NTSB National Transportation Safety Board

NTSB Briefing

For Single Pilot Operators

Robert Sumwalt

It's all in the definition…

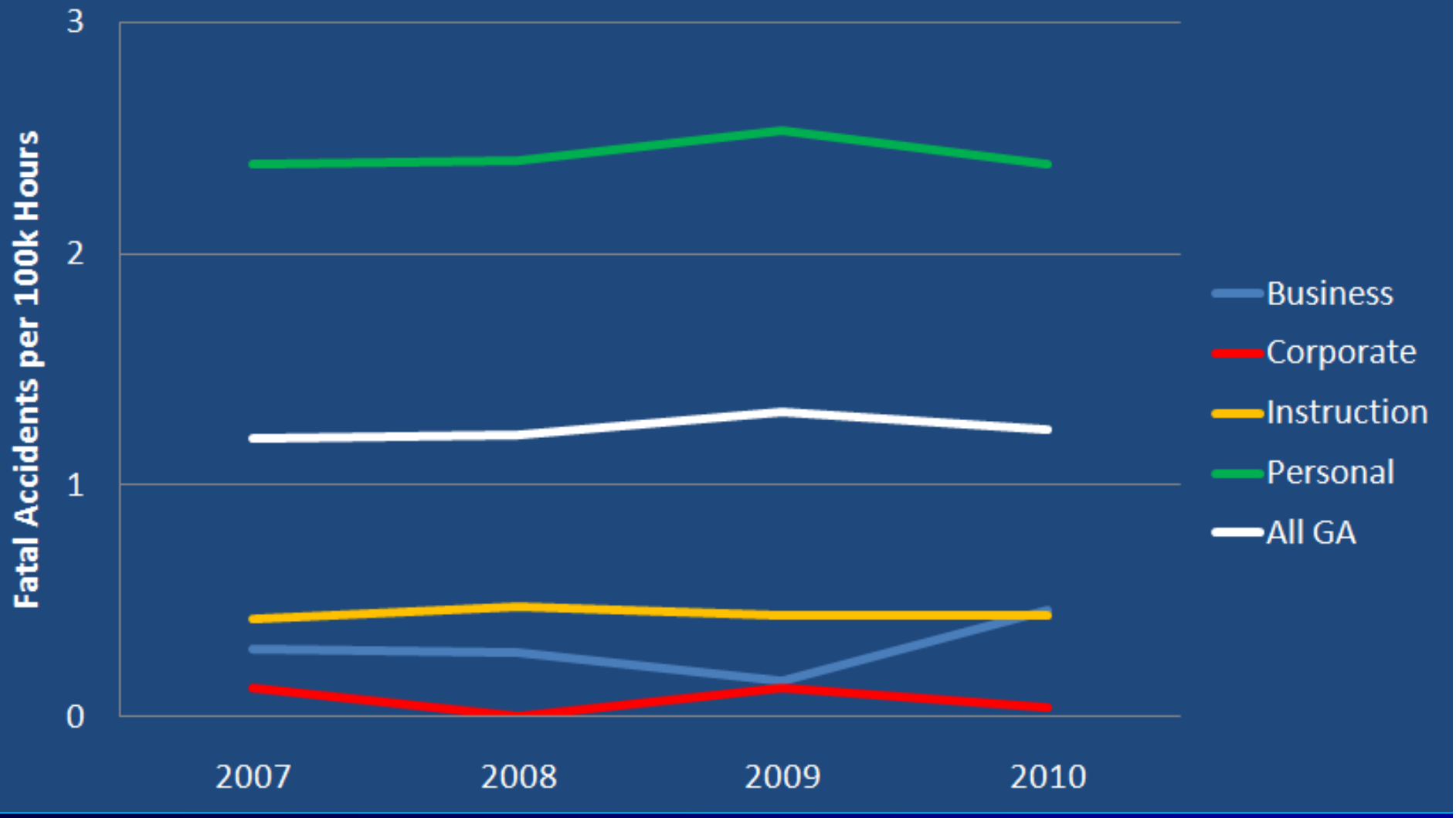
(Or at least how the NTSB defines it)

- **Business aviation** - flight operations by an owner or employee of a company who is not paid for the sole purpose of flying the aircraft.

- **Corporate aviation** - any use of an aircraft by a corporation, company or other organization (not for compensation or hire) for the purpose of transporting its employees and/or property, and employing professional pilot(s) for the operation of the aircraft.

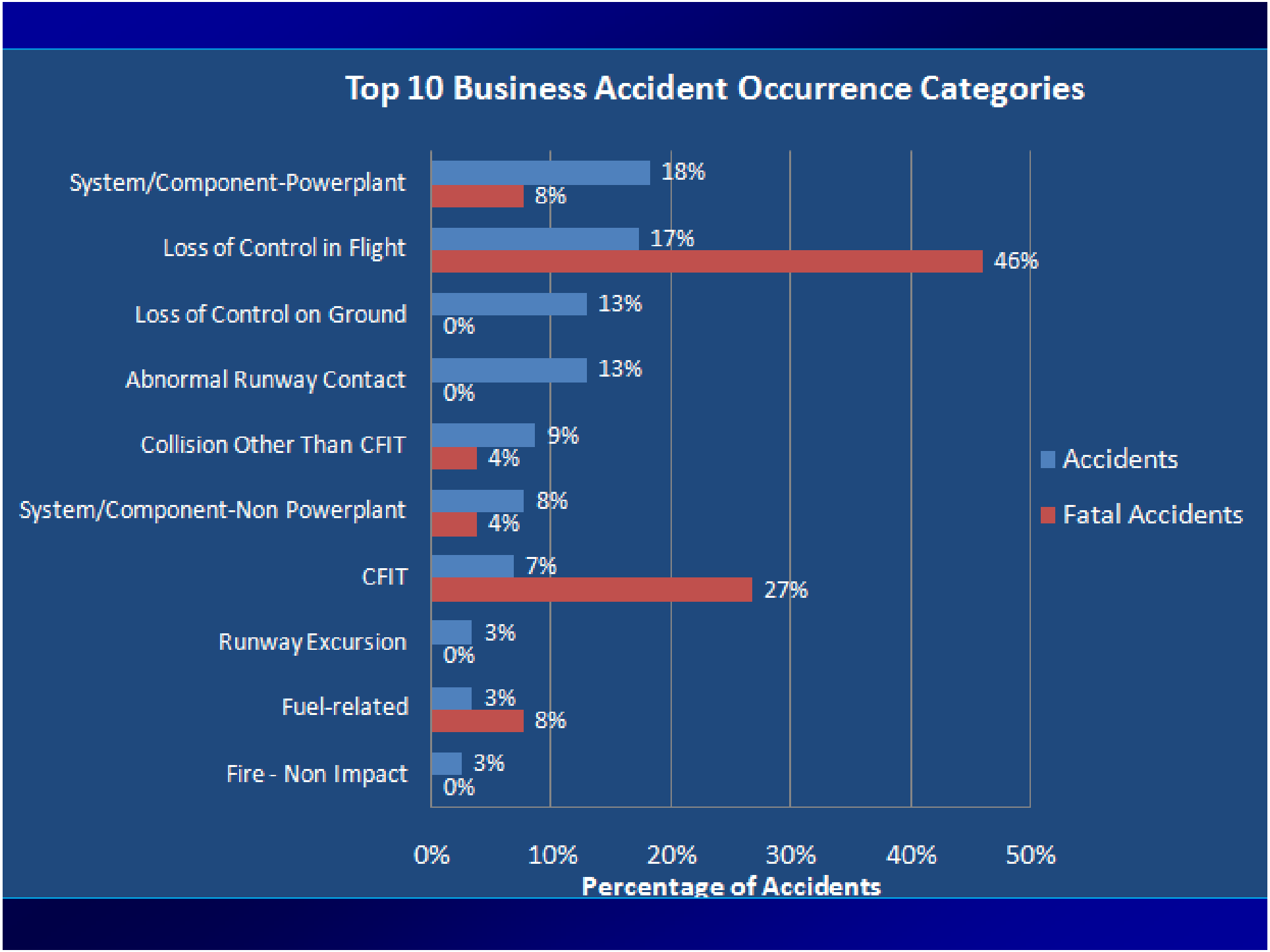
- **Personal flying** – non-compensated flying and not for business-related purposes.

