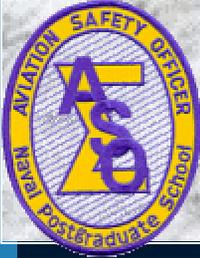


Assessing Naval Aviation Maintenance Safety: *Error Reporting, Data Management, and Trend Analysis*



CDR John Schmidt USN
LtCol Bob Figlock USMC (ret.)
LCDR Dylan Schmorrow USN
School Of Aviation Safety
Naval Postgraduate School
Monterey CA



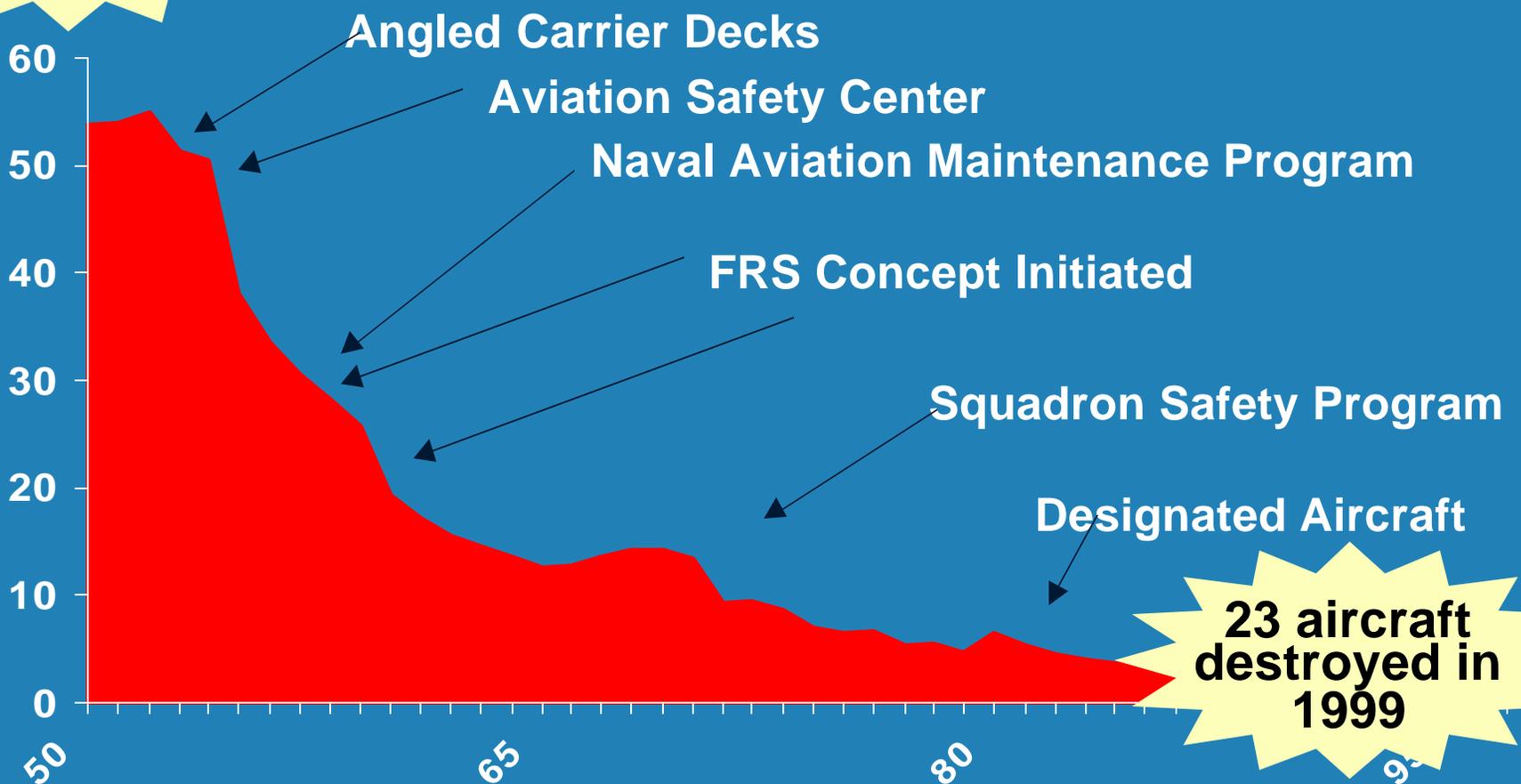


Naval Aviation Flight Mishap Rate

**776 aircraft
destroyed in
1954**

FY50-99

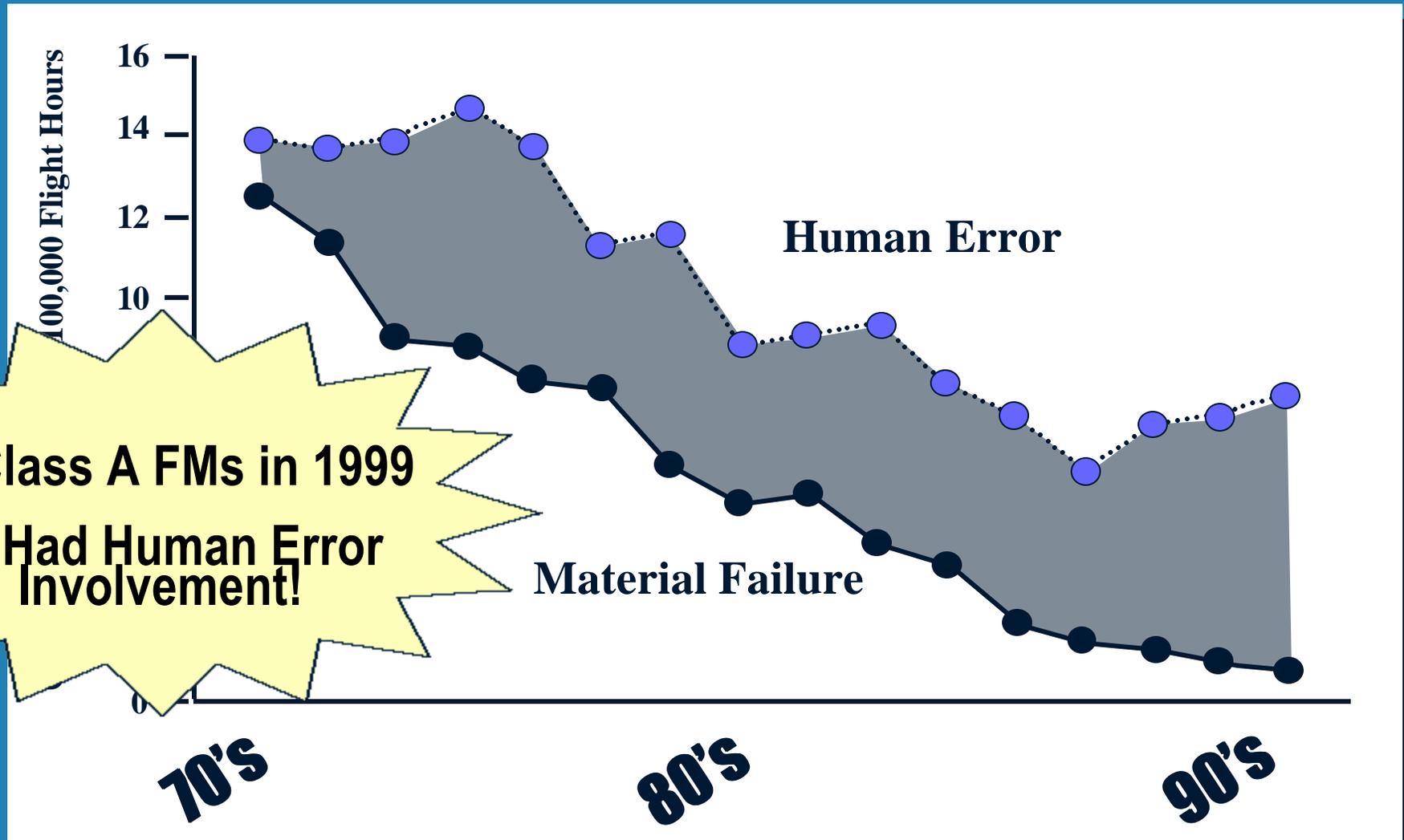
Class A Flight Mishaps / 100,000 Flight Hours



**23 aircraft
destroyed in
1999**



Engineering & Administrative Controls have Impacted Hardware Reliability, but....





Human Factors Intervention Strategy Matrix

	Engineering Control	Administrative Control	Personnel Control
Error Prevention			
Performance Enhancement			

Most Mishap Recommendations Fall into Just Two Categories!!!!!!

