

Part 3

Accident Investigation and Prevention

Accident Prevention

**Relies upon knowledge and understanding
of the entire operation**

- Aircraft**
- System**

A very human intensive process

Accident Prevention

Needs constant refreshment of the knowledge base:

- aircraft
- power plants
- air traffic systems
- communications
- airports
- weather
- and more

Aircraft Investigation

Provides major inputs to knowledge base:

- what happened
- where it happened
- when it happened
- how it happened
- why it happened

Relies on good "detective" work

Aircraft Investigation

Incomplete if we do not know about
the human interaction with
system and components

- design
- manufacture
- operation

Important to continuously upgrade
accident investigation tools

Accident Investigation



Past Accident Reduction

- Historically we have been **reactive**
 - Examination of accident wreckage
 - Analysis of "black box"
- This has produced a very low accident rate.
- The accident rate is now on a plateau.

Reactive approach is no longer effective.

Future Accident Reduction

- In the future we must be **pro-active**.
- Identify and eliminate adverse trends.
- Stop accidents **before** they happen.

Analysis of flight data recorder information can help to do this.

Accident Recorders

Flight Data Recorders



An invaluable tool to help in accident investigations

Cockpit Voice Recorders

Another invaluable tool
for accident investigators

However, in too many accident
investigations a 30 minute
audio recording loop was
not long enough

Why not two hours?



Cockpit Video Recorders



A tool to further improve
accident investigation

Available today so why
not use them?