Fatal Accident Rates per 100,000 Flight Hours, 2007-2010



Fatal accident rate per 100,000 flight hours

Fatal Accident RATE				
type_fly	2007	2008	2009	2010
Business	0.29	0.28	0.16	0.46
Corporate	0.12	0.00	0.12	0.04
Instruction	0.42	0.47	0.44	0.44
Personal	2.39	2.40	2.53	2.39
All GA	1.20	1.21	1.32	1.24


Top 10 Business Accident Occurrence Categories
System/Component-Powerplant
18%
8%
Loss of Control in Flight
17%
46%
Loss of Control on Ground
13%
0%
Abnormal Runway Contact
13%
0%
Collision Other Than CFIT
9%
4%
System/Component-Non Powerplant
8%
4%
CFIT
7%
27%
Runway Excursion
3%
0%
Fuel-related
3%
8%
Fire - Non Impact
3%
0%
Accidents
Fatal Accidents
0%
10%
20%
30%
40%
50%
Percentage of Accidents

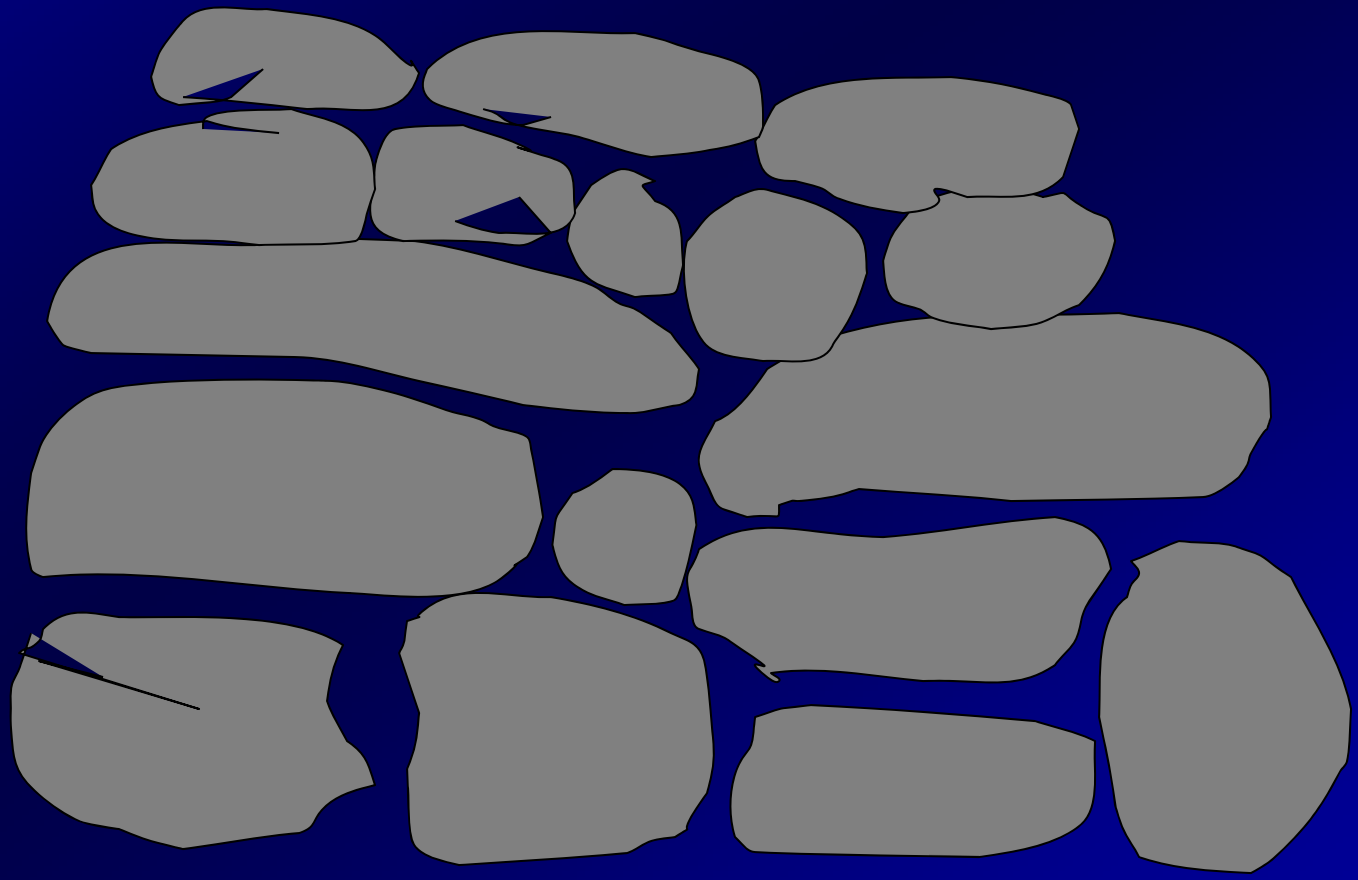
Threat and Error Management

For Single Pilot Operators

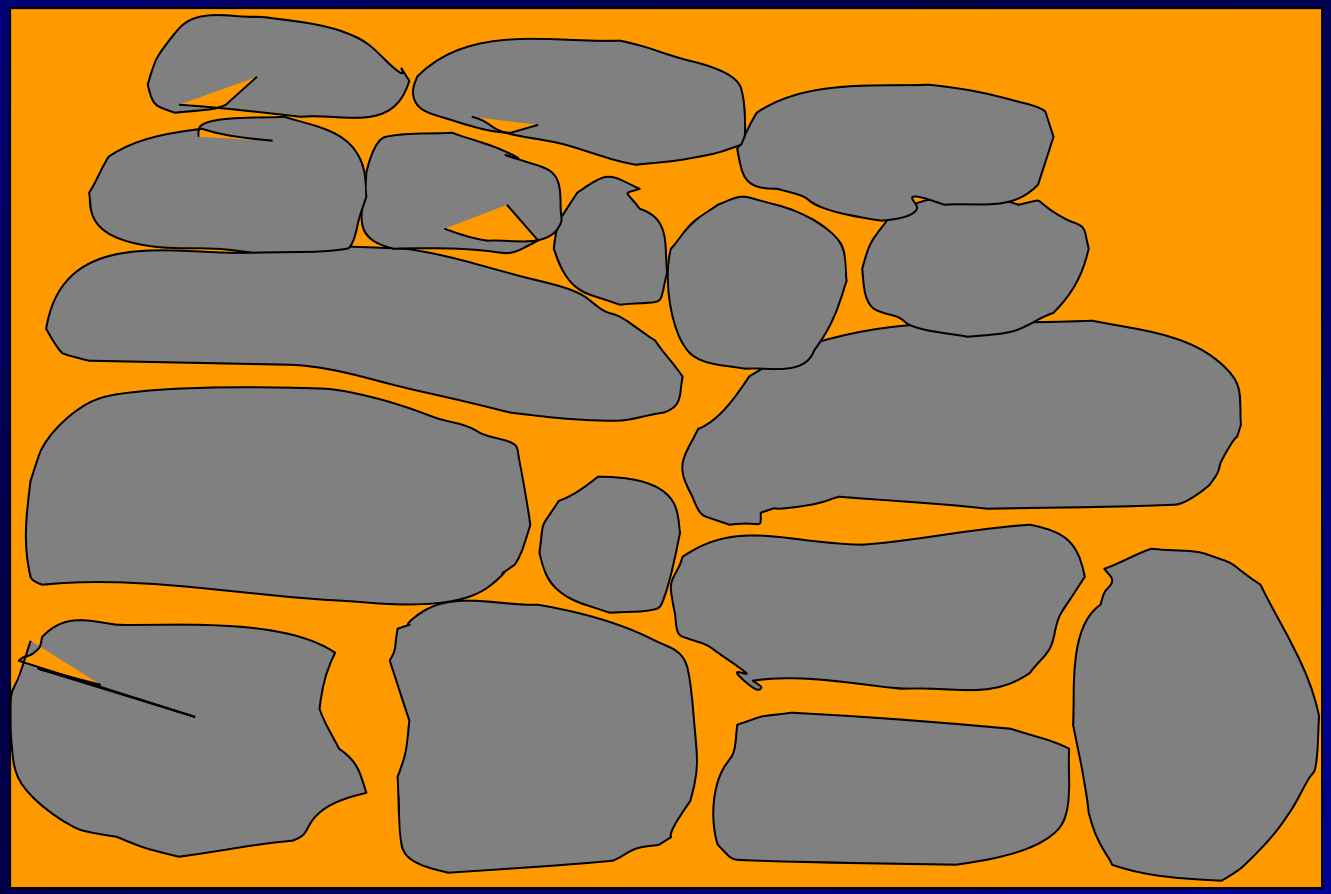

US AIRWAYS


Robert L. Sumwalt
Chairman, Board of Inquiry

Building a wall



Building a wall



How do we improve safety?

- Train pilots how to better manage Threats and Errors

Threat and Error Management is 6th Generation of CRM

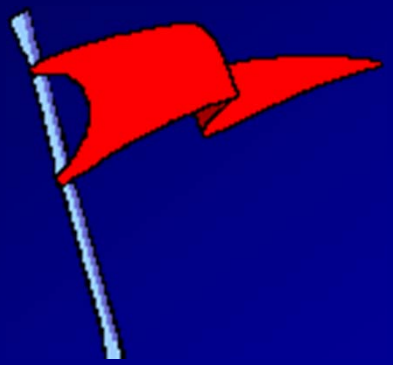
“Threats”

- Those things that can increase the operational complexity, and if not handled correctly, can decrease the safety margins

  - Weather
  - Delays
  - Mechanical Malfunctions
  - Stress
  - Time pressure
  - Distractions
  - ? ?

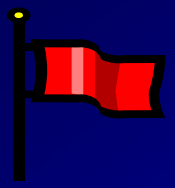
Threats

- Threats
  - Threats can increase error potential
  - Threats “put holes in” or weaken our barriers against error
- Threats = **Red Flags**



Be aware of threats!

