
"The focus must shift from blaming individuals for past errors to a focus on preventing future errors by designing safety into the system."

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

Current System Data Flow



Heinrich Pyramid



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

“Safety First”

Middle Management

“Production First”

Front-Line Employees

“Please the Boss First…
THEN Consider Safety?”

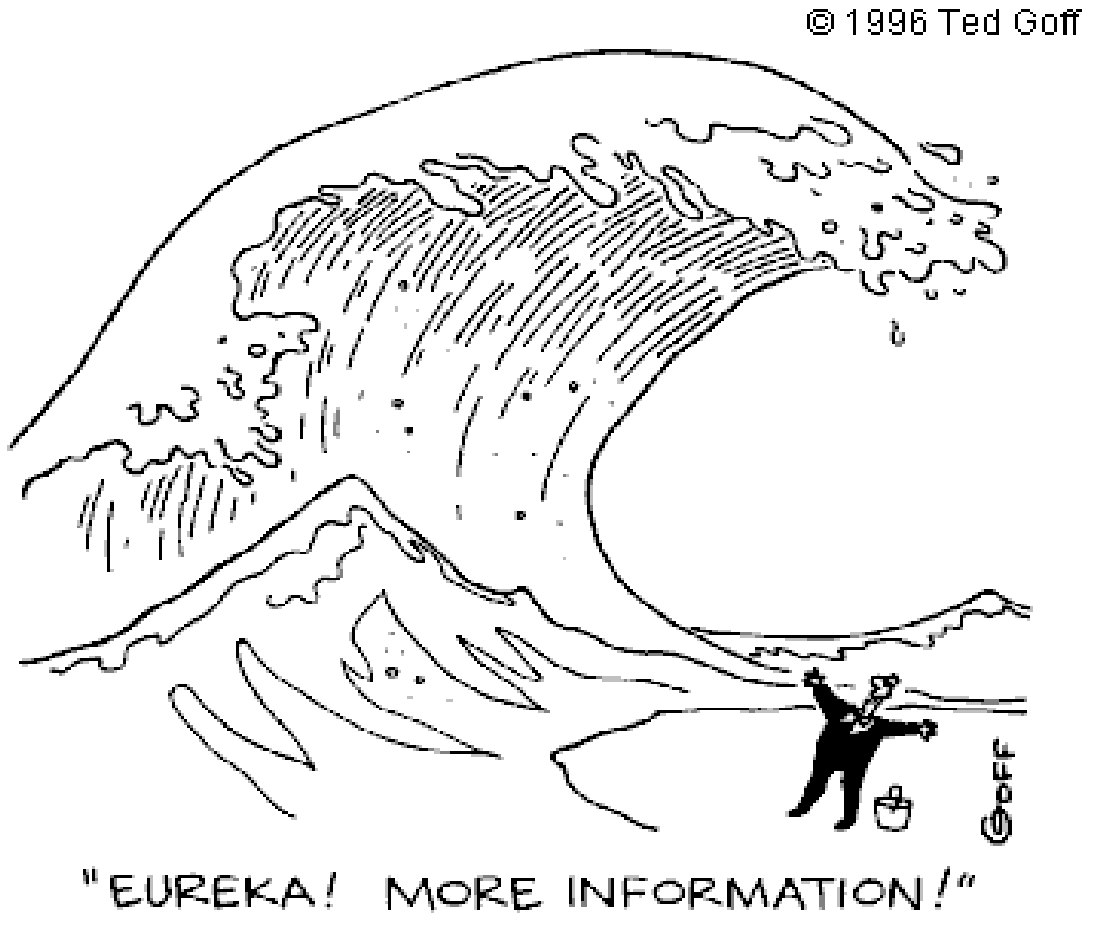
Next Challenge

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



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

USEFUL

INFORMATION

Smart Decisions

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

Analysts

Tools

Processes

Aviation Success Story

65% Decrease **in Fatal Accident Rate,**

1997 - 2007

largely because of

