

# Considerations in the Investigation of Incidents:

## Human Factors of ATS Incidents

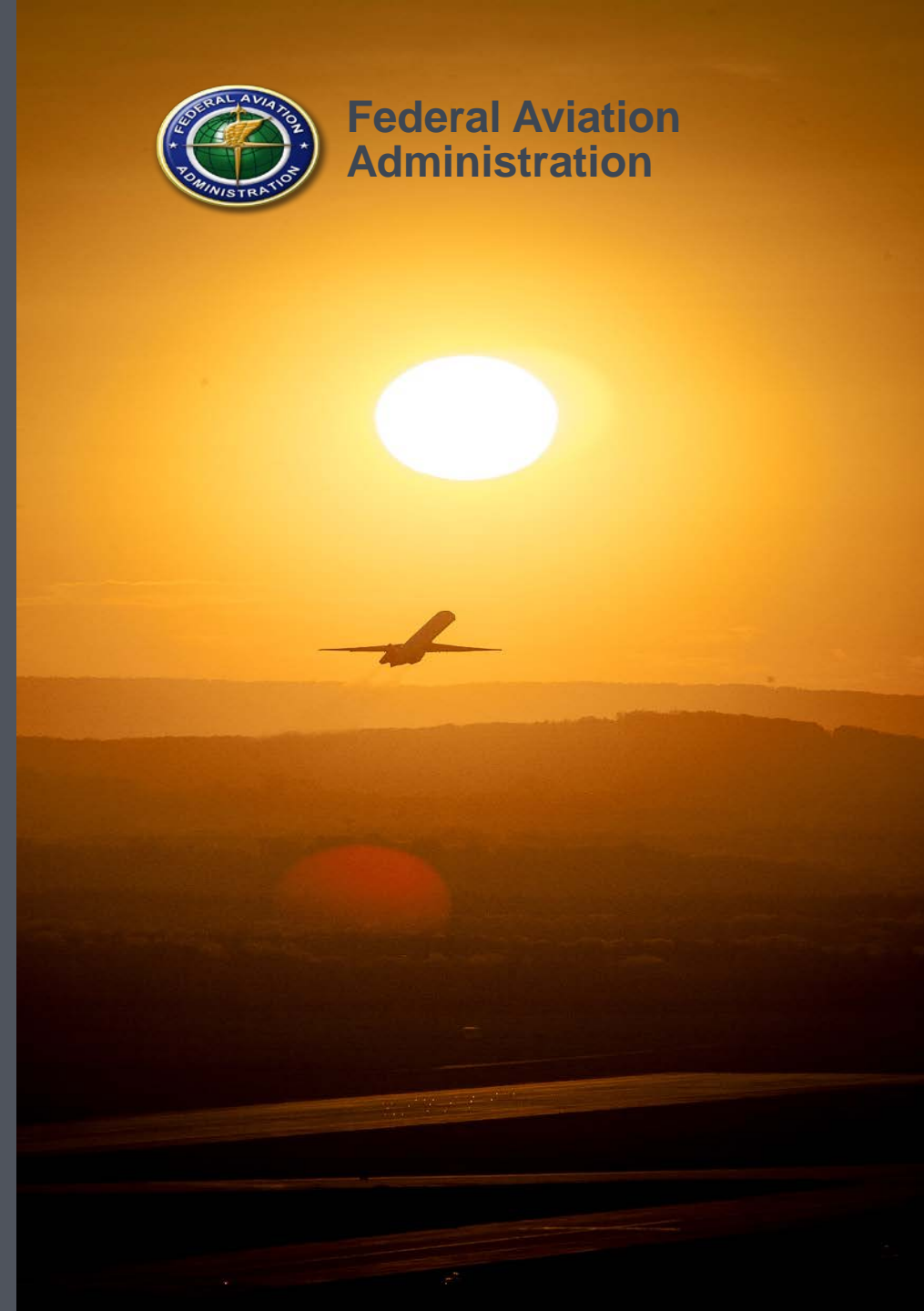
Presented to: **Air Traffic Incident Analysis Workshop**

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FAA ATO Safety and Technical Training

Date: 20 July 2016



Federal Aviation  
Administration



A photograph of an airplane cockpit, showing the instrument panel, control yokes, and overhead panel. The cockpit is illuminated with blue and white lights. A semi-transparent grey box is overlaid on the left side of the image, containing the title and date.