Can eliminate uncertainties
related to audio only



Privacy issues must
be addressed and
can be resolved



Video Recorders



Can also be used in other ways
inside and outside the aircraft



Not All Events Become Accidents

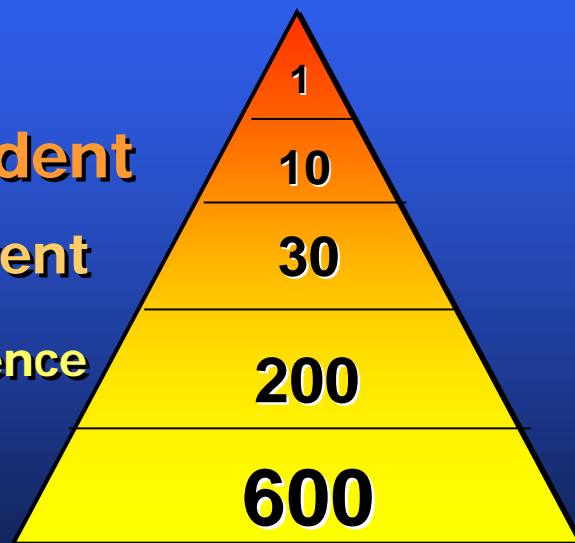
Accident

Serious incident

Significant event

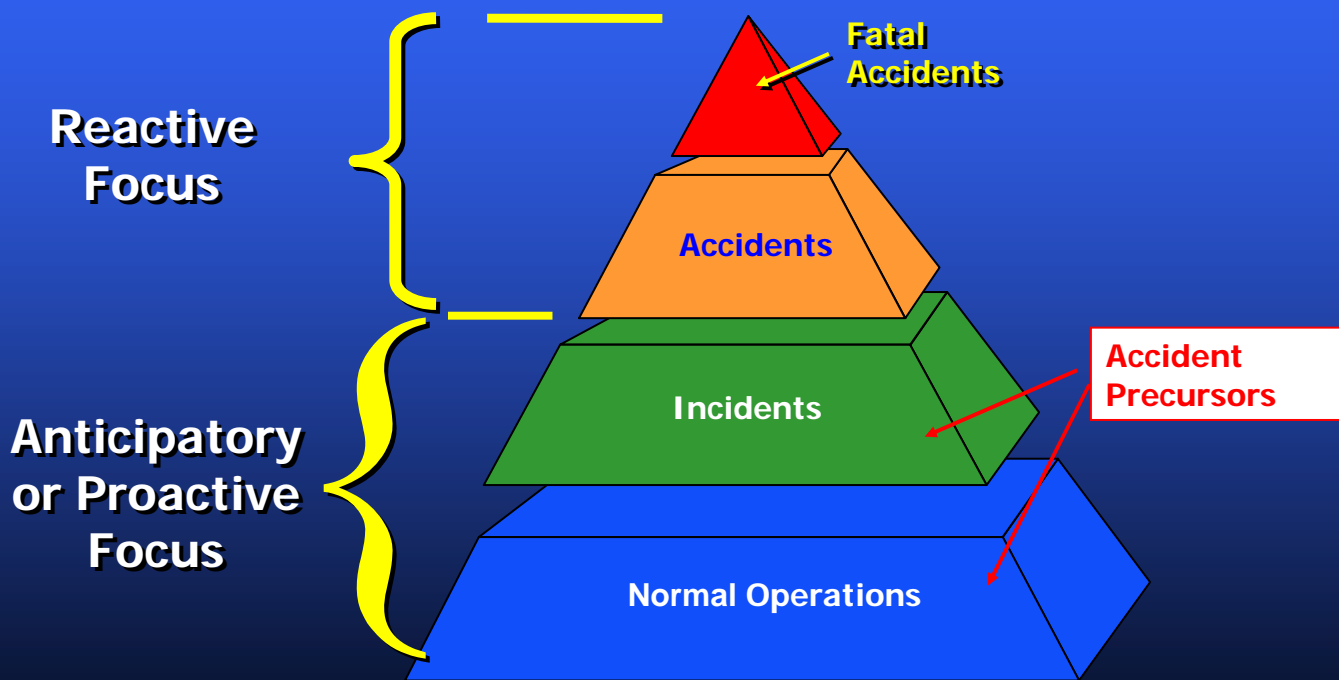
Routine occurrence

Statistical event



But events are precursors of accidents

The Accident Pyramid



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Digital Flight Data Recorder

Recorder is monitoring continuously:



Quick Access Recorders (QAR)
are now fitted to all modern aircraft

- **The aircraft**
 - systems
 - performance
- **The crew**
 - control
 - airmanship
 - exceedences
 - behavior