- "Snakes in the grass"
  - What are the things that can bite you on this flight?
- We want pilots to identify, talk about and think about threats, and
- those things that are different about this operation or flight
  - Unfamiliar airport
  - Different aircraft type
  - New procedures



- This puts the threats in the pilot's "mental RAM" and makes it readily available for retrieval
  - Example: mentally rehearse CFIT escape maneuver

Errors

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USA TODAY

NO. 1 IN THE USA . . . FIRST IN DAILY READERS

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HIT HIGHEST
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15 MONTHS
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ECONOMY WILL GET BOO

NEW FILMS FEATUR
WOMEN AND ISSUE
THEY FACE TOGETH
SISTERHOOD TO OUTSHINE
SHOWGIRLS, DRAG QUEENS

FIRST IN A 3-PART SERIES

WARNING: PILOT ERROR

How regional airlines failed to heed warning signals about pilots who didn't belong in the cockpit

“To err is human”

Marcus Tullius Cicero

106-43 B.C.

Why error management?

- Traditional thinking focused on eliminating human error in aviation
- Contemporary thinking acknowledges that error is a way of life
  - given the acceptance that human error may occur, the focus has become “How do you effectively manage error?”
  - proper error management greatly enhances safety

Errors will occur

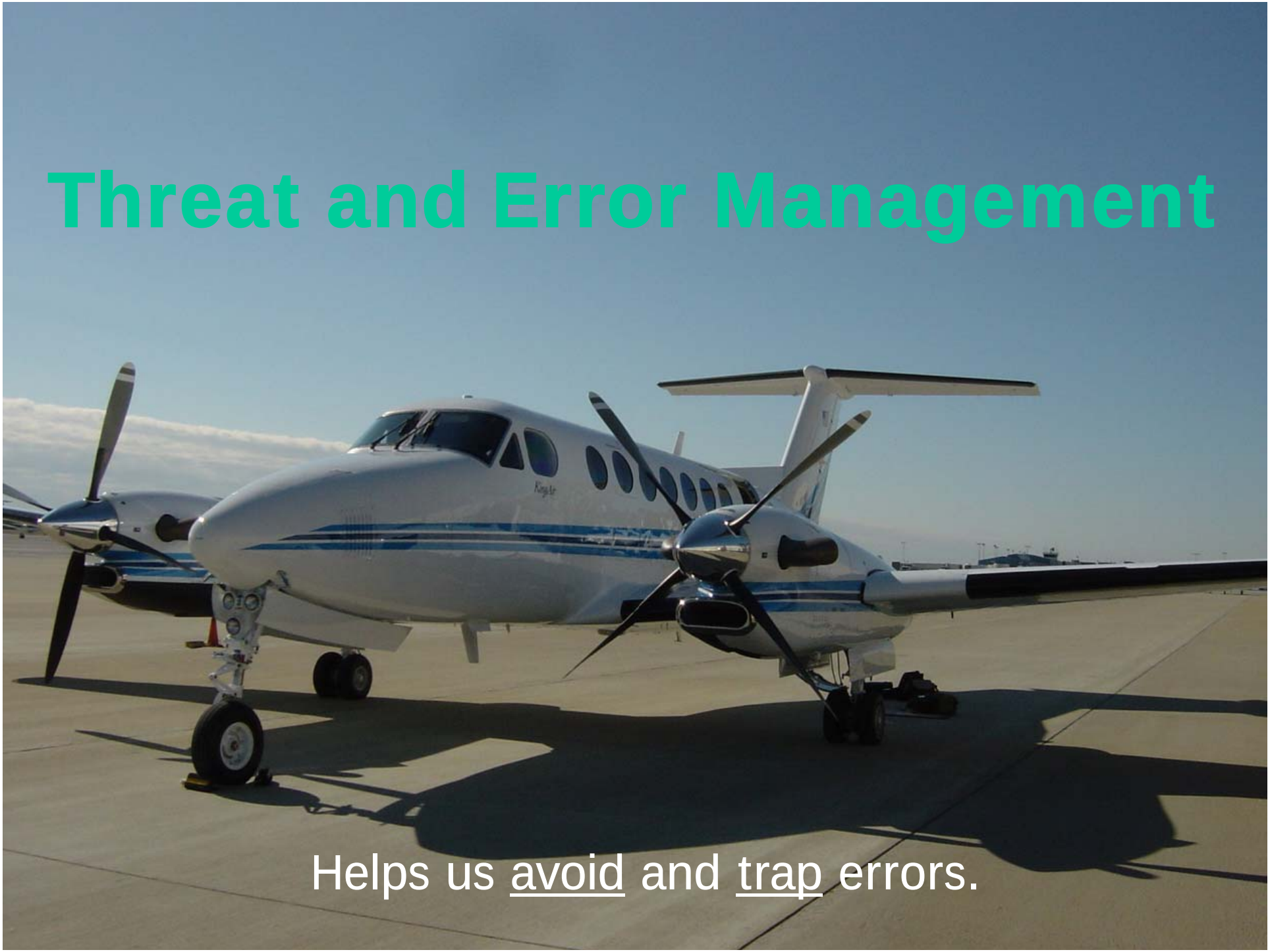
"So we must create an error management system in which the crew recognizes and corrects errors before negative consequences occur."