# ATS Incident Analysis Group Workshop

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July 2016



# Human Factors

- Human error underlies most aviation accidents and incidents
- The focus of most accident/incident investigations are:
  - Human error
  - Introduced risks
  - Contributing factors
  - 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



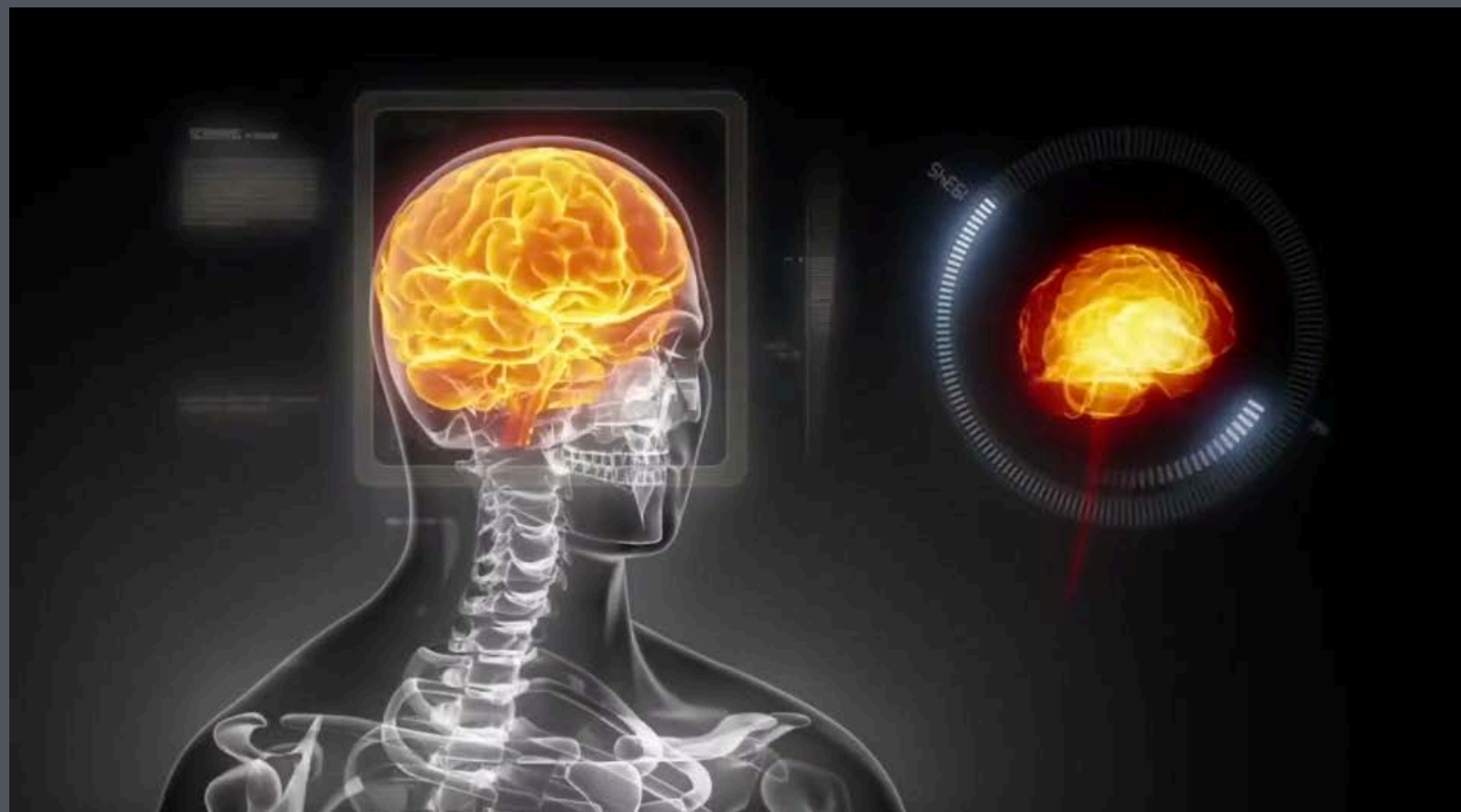
A photograph of an air traffic control room. In the foreground, a person is seated at a workstation, viewed from behind. The workstation is equipped with several computer monitors displaying various data, including what appears to be a radar display. To the right of the workstation is a control panel with numerous buttons and lights, some of which are illuminated in green. A telephone is also visible on the desk. The room is dimly lit, with the primary light source being the screens and the control panel lights. A teal-colored text box is overlaid on the left side of the image.