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FDM Data

Covers all Flights

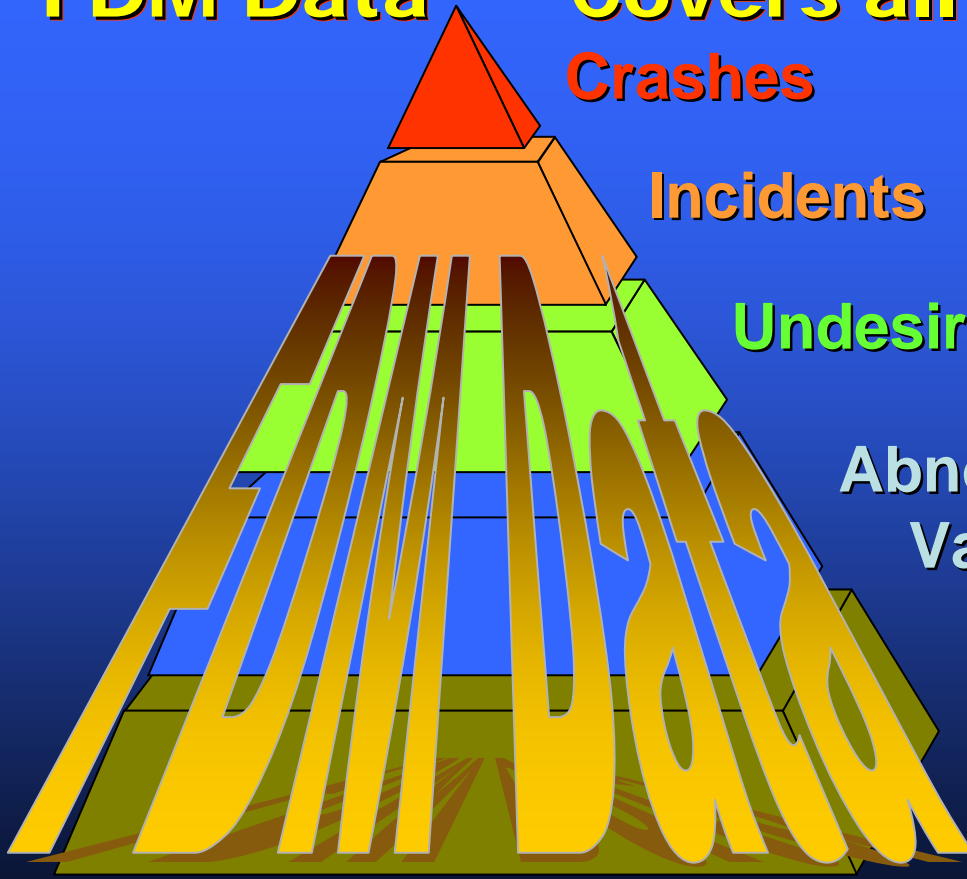
Crashes

Incidents

Undesirable Events

Abnormal Variations

Normal Variations



Flight Data Replay from DFDR



Preventing Future Accidents

Flight Operational Quality Analysis

FOQA or FDM

Monitoring of DFDR Information

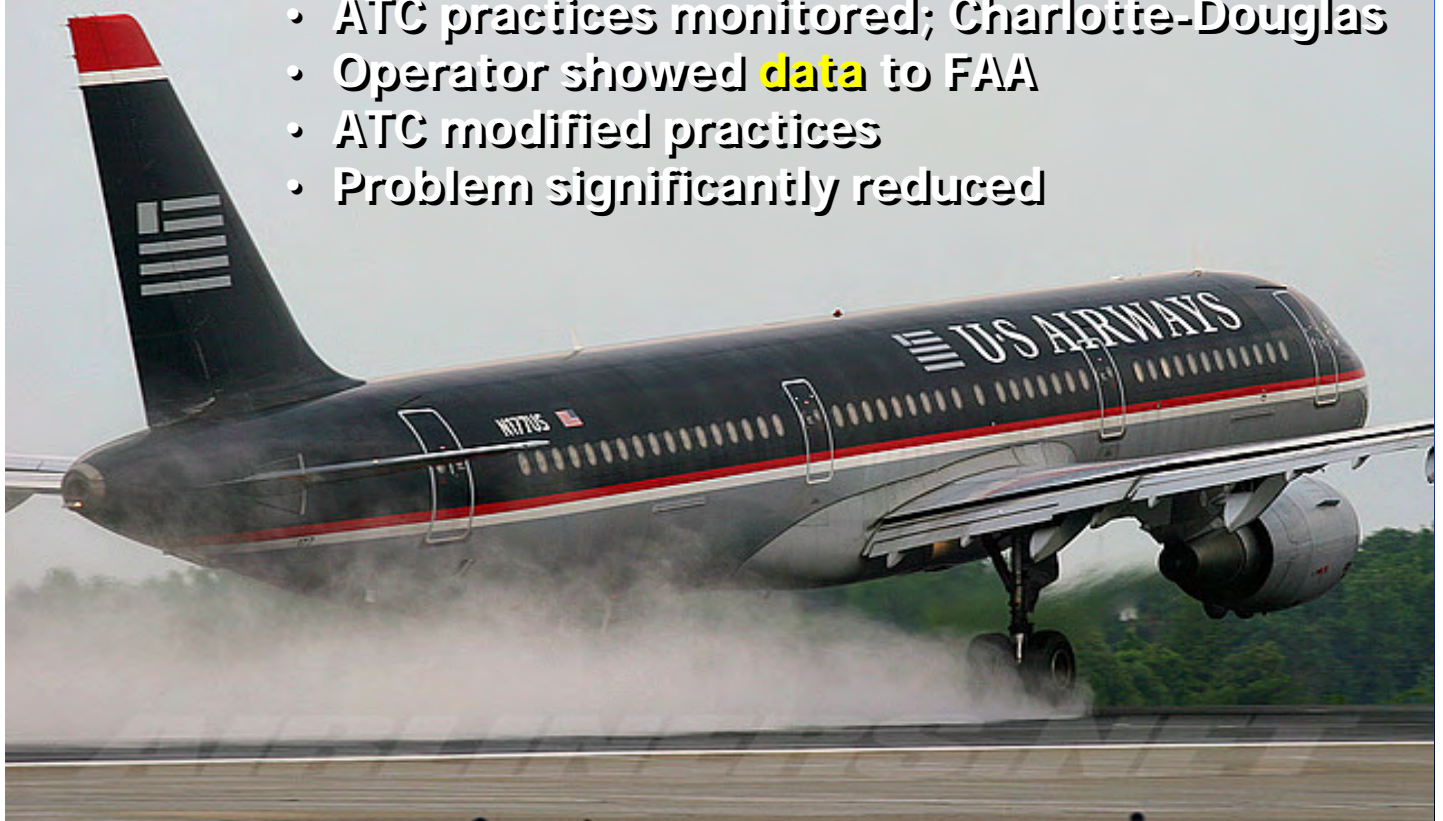
- Identifies normal operations
- Highlights abnormal operations
- Detects adverse trends in normal operations