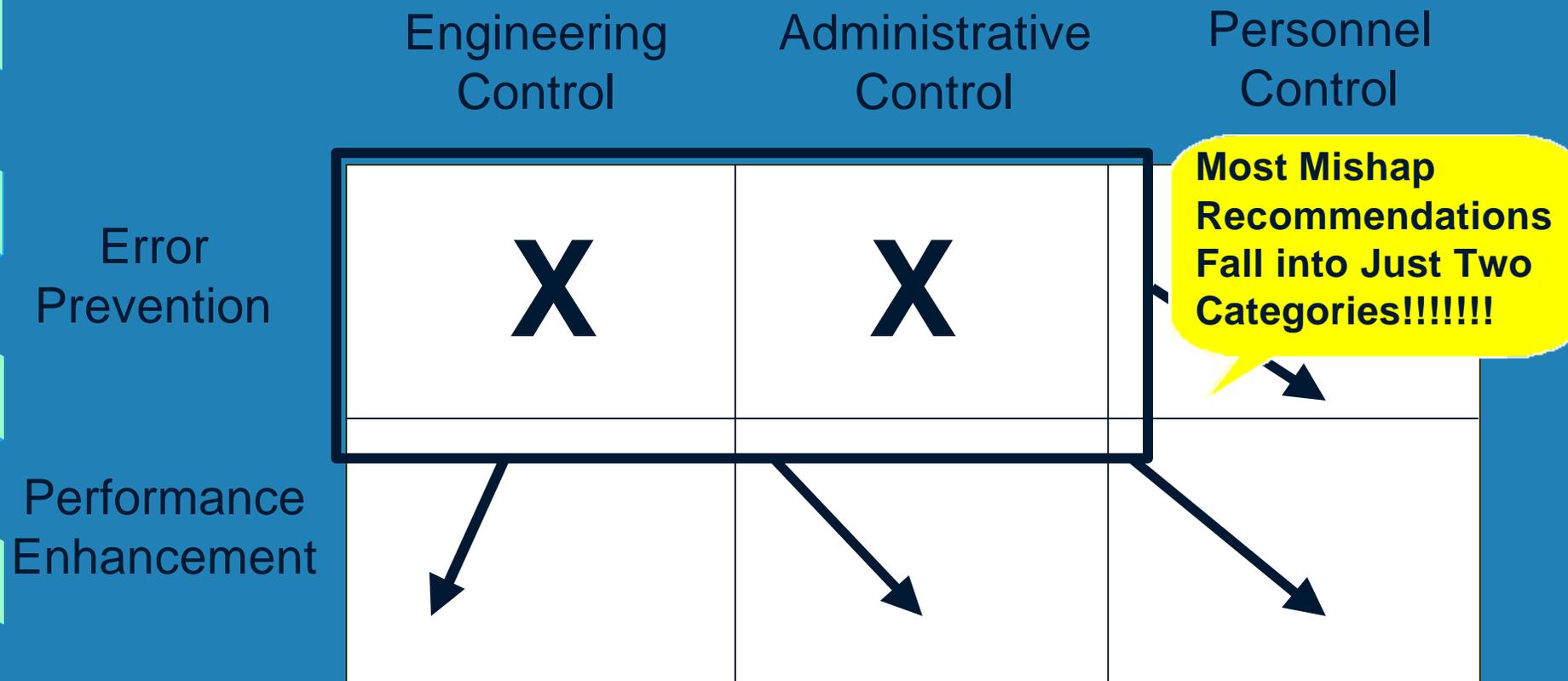


Human Factors Intervention Strategy Matrix

	Engineering Control	Administrative Control	Personnel Control
Error Prevention	X	X	
Performance Enhancement			



Human Factors Intervention Strategy Matrix



“We Need to Start Thinking Out of the Box”



Human Factors Quality Management Board

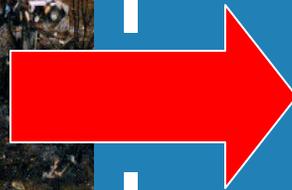
Watershed Event





Human Factors Quality Management Board

Watershed Event





Mishap Data Analysis in Naval Aviation

- Naval Aviation Safety Program (OPNAV 3750)
 - Specifies Reporting Requirements (3 W's)
 - Covers Major Mishaps to Minor Hazards: Supervisory, Aircrew, Maintenance, Material, & Facility (Focus ENG & ADM, touches HF Issues)
- Naval Safety Center Safety Information Management System (SIMS)
 - Relational Database Structured IAW 3750.6Q
 - Permits Structured Reports & On-line Queries