- Captain Frank J. Tullo

"Aviation Week and Space Technology"

May 21, 2001

Threat and Error Management



Helps us avoid and trap errors.

Avoiding Errors

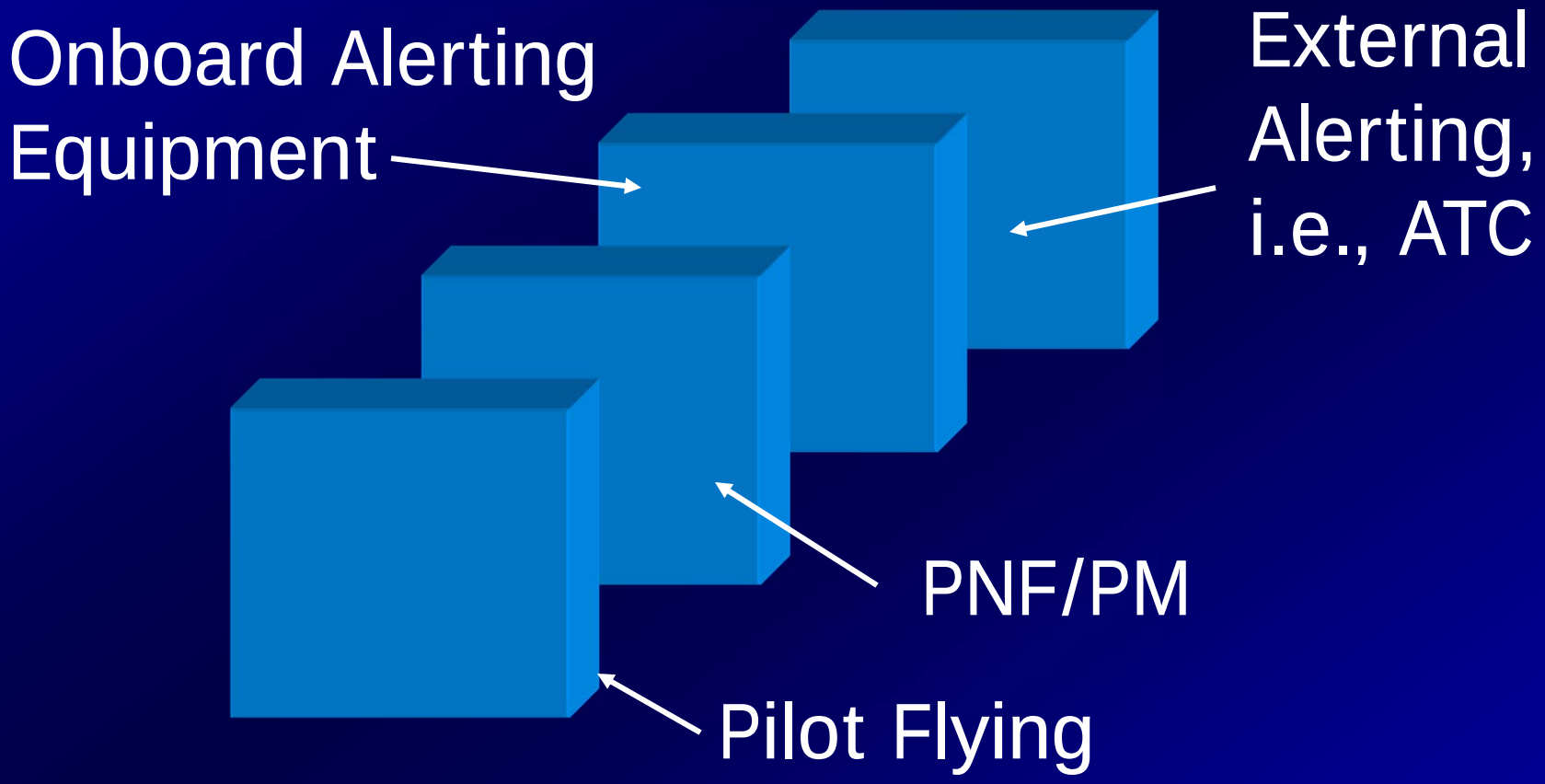
- Good training
- High levels of proficiency
- Following SOPs
- Minimizing distractions
- Planning ahead

- Maintaining situational awareness
- CRM – the effective use of all available resources

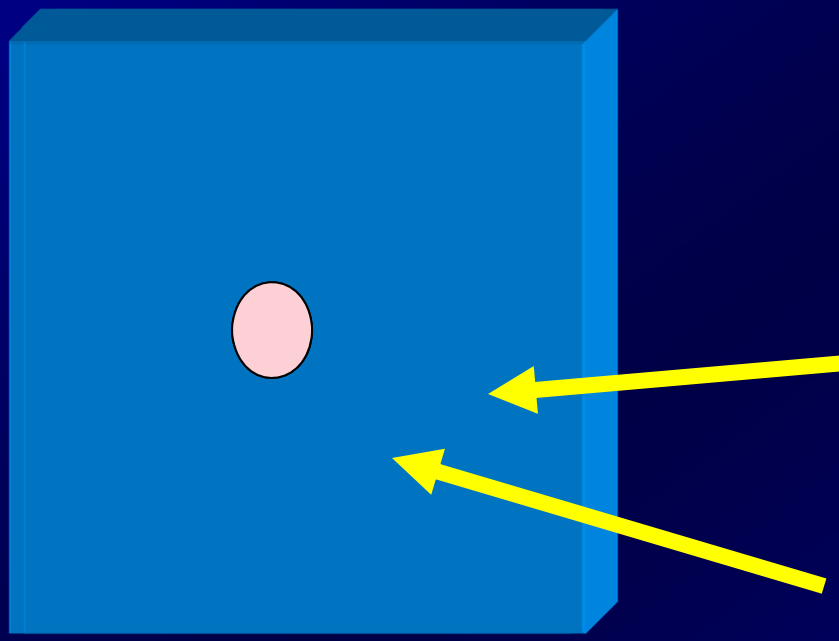
Trapping Errors

- Once an error is committed, it is difficult to catch (trap) your own error
- Other people are often more likely to catch your error
- Therefore, redundancy is one strong defense against error