Potential hazards can be identified and corrected **before** an accident occurs

Problem Solved Using DFDR

Unstable Approaches:

- ATC practices monitored; Charlotte-Douglas
- Operator showed **data** to FAA
- ATC modified practices
- Problem significantly reduced



FOQA or FDM Programs

- Analysis of the DFDR
 - tells you what was done
 - does not always say why
- Crew reports
 - tell you why

FOQA or FDM Programs

To:

- avoid concerns
- ensure open dialogue
- obtain best results

DFDR monitoring
and crew reports should be

CONFIDENTIAL and NON-PUNITIVE

FOQA Concepts

Inadvertent errors or mistakes

- Revealed by operational trend monitoring, including DFDR analysis**
- Voluntary reporting**
- When identified as information to help improve safety**

will not be penalized

FOQA Programs

Implementation:

- Inadvertent errors are not punished**
- Inadvertent mistakes are treated as symptoms of a problem**
- Symptoms are used to identify adverse trends and avert problems before they become serious**

Inadvertent Errors

Are not the same as:

- **repeated**
- **willful**
- **reckless**
- **deliberate**
- **intentional**
- **criminal**

**These types of mistakes or acts
will not be condoned**

FOQA Programs

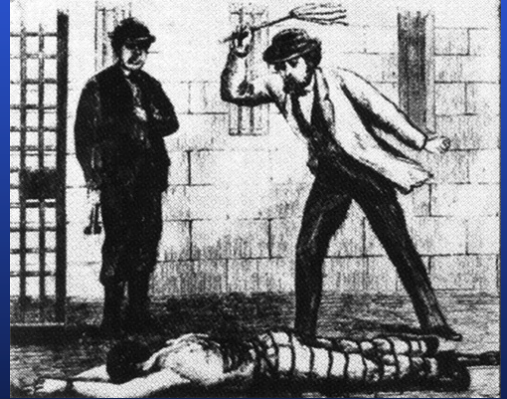
**Experience has shown that
Confidential Non-Punitive
DFDR Analysis and Reporting Systems**

- **Prevent accidents**
- **Reduce injuries**
- **Save lives**
- **Save equipment**
- **Reduce costs**

FOQA Programs

If they're so good, why aren't they used everywhere?

Because of a punitive culture!



Punitive Culture

When things go wrong:

- Find out who was responsible
- Blame them
- Get compensation from them
- Punish them

Presumes that will fix the problem !