Mishap Data Analysis: Reason's "Swiss Cheese" Model

HFACS-
*Human Factors Analysis
& Classification System*

**Organizational
Factors**

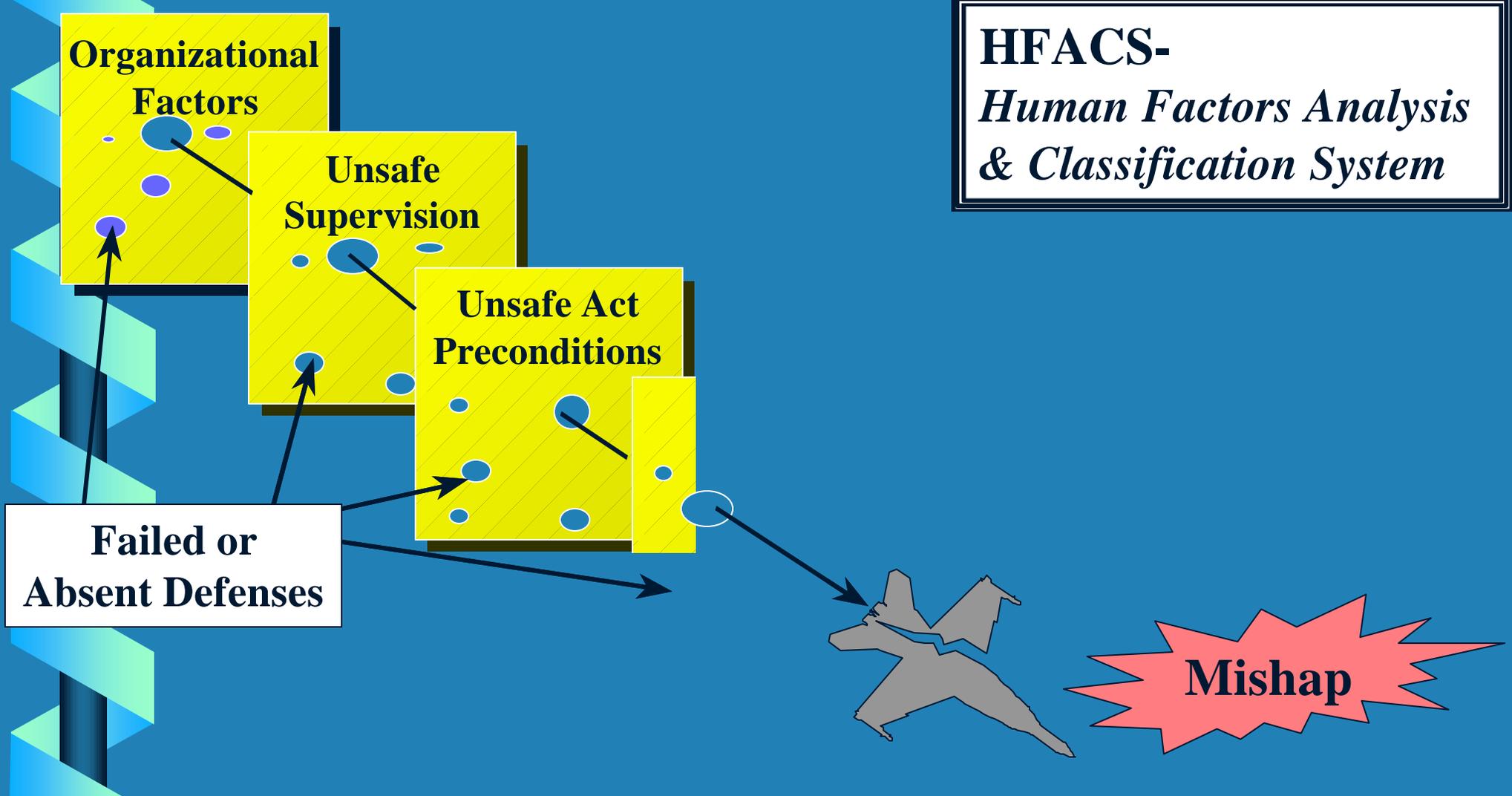
**Unsafe
Supervision**

**Unsafe Act
Preconditions**