System Think

fueled by

Proactive Safety

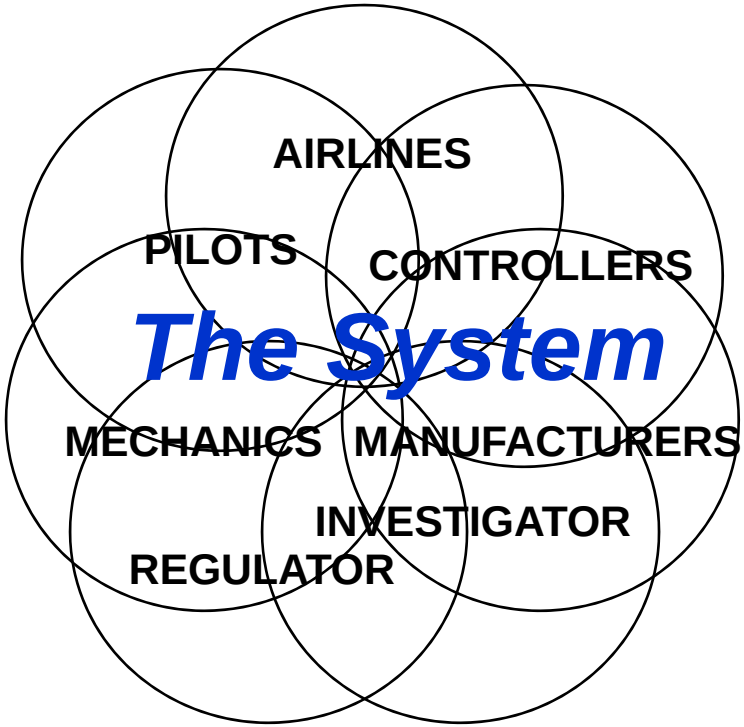
Information Programs

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

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)?]**



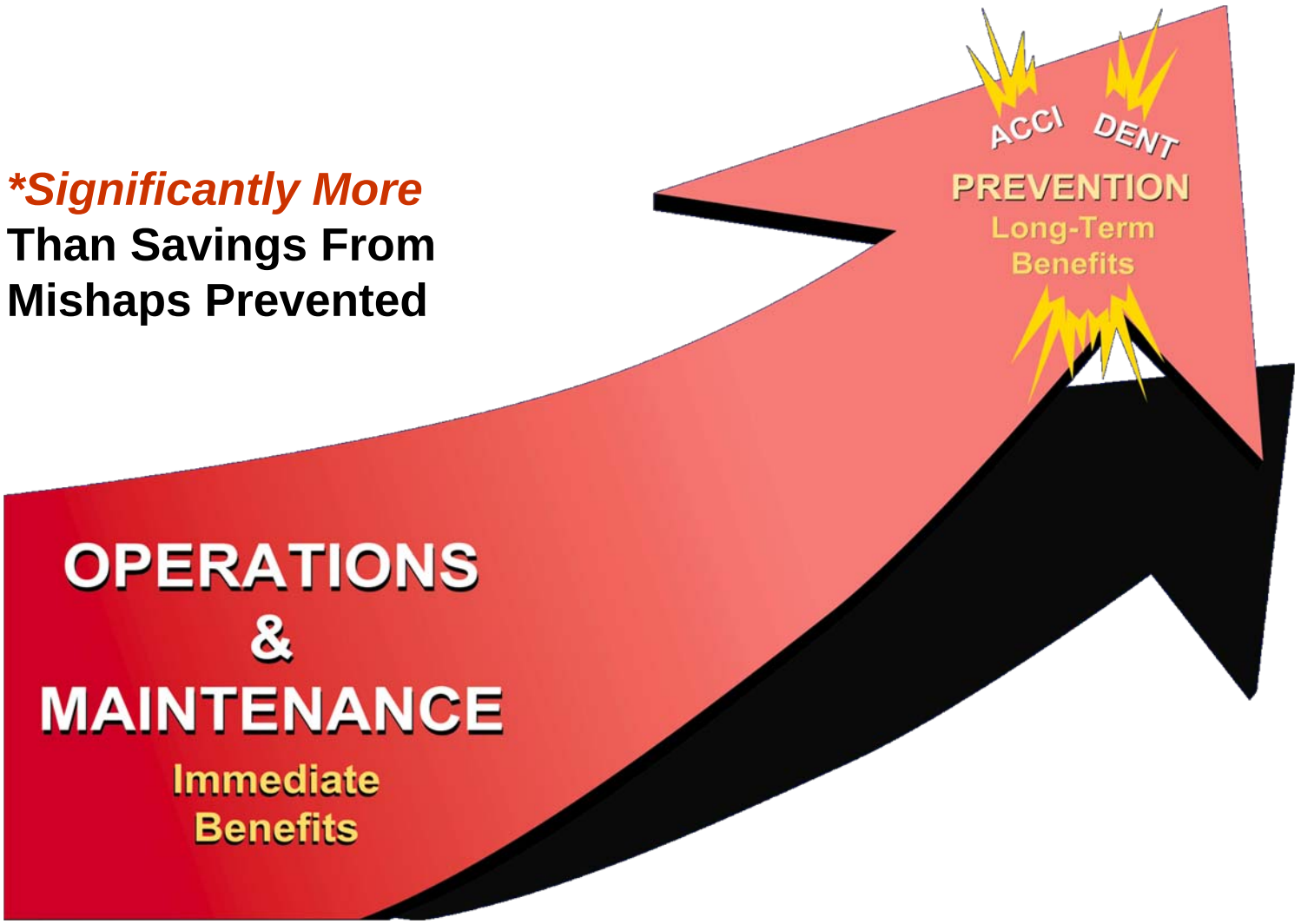
Manufacturer "System Think" Success

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

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

Major Benefit: $avings*

**Significantly More*
Than Savings From Mishaps Prevented



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	Safety *Well* Done
1. Punish/re-train operator	Look beyond operator, also consider system issues

- *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*

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" (*i.e.*, 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?