Punitive Culture

A natural human trait

BUT

**If people think they will be punished
who will report mistakes as long
as they think they can get
away with them ?**

FOQA Concerns

Line personnel worry about:

- **Loss of face among peers**
- **Punitive action by**
 - **management**
 - **regulators**
 - **civil authorities**
- **Job security**

FOQA Concerns

Management worries about:

- **Punitive regulatory action**
- **Legal action**

FOQA Concerns

Government/regulators worry about:

- **FOIA**
 - **media**
 - **lawyers**
 - **public**

FOQA Programs

**Why do they work
in other places ?**

**They have a different culture
and
legal environment**

FOQA Programs

**Confidential and Non-Punitive
Reporting Systems**

They work effectively in:

- **United Kingdom**
- **Scandinavia**
- **Australia**
- **France**
- **Japan**
- **USA (now)**
- **Many other countries**

Working Together to Improve Safety

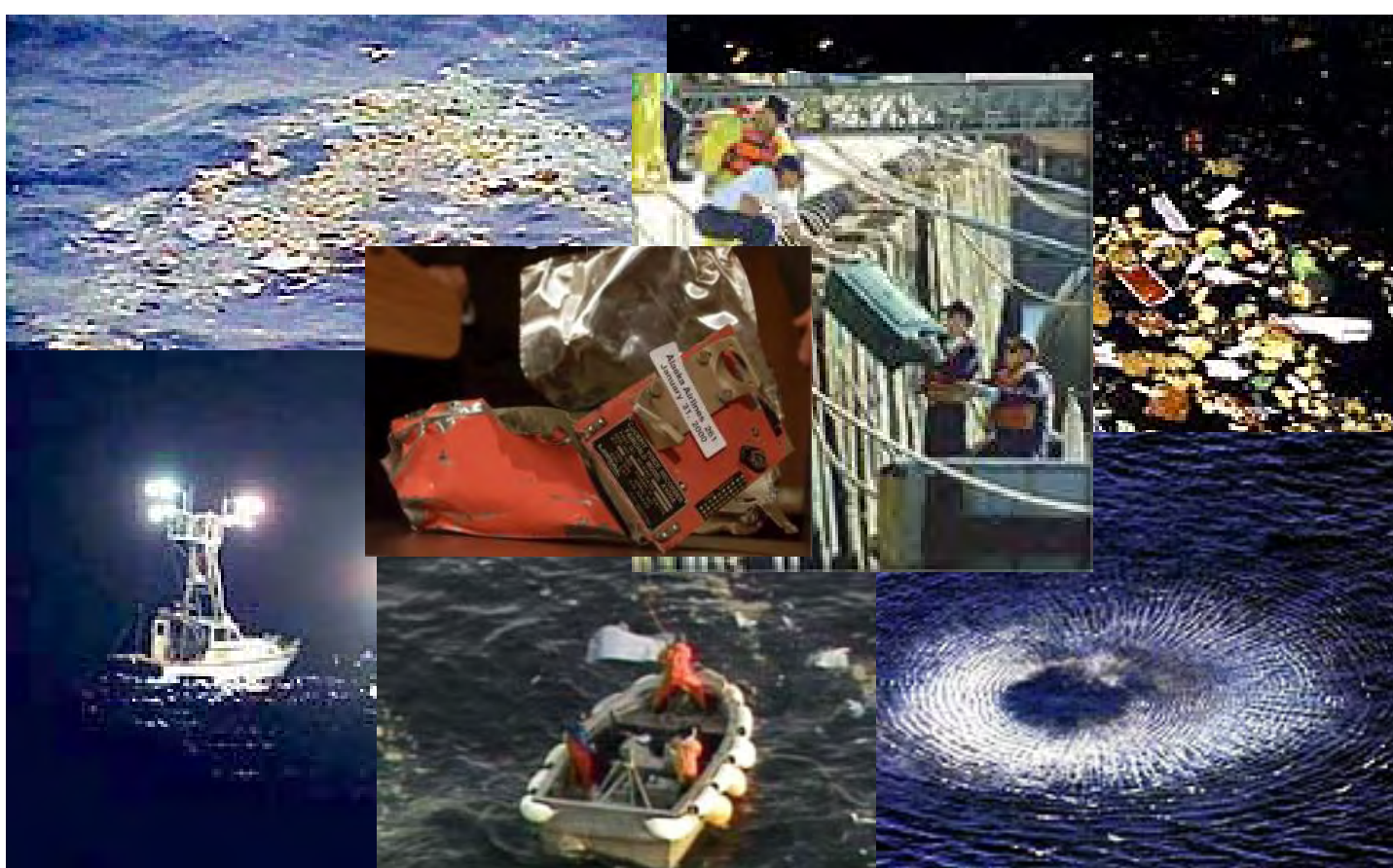
Accident investigation		1
Accident prevention	+	1
		—
Working together	=	<u>3</u>

Cooperation and communication are essential ingredients

Accident Flight Data Recorders



But, why do we need them at all?