**Failed or
Absent Defenses**



Mishap





Mishap Data Analysis: Reason's "Swiss Cheese" Model

HFACS-
*Human Factors Analysis
& Classification System*

**Organizational
Factors**

**Unsafe
Supervision**

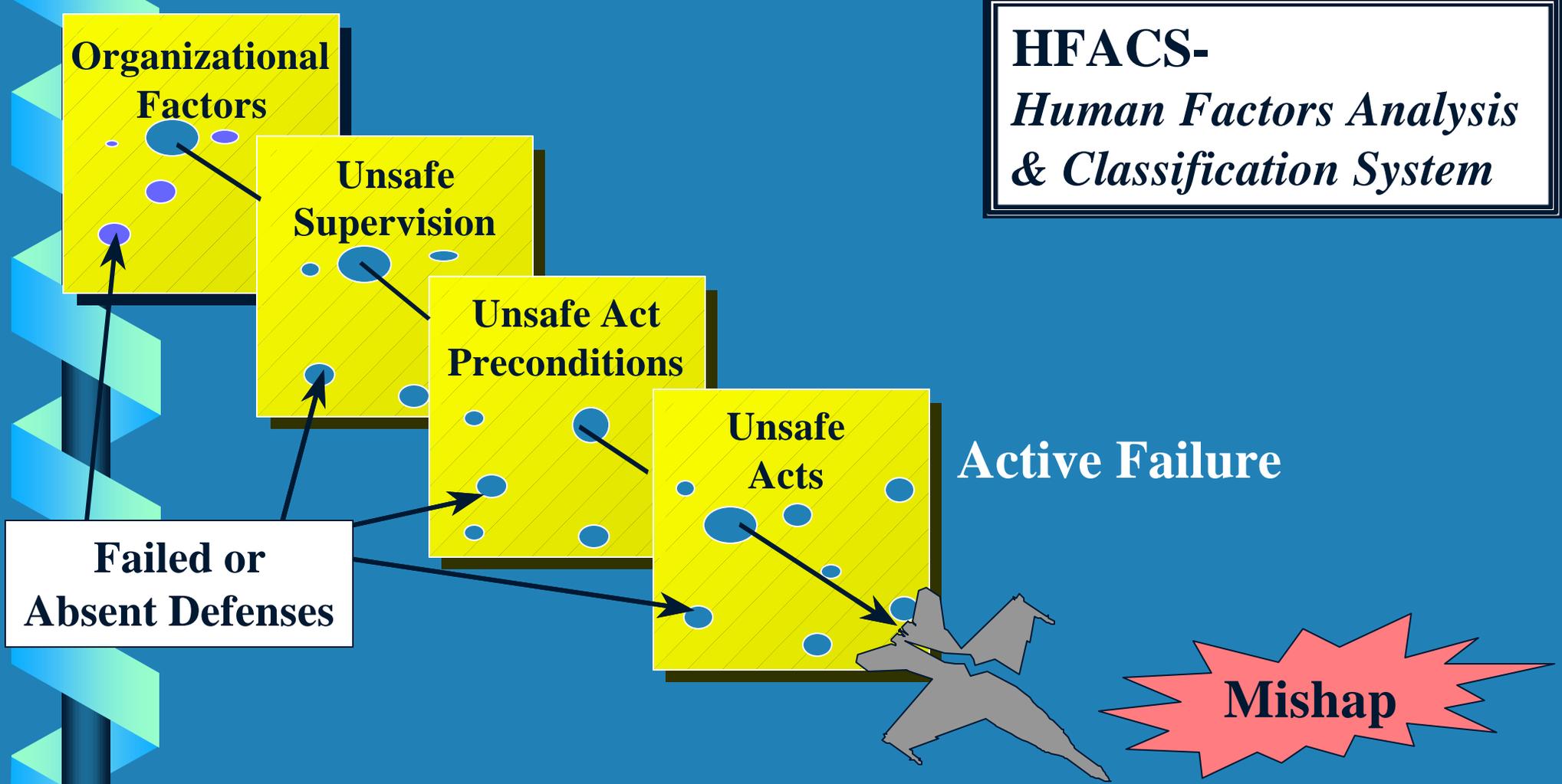
