Aircraft Mishap Investigation

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Overview

- Types of Aircraft Mishaps
- Aircraft Mishap Investigations
- Investigation Sequence
- Mishap Investigation Team
- Role of Human Factors
- Reason's Model
- Shappell & Wiegmann's Model
- Sample Cases DZ and B52

Types of Aircraft Mishaps

- Class A-Mishap cost totaling $2M+, fatality, permanent total disability and/or destroyed aircraft
- Class B-Mishap cost <$2M, >$500K
  - A permanent partial disability, Inpatient hospitalization of three or more personnel.
- Class C-Mishap cost <$500K, >$50K
  - Any injury or occupational illness or disease that causes loss of 1+ days away from work
  - An occupational injury or illness resulting in permanent change of job.

Mishap Investigations

- Safety Investigation Boards (SIB)
  - conducted to prevent future mishaps
  - assess possible force-wide implications on the combat readiness of these systems
  - Prevention focus
- Accident Investigation Boards (AIB)
  - conducted to provide a report for public release
  - Team gathers and preserves factual information for claims, litigation, administrative or potential disciplinary actions, and all other purposes
  - Responsibility focus

Safety Investigation Board

- SIBs take priority over AIBs
  - need quick assessment on impact on a weapons system's ability to fulfill its national defense role.
- SIB Team given freedom to assist in quickly moving to conclusion
  - Not looking for substantial burden of proof

SIB Sequence

- SIB convened w/in days of mishap, concludes in 30 days
- Headed by a colonel and consists of 6 to 10 additional officers or senior enlisted people
  - 7-10 days gathering factual data at crash site and taking testimony from witnesses
  - Next 14 days used to develop/refine SIB's findings and recommendations.

SIB Sequence

- Prepare and present completed 2 part report to the convening authority.
  - Part I: purely factual, passed to the accident investigation board and is incorporated in that report in its entirety.
  - Part II: is privileged,
    - Meaning it is to be used solely for mishap prevention
    - Restricted from release outside the AF
    - Contains confidential and private medical information

SIB Team

- Board President—O-6, final decision authority, reports to Convening Authority, ensures complete and impartial investigation
- Recorder—Administrative assistant; controls, compiles, reproduces, and distributes records
- Investigating Officer—A pilot or navigator, Responsible for daily ops of investigation
- Pilot Member—Rated in mishap aircraft (MA), collects data from crew, witnesses, ops records, mishap sortie review beginning w/preflight planning and ending with crash rescue activities

SIB Team

- Maintenance Member—Officer or SNCO familiar w/MA, servicing record of aircraft, records for those who most recently worked on mishap aircraft
- Medical Member—Flight Surgeon, familiar with MA and mission---determines cause of injury/death, decide if egress/life support equipment functioned properly, determine if medical/human factors had a role

SIB Team

- AF Safety Center member—guides the process ensuring proper procedures
- Conditional Members—Experts in various disciplines including Aerospace/Aviation (Operational) Psychologist, Aerospace Physiologist (Human Factors Specialist)

Role of Human Factors

Human error found to be a primary causal factor in approximately 80% of all flight accidents in the Navy and Marine Corps

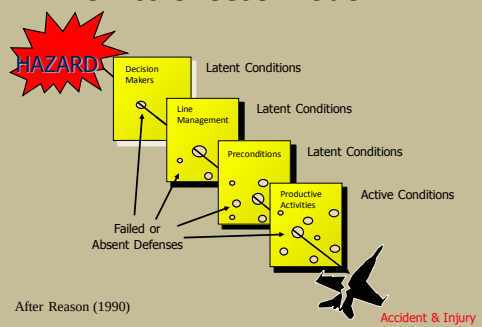
Reason's Model for accident causation

- Originally developed for nuclear industry
- Fundamental elements of aviation must harmoniously work together in order to have a safe and efficient system
- Safe and efficient system produced by pilots
- Production is a result of preconditions, management, and corporate decision makers

Reason's Model: Breakdown of the Productive System

- Mishaps occur w a breakdown among elements of the production process
- Breakdowns make the system vulnerable to operational hazards
  - These are "holes" in the system
  - To fully understand an accident all facets of the org must be analyzed

Swiss Cheese Model



After Reason (1990)

Reason's Swiss Cheese

- Active and Latent Conditions
- Active Conditions
  - Actions of aircrew directly leading to mishap, last events to take place before mishap
- Latent Conditions
  - Adversely affect aircrew
  - May be unnoticed for days, weeks, months, years until a mishap occurs

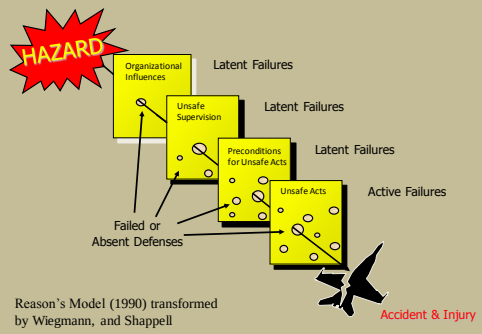
Reason's Model: Limitations

- Theoretical, limiting application
- Reason's Model does not *define* the holes in the cheese
- Without definition, the holes cannot be identified during investigations or identified and corrected before an accident occurs