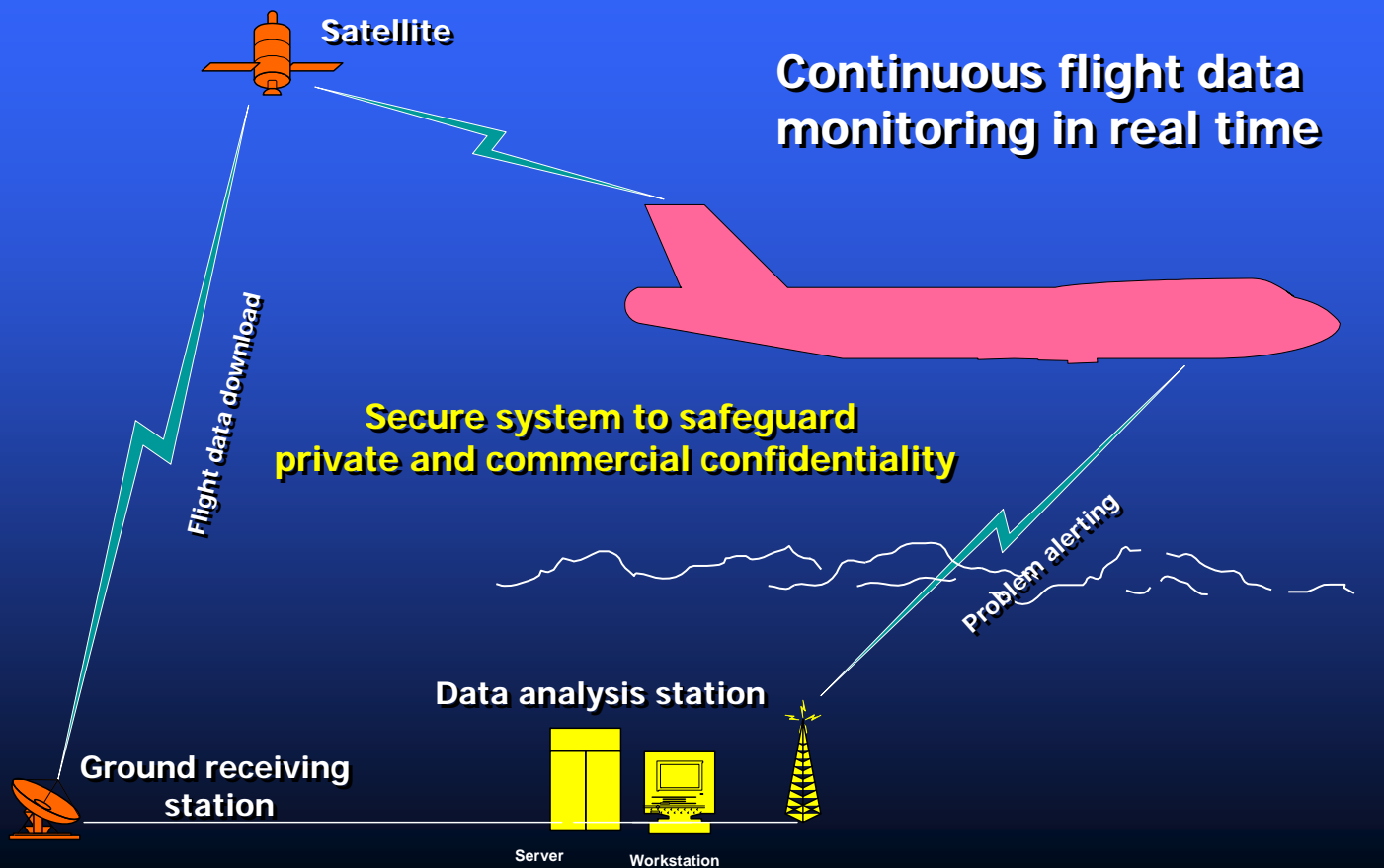


**Finding the "black box" is often time-consuming
and very expensive**

Continuous Monitoring via Satellite

Is this the future?