**Unsafe Act
Preconditions**

**Unsafe
Acts**

Active Failure

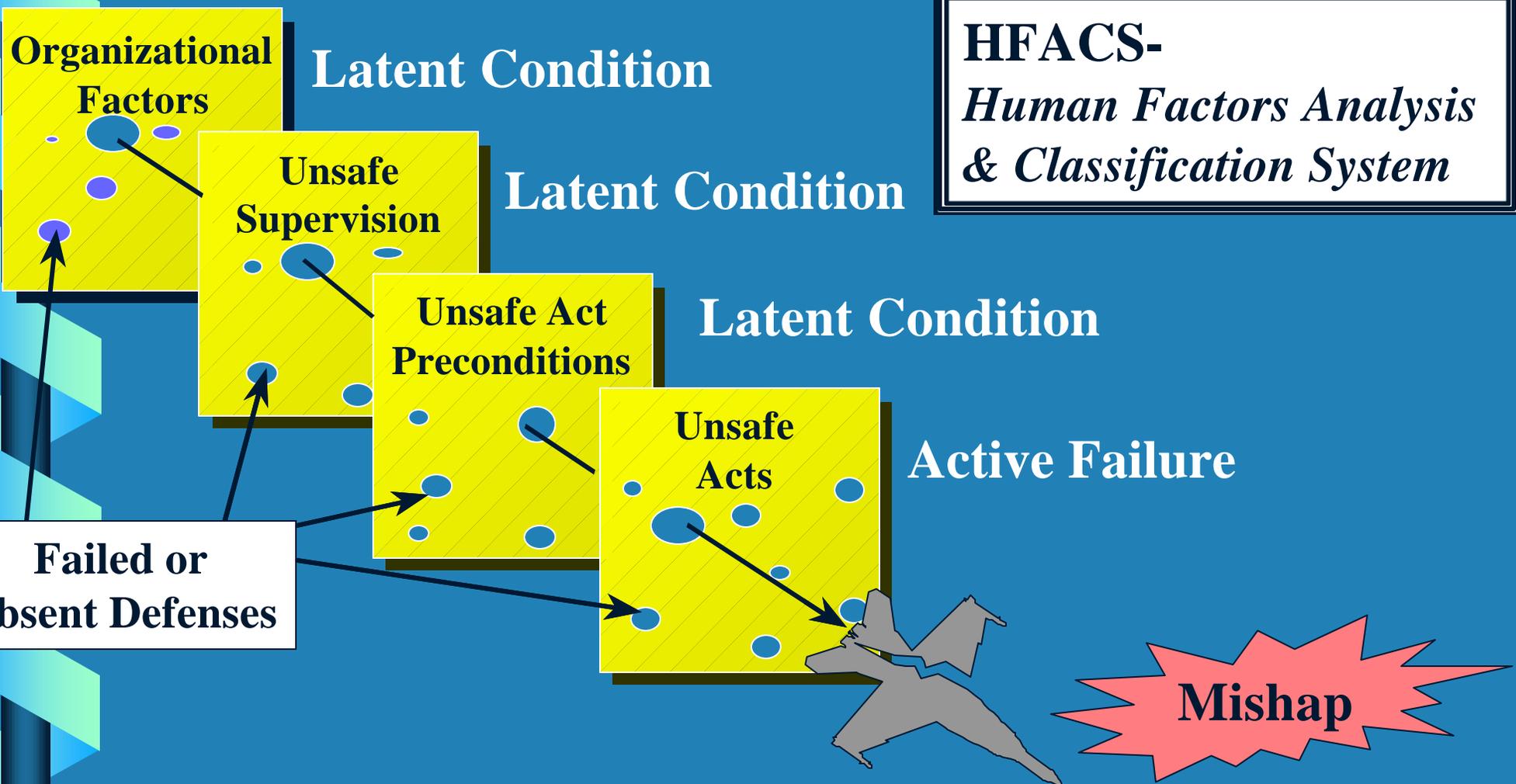
**Failed or
Absent Defenses**

Mishap



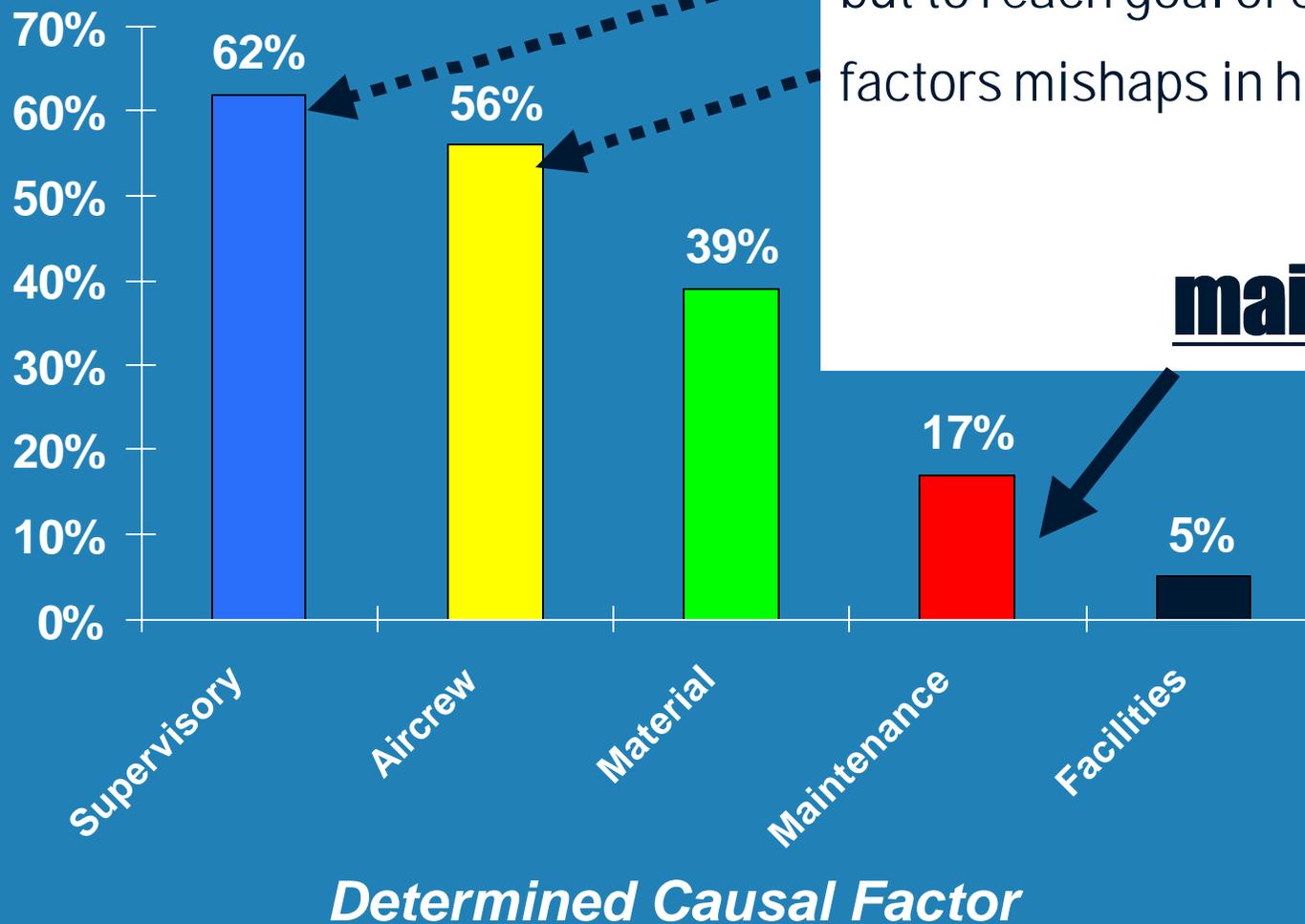


Mishap Data Analysis: Reason's "Swiss Cheese" Model