Wiegmann & Shappell

- Developed the Human Factors Analysis and Classification System (HFACS)
- Designed specifically for military aviation but has been effective in civil aviation
- Describes 4 levels of failure: Unsafe Acts, Preconditions of Unsafe Acts, Unsafe Supervision, and Organizational Influences

Swiss Cheese Model

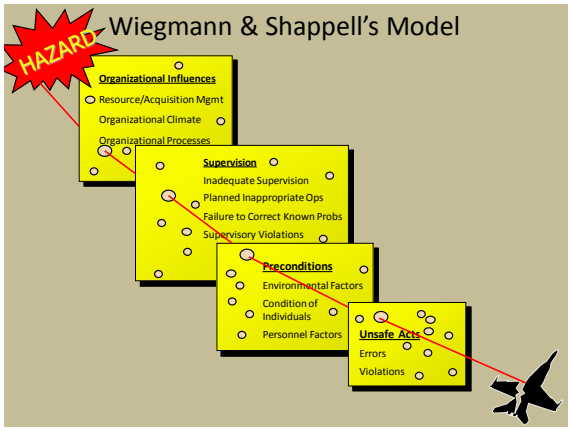


Reason's Model (1990) transformed by Wiegmann, and Shappell

Wiegmann & Shappell's Model

- Defined the latent and active failures implied in Reason's Swiss Cheese Model
- Empirically derived/refined by analyzing hundreds of mil and civ aviation accident reports

Wiegmann & Shappell's Model



Unsafe Acts

- Errors
  - Skill based (attention, memory, technique)
  - Decision "honest mistakes" in procedure errors, poor choices, and problem solving errors
  - Perceptual misjudge aircraft altitude, attitude, or airspeed
- Violations
  - Routine habitual and tolerated by authority
  - Exceptional viewed as isolated and atypical of individual's normal behavior and not condoned by authority

Errors

Skill-based Errors
- Breakdown in visual scan
- Inadvertent use of flight controls
- Poor technique/airmanship
- Over-controlled the aircraft
- Omitted checklist item
- Omitted step in procedure
- Over-reliance on automation
- Failed to prioritize attention
- Task overload
- Negative habit
- Failure to see and avoid
- Distraction

Decision Errors
- Inappropriate maneuver/procedure
- Inadequate knowledge of systems, procedures
- Exceeded ability
- Wrong response to emergency

Perceptual Errors
- *Due to* visual illusion
- *Due to* spatial disorientation/vertigo
- *Due to* misjudged distance, altitude, airspeed, clearance

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Violations

Routine
- ❑ Inadequate briefing for flight
- ❑ Failed to use ATC radar advisories
- ❑ Flew an unauthorized approach
- ❑ Violated training rules
- ❑ Filed VFR in marginal weather conditions
- ❑ Failed to comply with departmental manuals
- ❑ Violation of orders, regulations, SOPs
- ❑ Failed to inspect aircraft after in-flight caution light

Exceptional
- ❑ Performed unauthorized acrobatic maneuver
- ❑ Improper takeoff technique
- ❑ Failed to obtain valid weather brief
- ❑ Exceeded limits of aircraft
- ❑ Failed to complete performance computations for flight
- ❑ Accepted unnecessary hazard
- ❑ Not current/qualified for flight
- ❑ Unauthorized low-altitude canyon running

Preconditions for Unsafe Acts

- Condition of Operators
  - Adverse Mental States
  - Adverse Physiological States
  - Physical/Mental Limitations
- Personnel Factors
  - Crew Resource Management (CRM)
  - Personal Readiness
- Environmental Factors
  - Physical Environment
  - Technological Environment

Condition of Operators

Adverse Mental States
- ❑ Loss of situational awareness
- ❑ Complacency
- ❑ Stress
- ❑ Overconfidence
- ❑ Poor flight vigilance
- ❑ Task saturation
- ❑ Alertness (drowsiness)
- ❑ Get-home-itis
- ❑ Mental fatigue
- ❑ Circadian dysrhythmia
- ❑ Channelized attention
- ❑ Distraction

Adverse Physiological States
- ❑ Medical illness
- ❑ Hypoxia
- ❑ Physical fatigue
- ❑ Intoxication
- ❑ Motion sickness
- ❑ Effects of OTC medications

Physical/Mental Limitations
- ❑ Visual limitations
- ❑ Insufficient reaction time
- ❑ Information overload
- ❑ Inadequate experience for complexity of situation
- ❑ Incompatible physical capabilities
- ❑ Lack of aptitude to fly
- ❑ Lack of sensory input

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Personnel Factors

Crew Resource Management

- ❑ Failed to conduct adequate brief
- ❑ Lack of teamwork
- ❑ Lack of assertiveness
- ❑ Poor communication/ coordination within & between aircraft, ATC, etc.
- ❑ Misinterpretation of traffic calls
- ❑ Failure of leadership