Global Telemetry System



Global Flight Data Monitoring

Can we ensure privacy? - Yes, and we must

Will it be difficult to implement? - Probably

Will it prevent accidents? - Almost certainly

Will it be expensive? - Yes, very!

Can we afford it? - Almost certainly, yes!

**The cost of three major accidents
could exceed \$1 Billion**

The Future

- Air traffic will continue to grow
- Inevitably there will be accidents
- Accident investigation will remain important
- The accident investigator can not be replaced
- Technology can provide additional tools to help in the investigative task

Improving Accident Investigation

- Accident investigation will remain an integral part of the continuous effort to improve aviation safety
- Accident investigations and fixes are expensive
- Improving the investigative tools available and the process is also expensive – but less so.

The investigation process can be improved by:

- Adopting technology now available
- Ensuring that it is impartial and unimpeded

**So long as there are accidents,
accident investigation will remain**

**a prime activity for the
improvement of safety**

Criminalization

Accident Investigation Process

- Determines probable cause
- Does not assign blame
- Does not determine liability

This separation has served aviation safety well for nearly 100 years of progress

Accident Investigation Process

Now facing new challenges to effective, objective evaluation investigation

Increased judicial and prosecutorial interference threatens protection of data and accident evidence

- Hard evidence impounded
- Witnesses intimidated
- Prosecutions before investigation completed

Can make information difficult to obtain

Inhibiting Information Flow

- Increasingly litigious society
- Blame centered culture
- Need to punish mistakes

Criminalization of accident parties

Recent Criminalization Examples

Japan:	Pilot prosecuted over turbulence accident
Korea:	Pilot threatened with prosecution following CFIT accident
New Zealand:	Police confiscate CVR and FDR to use as evidence Pilots tried for manslaughter and acquitted
Taiwan:	Pilots held following runway accident
Italy:	ATC and others jailed after runway incursion accident
Switzerland:	ATC under judicial investigation following a midair
France:	Judge retains vital piece of crash evidence for use in a possible criminal trial
USA:	Prosecutor retains accident evidence for use in trial proceedings
Greece:	Pilots put on trial following a turbulence accident

Need To Prioritize Accident Investigations

Can not be done by industry alone

- **Educate public that safety is enhanced by an unimpeded investigation**
- **Define allocation of local and central government responsibilities**
- **Delineate departmental responsibilities and limitations**
- **Protect investigations and give priority**
- **Change laws as necessary**

**Civil and criminal prosecution have their place
but only after the accident investigation
has been completed**

Accident Investigations Must Not be Impeded

**It is better to find the reasons for an accident
so that it does not happen again, than to
allocate blame and punish in the hope that
that will fix the problem**

Amendment of Annex 13

Investigation of Accidents and Incidents

- Protects safety information and sources from improper use in legal proceedings against operational personnel
- Establishes guidelines for use by States to make changes to law and regulations
- Approved by ICAO Council 3 March 2006
- Effective November 2006

A major FSF success

Criminalization of Aircraft Accidents

- Does not improve safety; may harm it
- FSF very concerned
- FSF Resolution deploring practice
- Issued jointly with:
 - Royal Aeronautical Society (UK)
 - ANAE (France)
 - CANSO
 - Others

The Next Big Criminalization Trial



Designers and engineers being prosecuted for poor design that allegedly caused an accident, more than 25 years after the event

Looking into the Future

If there is a possibility of being prosecuted many years in the future for decisions considered to be reasonable today, who will risk making any more such decisions?

Will technology and operational capability stagnate?