Layers of Defense (barriers) to trap crew errors



Threats and errors put "holes" in our barriers



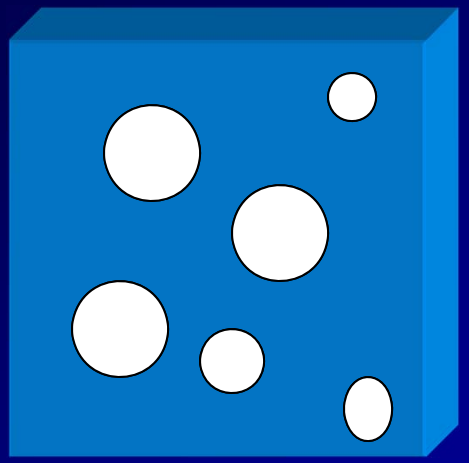
We can attempt to build barriers against error to trap errors

Even good barriers have weaknesses

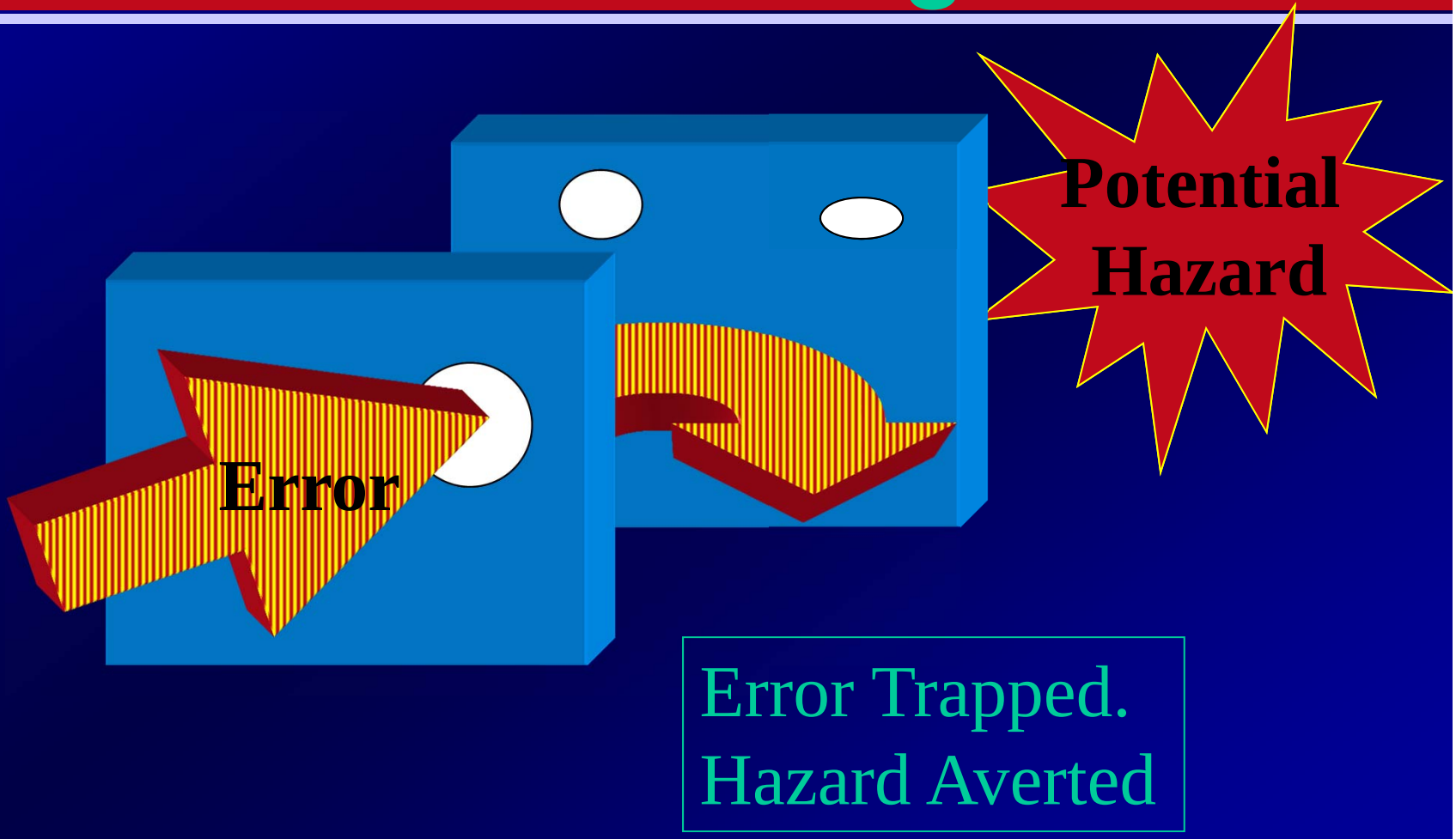
Threat and Error Management helps reduce the size of these holes

Examples of how “holes in defenses” can be formed

- Increasing workload
- Undue time pressure
- Fatigue
- Procedural non-compliance
- Poor crew coordination
- Interruptions / Distractions

