REPUBLIC POLYTECHNIC

P07

What Is Going On?

E365 – Aviation Human Factors

SCHOOL OF ENGINEERING

Situation Awareness

- Situation awareness (SA) can be defined by stating it in its three levels:
  - the perception of the elements in the environment within a volume of time and space,
  - the comprehension of their meaning, and
  - the projection of their status in the near future.
- The integrated picture forms the central organizing feature from which all decision making and action takes place.
- A large portion of an aviator’s job consists of the development of SA and keeping it up to date in a rapidly changing environment

3 levels of situation awareness

- Level 1 SA: Perception of the elements
  - Perceive the status, attributes and dynamics of relevant elements in the environment
- Level 2 SA: Comprehension of the current situation
  - Comprehension of the situation is based on a synthesis of disjointed Level 1 elements
  - Understanding of the significance of those elements in light of one's goals
- Level 3 SA: Projection of future status
  - Ability to project the future actions of the elements in the environment, at least in the very near term.
  - Achieved through knowledge of the status and dynamics of the elements and a comprehension of the situation
  - Provides knowledge, and possibly time, necessary to decide on the best course of action to meet one's objectives

Factors affecting SA

- Individual differences
  - Spatial abilities
  - Attention division
  - Memory
  - Perceptual speed
  - Cognitive functions
  - Stress management
  - Knowledge
  - Skills
  - Experience
  - Training
- Non-human related
  - Airport infrastructure
  - Equipment
  - Aircraft performance
  - Navigational aids
  - Environment
  - Weather
  - Traffic
  - Procedures

Enemies of Situation Awareness

- Attentional Tunneling
  - The user fixates on specific elements of information while becoming blinded to other elements.
- Requisite Memory Trap
  - Some designs tax working memory to the point where SA is decreased due to overload.
- Workload, Anxiety, Fatigue, and Other Stressors
  - Psychological and physical stressors can negatively affect information intake by making it less systematic and more error prone.
- Data Overload
  - The way data is processed, stored and displayed all affect how data is organized and presented to the user. These factors can contribute to overload.

Enemies of Situation Awareness

- Misplaced Salience
  - Salience may help or hinder SA depending on the context of use. Designers must be careful to use it appropriately.
- Complexity Creep
  - This phenomenon may undermine the user's ability to correctly interpret information presented and to project what is likely to happen.
- Errant Mental Models
  - Lack of standardization and use of modes can activate errant mental models in user's minds and cause them to misinterpret the meaning of cues.
- Out-of-the-loop Syndrome
  - Too much automation can push the user out-of-the-loop, causing them to lose SA in regards to the status of the elements under systems control.

Situation awareness errors

- Level 1: Failure to correctly perceive information
  - Data not available
  - Data hard to discriminate or detect
  - Failure to monitor or observe data
  - Misperception of data
  - Memory Loss
- Level 2: Failure to correctly comprehend information
  - Lack of or poor mental model
  - Use of incorrect mental model
  - Over-reliance on default values
- Level 3: Failure to project future state of the system
  - Lack of or poor mental model
  - Over-projection of current trends

Improvement of SA

- Good system design
  - salient information readily available, easy to discriminate, easy to comprehend;
  - prevents overload, minimal distractions
  - Well-structured standard operating procedures (SOP)
- Training
  - Improving skills
    - Attention sharing, task management, contingency planning, information gathering, self-checking etc.
    - Ability to look for relevant cues and comprehend their significance
    - Better prediction of the progression of events
  - Improving knowledge
    - Building relevant mental models
    - Better understanding of importance and consequences of different events and options
- Good briefing sessions before taking on tasks

Decision making

- Decision making is a process where a course of action is selected from different options on the basis that it is best equipped to produce the desired outcome.
  - Requires a list of options, which are the specific alternative course of actions that are to be evaluated.
  - Determines the risk with each option based on a set of criteria and chooses the best one.
- Situation awareness is necessary but not sufficient for good decision making.

Bias affecting judgment

- Association bias
  - Selection of facts which are logically linked
- Expectation bias
  - Choosing of most familiar solutions, rather than unfamiliar but potentially better solutions.
- Confirmation bias
  - potentially poor choices which are “backed up” by facts which confirm its suitability, despite a lack of further information or the presence of facts that make the option unsuitable.
- Group think bias
  - decisions being made based on majority preferences – this can lead to riskier decisions.

Causations of poor judgment

- Insufficient or erroneous information regarding current situation.
- Limited knowledge or understanding of alternative solutions.
- Not generating sufficient alternatives, not thinking through alternatives.
- Time pressure.
- Previous outcomes of similar judgments in similar situations may lead to complacency.

Learning Objectives

- Definition and levels of situation awareness
- Factors affecting situation awareness
- Situation awareness errors
- Improvement of situation awareness
- Decision making
- Factors affecting judgment