Personal Readiness

- ❑ Failure to adhere to crew rest requirements
- ❑ Inadequate training
- ❑ Self-medicating
- ❑ Overexertion while off duty
- ❑ Poor dietary practices
- ❑ Pattern of poor risk judgment

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Environmental Factors

Physical Environment
- ❑ Weather
- ❑ Altitude
- ❑ Terrain
- ❑ Lighting
- ❑ Vibration
- ❑ Toxins in the cockpit

Technological Environment
- ❑ Equipment/controls design
- ❑ Checklist layout
- ❑ Display/interface characteristics
- ❑ Automation

Unsafe Supervision

- Inadequate Supervision
  - Lack of guidance and oversight opens door to violations and must be examined for its role in generating human error
- Planned Inappropriate Operations
  - Ops temp, scheduling that places crew at unacceptable risk, jeopardizes crew rest, and performance negatively impacted
- Failure to Correct a Known Problem
  - Supervisor knows of and allows deficiencies in crew, equipment, training, or other safety area
- Supervisory Violations
  - Existing rules and regulations are willfully disregarded; violate rules and doctrine when managing their assets

Inadequate Supervision

- ❑ Failed to provide proper training
- ❑ Failed to provide professional guidance/oversight
- ❑ Failed to provide current publications/adequate technical data and/or procedures
- ❑ Failed to provide adequate rest period
- ❑ Lack of accountability

- ❑ Perceived lack of authority
- ❑ Failed to track qualifications
- ❑ Failed to track performance
- ❑ Failed to provide operational doctrine
- ❑ Over-tasked/untrained supervisor
- ❑ Loss of supervisory situational awareness

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Planned Inappropriate Operations

Planned Inappropriate Operations

- ❑ Poor crew pairing
- ❑ Failed to provide adequate brief time/supervision
- ❑ Risk outweighs benefit
- ❑ Failed to provide adequate opportunity for crew rest
- ❑ Excessive tasking/workload

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Failure to Correct a Known Problem

Failed to Correct a Known Problem

- ❑ Failed to correct inappropriate behavior/identify risky behavior
- ❑ Failed to correct a safety hazard
- ❑ Failed to initiate corrective action
- ❑ Failed to report unsafe tendencies

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Supervisory Violations

Supervisory Violations

- ❑ Authorized unqualified crew for flight
- ❑ Failed to enforce rules and regulations
- ❑ Violated procedures
- ❑ Authorized unnecessary hazard
- ❑ Willful disregard for authority by supervisors
- ❑ Inadequate documentation
- ❑ Fraudulent documentation

Organizational Influences

- Resource Management
  - Human Resources
  - Monetary/Budget Resources
  - Equipment/Facility Resources
- Organizational Climate
  - Structure
  - Policies
  - Culture
- Organizational Process
  - Operations
  - Procedures
  - Oversight

Resource Management

Human Resources
- ❑ Selection
- ❑ Staffing/manning
- ❑ Training
- ❑ Background checks

Monetary/Budget Resources
- ❑ Excessive cost cutting
- ❑ Lack of funding

Equipment/Facility Resources
- ❑ Poor aircraft/aircraft cockpit design
- ❑ Purchasing of unsuitable equipment
- ❑ Failure to correct known design flaws

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Organizational Climate

Structure
- ❑ Chain-of-command
- ❑ Communication
- ❑ Accessability/visibilty of supervisor
- ❑ Delegation of authority
- ❑ Formal accountability for actions

Policies
- ❑ Promotion
- ❑ Hiring, firing, retention
- ❑ Drugs and alcohol
- ❑ Accident investigations

Culture
- ❑ Norms and rules
- ❑ Organizational customs
- ❑ Values, beliefs, attitudes

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Organizational Process

Operations
- ❑ Operational tempo
- ❑ Incentives
- ❑ Quotas
- ❑ Time pressure
- ❑ Schedules

Procedures
- ❑ Performance standards
- ❑ Clearly defined objectives
- ❑ Procedures/instructions about procedures

Oversight
- ❑ Established safety programs/ risk management programs
- ❑ Management's monitoring and checking of resources, climate, and processes to ensure a safe work environment

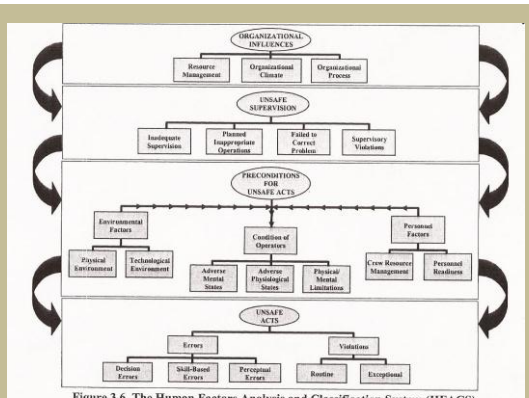

Figure 3.6. The Human Factors Analysis and Classification System (HFACS).