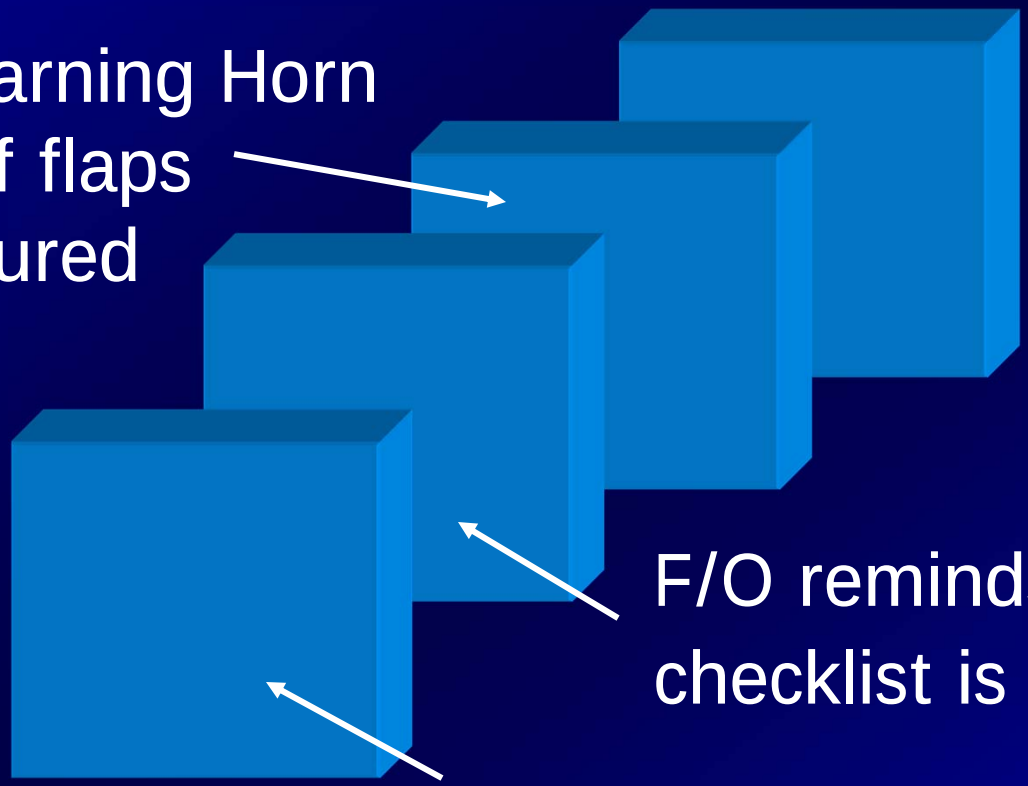


Layers of defense help deflect errors from becoming hazards



Designed system redundancies

Takeoff Warning Horn activates if flaps not configured



External Alerting - does not exist

F/O reminds Captain if checklist is not done

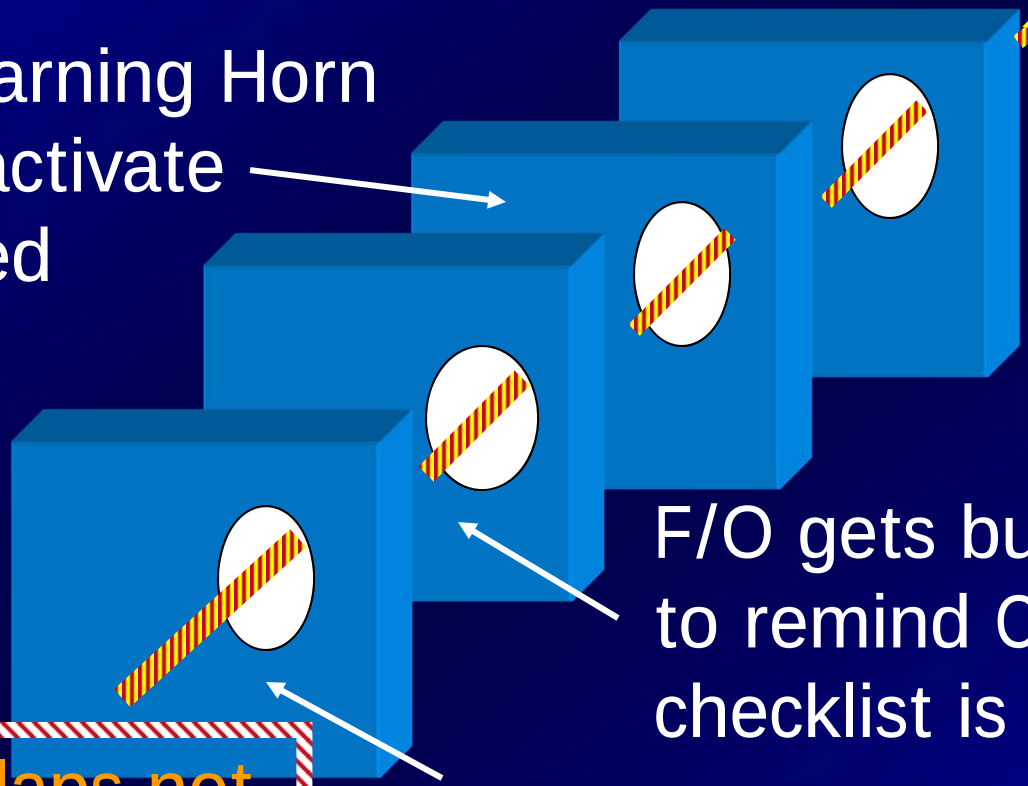
Captain calls for checklist

Holes in defenses

Accident

Takeoff Warning Horn does not activate as designed

External Alerting - does not exist



F/O gets busy and forgets to remind Captain that checklist is not done

Error – flaps not set from flow

Captain has developed personal style of allowing FO to initiate checklist

ABCD'SS of Threat and Error Management

Threat and Error Management ABCD'SS

Acknowledge that we are error prone

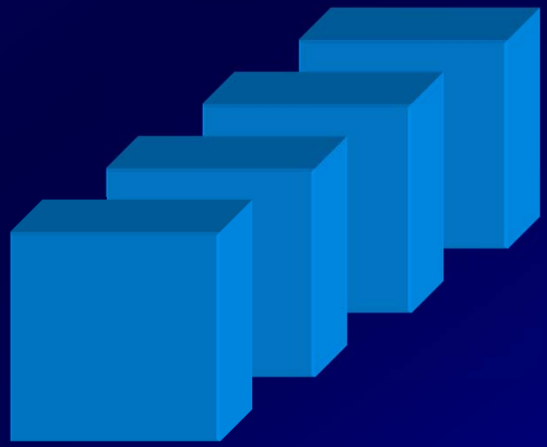
Threat and Error Management ABCD'SS

- This does not mean that errors are okay
  - Naturally we would prefer not to make them
  - However, the reality is that we will make mistakes, so acceptance and awareness are vital
- Acknowledge that threats can affect performance

Acknowledge errors

Threat and Error Management ABCD'SS

Maximize Barriers



Realize the importance of redundancies

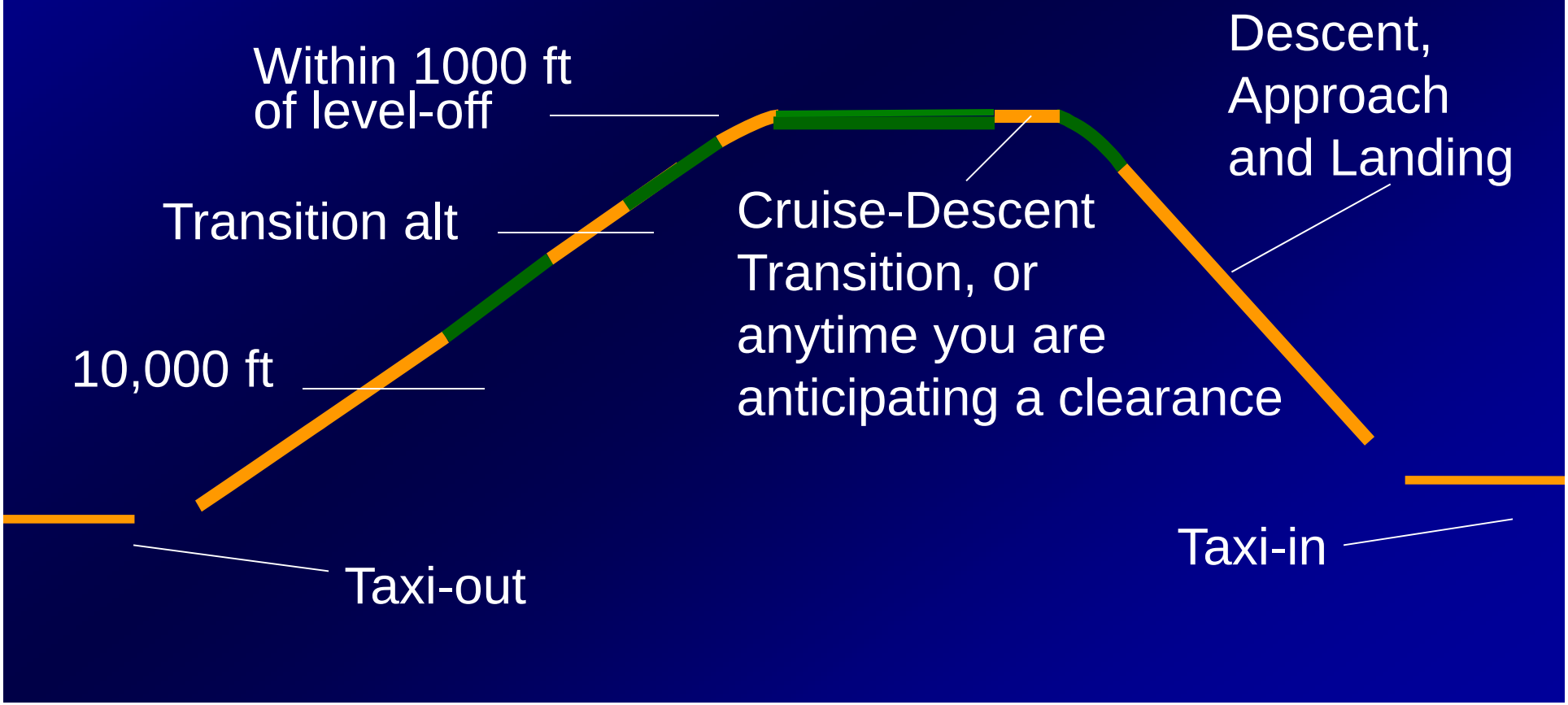
- Keep as much redundancy in the operation, for as long as possible
- Plan best time for being “out of the loop” (split cockpit)
  - lowest workload
  - least risk
- Both pilots “cross-verify” critical checklist items (“killer items”) and ATC clearances

Maximize **Barriers**

Practicing monitoring skills

- Pilots should recognize those flight phases where poor monitoring can be most problematic.
- Strategically plan workload to maximize monitoring during those areas of vulnerability (AOV)
  - Examples of non-monitoring tasks that should be conducted during lower AOV include stowing charts, programming the FMS, getting ATIS, accomplishing approach briefing.