# Human Factors

ATS Incident Analysis Group

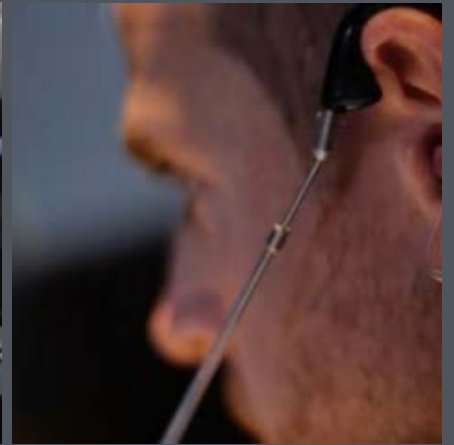
# INTRODUCTION

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.**



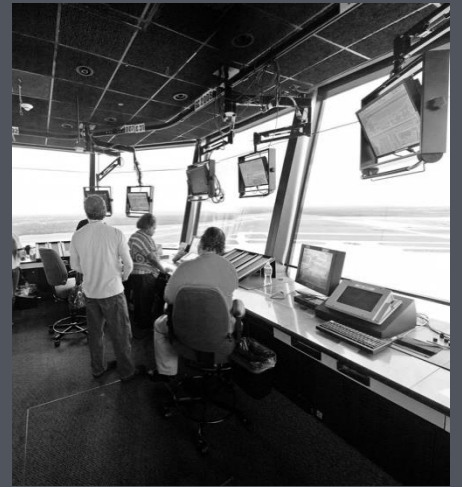
# OBJECTIVES

- 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

## LACK OF COMMUNICATION

### Issues around:

- Words
- Phrases

### Example:

*Using non-standard phraseology can cause miscommunication.*

## DISTRACTIONS

### Internal:

- You become bored, which causes your mind to wander

### Example:

*While bored, your mind can wander to more entertaining thoughts.*

## LACK OF RESOURCES

### Lack of:

- Skill
- Experience
- Knowledge

### Example:

*A lack of any of the above can interfere with your ability to complete a task.*

## STRESS

### Acute:

- Caused by dealing with an emergency
- Working under pressure

### Chronic:

- Caused by long-term demands, such as family, finances, or illness

### Example:

*Stress can affect your judgment and ability to concentrate.*

# 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

## LACK OF KNOWLEDGE

### Caused by:

- Not having the appropriate training
- Not knowing what you need to know
- A bit shy to ask a coworker for help

### Example:

*Systems and procedures can change substantially, and controllers' knowledge can quickly become out of date.*

## FATIGUE

### Fatigue:

- Can diminish your mental capacity

### Tiredness:

- Result of needing sleep or physical rest

### Example:

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

## LACK OF ASSERTIVENESS

### Exemplified by:

- Not asking for help
- Reluctance to express safety concern

### Example:

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

## NORMS

### Enforced through peers:

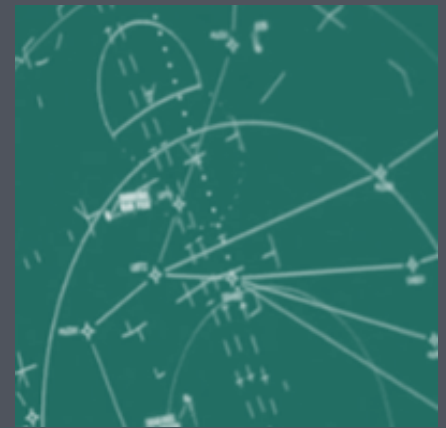
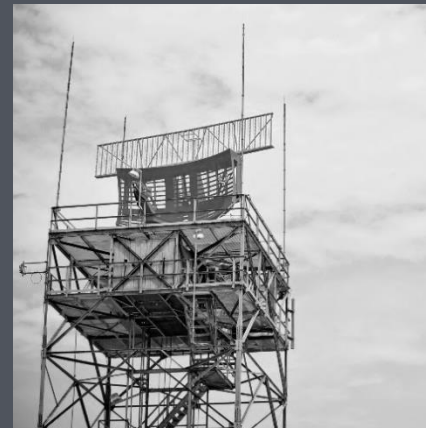
- Everyone in the facility does it "that way"
- Often deviates from procedures

### Example:

*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



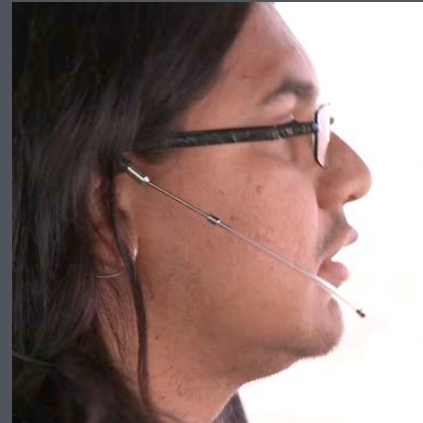
**MYTH** SEAT BELT WILL SLOW  
EXIT FROM VEHICLE

**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.

# CONCLUSION

- 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