Mishap Data Analysis Focus: Naval Aviation Class A FM Causal Factors



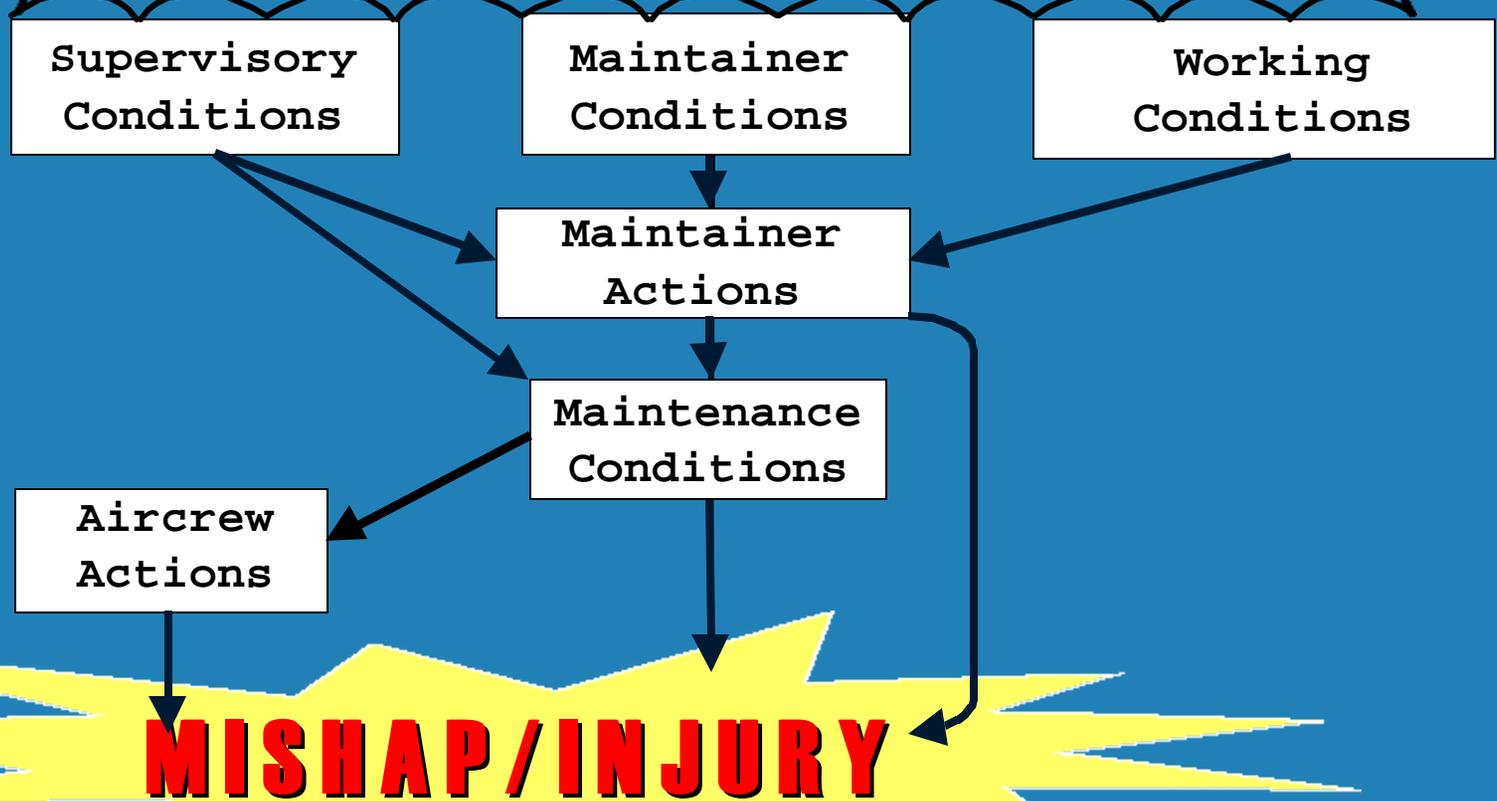
Initial emphasis on "Pilot Error";
but to reach goal of cutting human
factors mishaps in half the focus