Areas of Vulnerability



Planning Workload

- LOSA data: crews who briefed the approach after Top-Of-Descent (TOD) committed 1.6 times more errors during the descent/ approach/land flight phase compared to crews who briefed prior to TOD.

Threat and Error Management ABCD'SS

Communicate

Threats and Intentions Effectively

Communicate

Anything that can:

- Reduce your ability to detect errors
- Anything that can increase your chance of making errors

Communicate

Communicate threats

- "Snakes in the grass"
  - What are the things that can bite you on this flight or operation?
  - Identify, discuss and think about these things (threats) and those that are different about this operation

Communicate

Effective communications

- Effective communication
  - Makes sure that everyone is “on the same page”
  - Raises crew’s situational awareness
  - Helps avoid and trap the consequences of errors

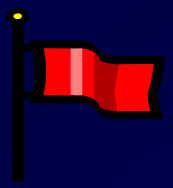
Communicate


TV

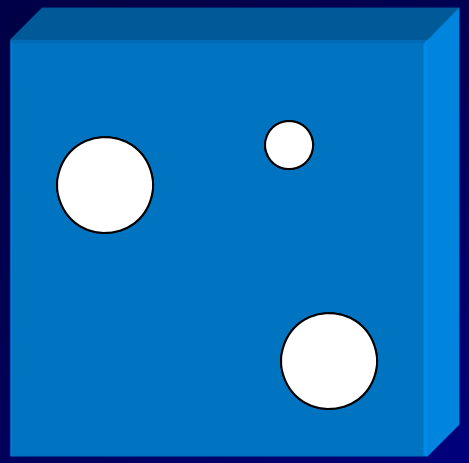

TV

Threat and Error Management ABCD'SS

Distractions and Interruptions



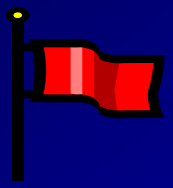
Distractions & Interruptions can form “holes in defenses”



Manage Distractions

Distractions & Interruptions are Red Flags

- Treat Distractions and Interruptions as Red Flags



Manage Distractions

Distractions & Interruptions

http://asrs.arc.nasa.gov/

NASA Ames research on distractions and interruptions in air carrier operations

Manage Distractions

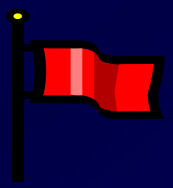
"Interruptions Always Distract"

I A D

Identify – the interruption

Ask – what was I doing before being interrupted?

