Considerations in the Investigation of Incidents:

Human Factors of ATS Incidents

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Human Factors

• Human error underlies most aviation accidents and incidents
• The focus of most accident/incident investigations are:
  o Human error
  o Introduced risks
  o Contributing factors
  o Breakdowns in crew resource management (CRM)
• Human factors involves gathering information about:
  • human abilities
  • human limitations
  • other characteristics
Human Factors cont.

• In the aviation industry, the science of human factors is dedicated to better understanding how humans can most safely and efficiently be integrated with technology.

• We will focus on understanding human abilities and limitations
Human Factors
ATS Incident Analysis Group
The purpose of this topic is to understand how humans process information to make decisions and to learn about **human errors and at-risk behaviors.**
OBJECTIVES

- Identify reasons for human errors
- Discuss the difference between internal and external factors
- Discuss the difference between errors and at-risk behaviors
INTRODUCTION TO HUMAN ERROR
RECAP AND INTRODUCTION TO HUMAN ERROR

There are 3 types of Human Error:

MISTAKE
You don’t know what you need to know.

LAPSE
Something you forgot to deal with.

SLIP
You have the correct solution, but execute it incorrectly.
CAUSES OF HUMAN ERROR

Why do we make errors?

INTERNAL FACTORS

VS

EXTERNAL FACTORS
## INTERNAL FACTORS: THE DIRTY DOZEN

<table>
<thead>
<tr>
<th>LACK OF COMMUNICATION</th>
<th>DISTRACTIONS</th>
<th>LACK OF RESOURCES</th>
<th>STRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Issues around:</strong></td>
<td><strong>Internal:</strong></td>
<td><strong>Lack of:</strong></td>
<td><strong>Acute:</strong></td>
</tr>
<tr>
<td>• Words</td>
<td>• You become bored, which causes your mind to wander</td>
<td>• Skill</td>
<td>• Caused by dealing with an emergency</td>
</tr>
<tr>
<td>• Phrases</td>
<td></td>
<td>• Experience</td>
<td>• Working under pressure</td>
</tr>
</tbody>
</table>

**Example:**

- **LACK OF COMMUNICATION:** Using non-standard phraseology can cause miscommunication.
- **DISTRACTIONS:** While bored, your mind can wander to more entertaining thoughts.
- **LACK OF RESOURCES:** A lack of any of the above can interfere with your ability to complete a task.
- **STRESS:** Stress can affect your judgment and ability to concentrate.

**Chronic:**

- Caused by long-term demands, such as family, finances, or illness.
# Internal Factors: The Dirty Dozen

## Complacency
Some people think:
- They are perfect controllers
- They will never have an incident
- They are Teflon-coated

Example: Overconfidence can lead to complacency.

## Lack of Teamwork
Key teamwork skills include:
- Effective communication
- Trust

Example: No single person can be responsible for the safe outcomes of all tasks.

## Pressure
Caused by:
- Lack of resources
- Inability to cope with a situation

Example: Pressure to maintain separation can interfere with our ability to control traffic.

## Lack of Awareness
Tunnel vision may result from:
- Stress
- Fatigue
- Pressure
- Distraction

Example: Not working as a team and only considering one’s own responsibilities can lead to tunnel vision.
## INTERNAL FACTORS: THE DIRTY DOZEN

<table>
<thead>
<tr>
<th>LACK OF KNOWLEDGE</th>
<th>FATIGUE</th>
<th>LACK OF ASSERTIVENESS</th>
<th>NORMS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Caused by:</strong></td>
<td><strong>Fatigue:</strong></td>
<td><strong>Exemplified by:</strong></td>
<td><strong>Enforced through peers:</strong></td>
</tr>
<tr>
<td>• Not having the appropriate training</td>
<td>• Can diminish your mental capacity</td>
<td>• Not asking for help</td>
<td>• Everyone in the facility does it “that way”</td>
</tr>
<tr>
<td>• Not knowing what you need to know</td>
<td></td>
<td>• Reluctance to express safety concern</td>
<td>• Often deviates from procedures</td>
</tr>
<tr>
<td>• A bit shy to ask a coworker for help</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Tiredness:**
• Result of needing sleep or physical rest

**Example:**
**LACK OF KNOWLEDGE**
Systems and procedures can change substantially, and controllers’ knowledge can quickly become out of date.

**FATIGUE**
After 2 hours on position, your brain is fatigued, but you are not tired.

**LACK OF ASSERTIVENESS**
Being unable to express concerns causes ineffective communication and damages teamwork.

**NORMS**
Most norms do not apply to all circumstances.
EXTERNAL FACTORS

- Inadequate workspace or layout
- Poor environmental conditions
- Inadequate human engineering design
- Inadequate training
- Technology changes
- Task or procedure changes
- Cell phone distractions
Seven vulnerabilities to Human Information Processing

• Visual sampling/Selective Attention
  • Information clutter

• Expectation Driven Processing
  • Read back-Hear back

• Working Memory
  • Information saturation

• Situation Awareness
  • Predictive SA is dependent on spatial working memory to compute trajectories based on aircraft state, intended plans, and aircraft dynamics

• Communications
  • Effectiveness depends on shared assumptions (it’s a conversation)

• Long Term Memory
  • Prospective memory, the bridge to future actions based on knowledge

• Judgment/Decision Making
  • Agile memory built from knowledge based experience
ERRORS VS. AT-RISK BEHAVIORS
AT-RISK BEHAVIOR DISCUSSION

From 2004 to 2013...
Over 3,100 law enforcement personnel have been injured in crashes. 11% were not belted, a much higher non-compliance rate than the general driving public.

MYTH
SEAT BELT WILL SLOW EXIT FROM VEHICLE
Humans process information for meaning and to prioritize in order to complete the required task.

Human error is inadvertently doing something other than what should have been done: a mistake, lapse, or slip.

We can lessen mistakes, lapses, or slips by recognizing and mitigating internal and external factors that can lead to errors.

At-risk behaviors occur when we choose not to follow the rules.
End-of-Lesson