maintenance



HFACS-ME Model

ORGANIZATIONAL CLIMATE





HFACS- *Maintenance Extension*

Supervisory Conditions

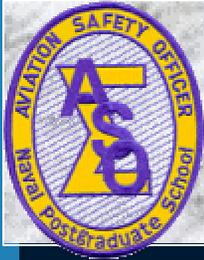
Working Conditions

Maintainer Conditions

Maintainer Acts

3 ORDERS



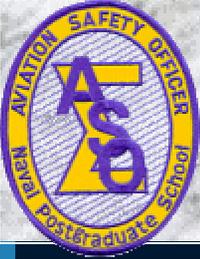




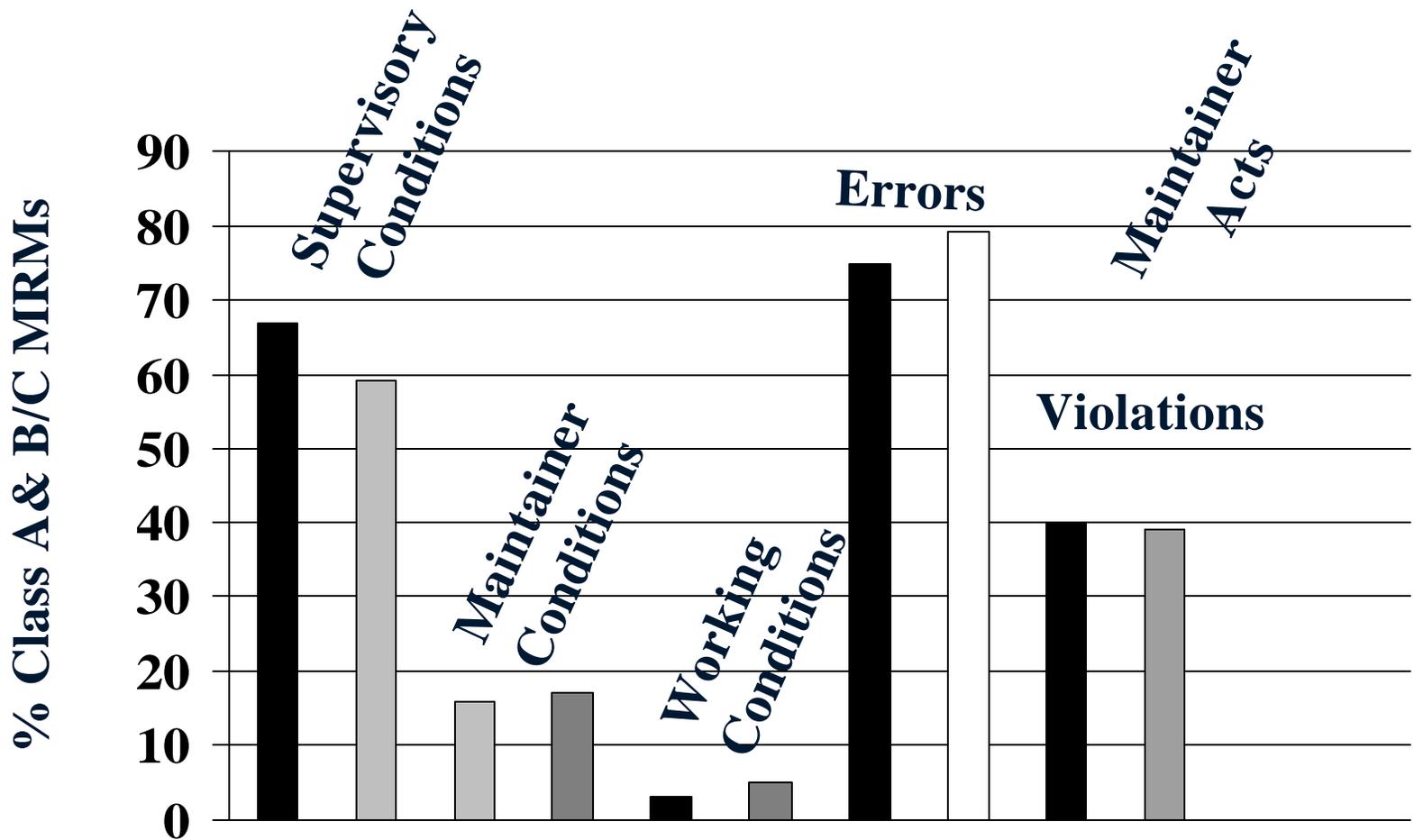
Human Error in Maintenance Related Mishaps (FY 90-97)