Decide – what action to take to get back on track



Manage Distractions

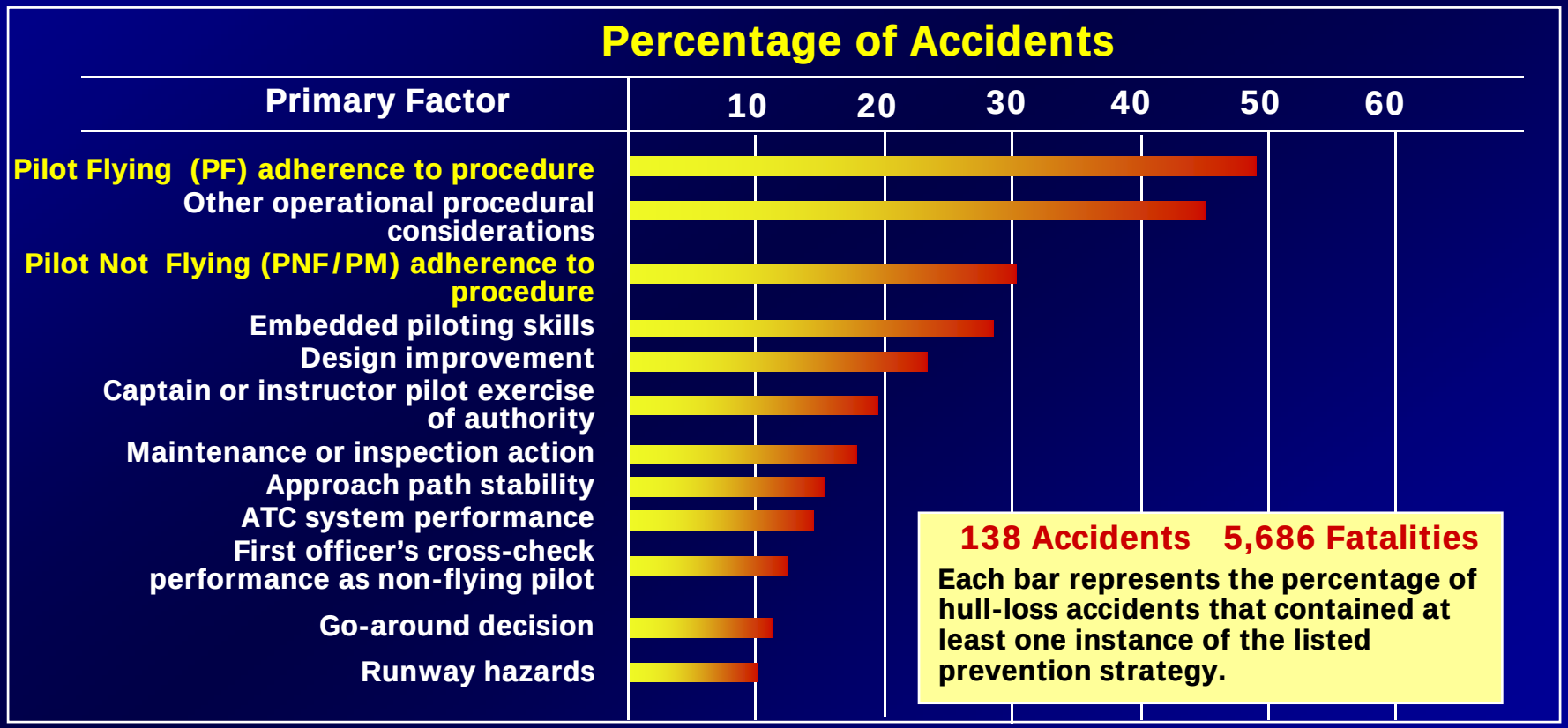
Threat and Error Management ABCD'SS

Follow SOPs

Standard Operating Procedures

Importance of SOPs

Hull-loss Accidents over 10 Year Period

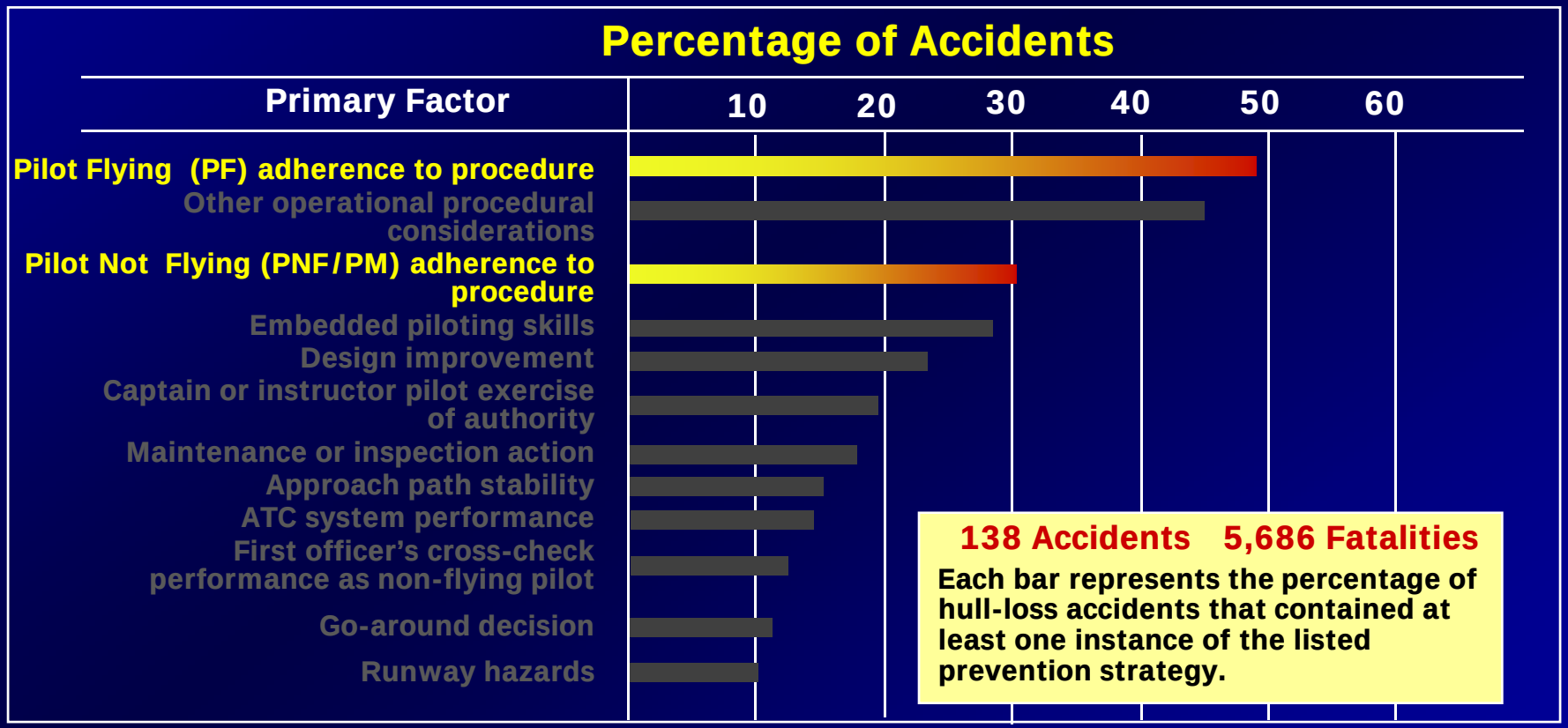


Source: Boeing study of accident prevention strategies

Follow **SOPs**

Importance of SOPs

Hull-loss Accidents over 10 Year Period



Source: Boeing study of accident prevention strategies

Follow **SOPs**

How SOPs relate to error

- University of Texas LOSA data show that crews who intentionally erred by not following SOPs were 3 times more likely to commit another error with consequential results

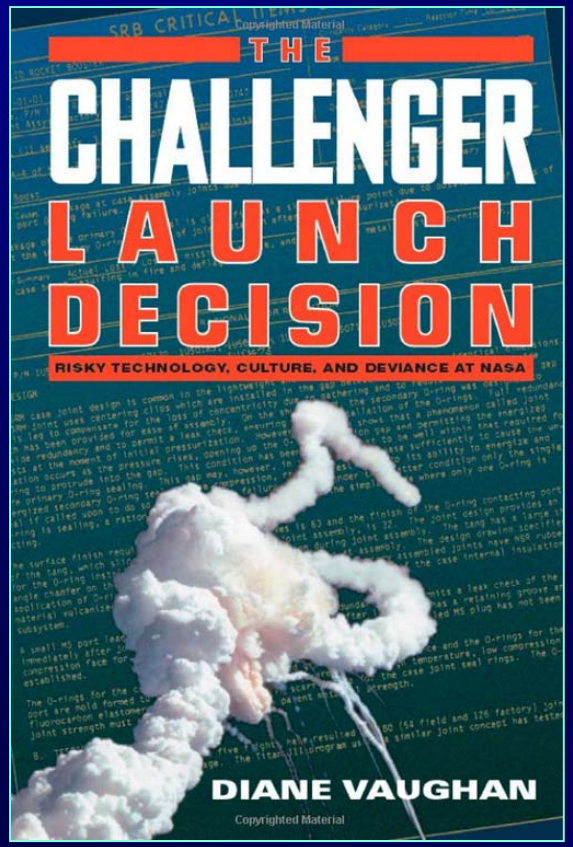
Follow **SOPs**

Standard Operating Procedures

- SOPs establish a consistent baseline for performance
- Because the baseline is established, deviations from it can be identified easier
  - "Hmm, I don't usually miss things like that."
- Allows crewmembers to concentrate on issues not covered by SOPs

Follow **SOPs**

Avoid “Normalization of Deviance”



- Normalization of Deviance: When not following procedures and taking “short cuts” and becomes an accepted practice.

Avoid Selective Compliance

- “That is a stupid rule.”
- “I don’t have to comply with that one.”

Threat and Error Management ABCD'SS

Sensible?

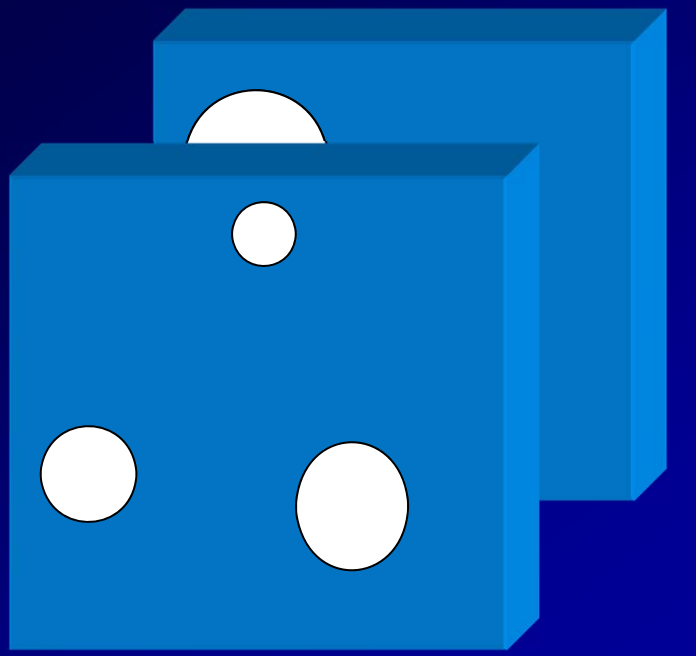
Sensible?

- Ask yourself and make sure that what you are doing (and are about to do) is sensible

Sensible?

Threat and Error Management ABCD'SS

- **A** Acknowledge
- **B** Barriers
- **C** Communicate
- **D** Distractions
- **S** SOPs
- **S** Sensible

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