- 470 Maintenance Related Mishaps Were Analyzed For Human Errors
- Classification Process Performed by Naval Maintenance Personnel





HFACS-Maintenance Extension Profile: Class A vs. B/C MRM





General Findings

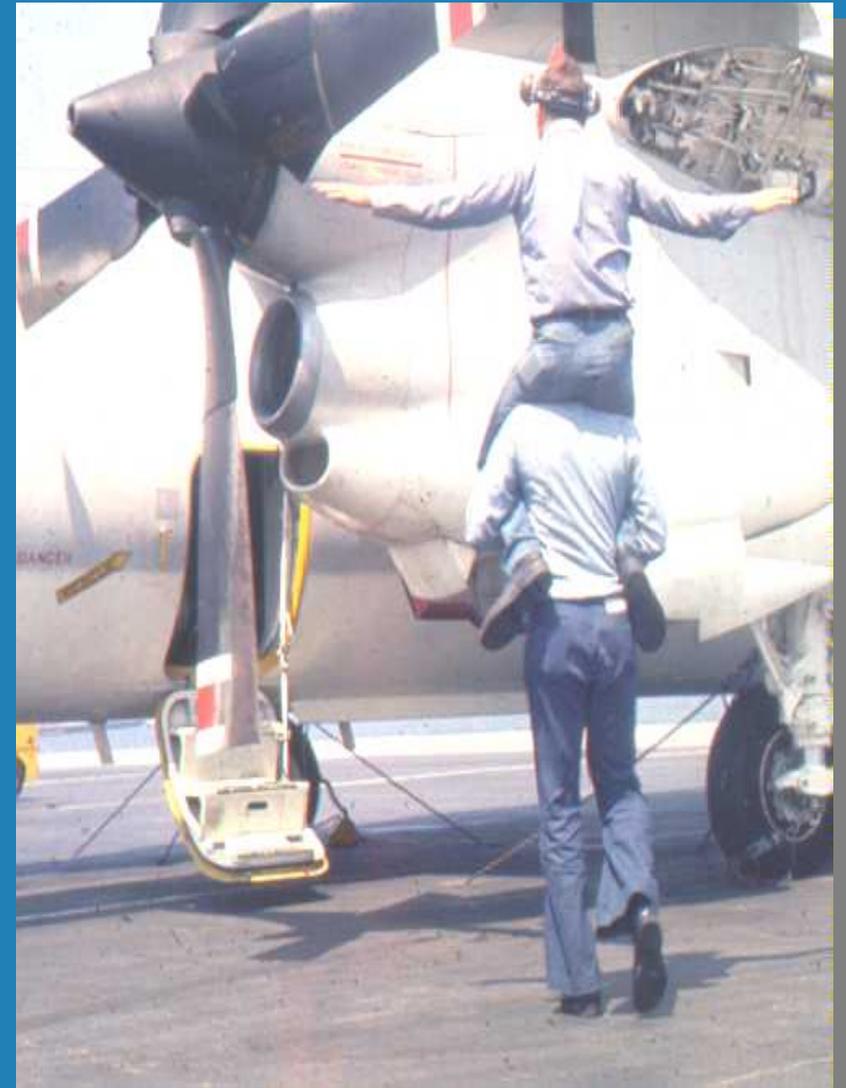
Poor/Non - existent maintenance procedures

Inadequate/Poor Supervision of Maintenance Evolutions

Miscommunication - supervisor to subordinate, pass-down, or shift turnover

Not using, lack of, or outdated

Violations - not following policy, procedures, checklists, etc.





HFACS-ME Implementation

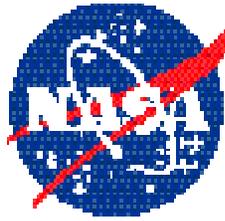
- HFACS-ME Adopted for Inclusion in 3750.6R
- Results Influencing the Naval Aviation Maintenance Program Policies (4790.2G)
- Tailored Training Materials for Users
- Data Collection/Analysis Tool Development
- Interim Construction of HFACS-ME Database (training, intervention, & ROI)



Supporting Agencies/Sponsors



**Medical Specialties Division
FAA Office of Aviation Medicine**



**Dr. Barbara Kanki
Crew Factors System Safety Branch
NASA Ames Research Center
Moffett Field, CA**



**CAPT Jim Frazier MC USN
Aeromedical Division
Naval Safety Center**



Questions?