# HMI Flight Experiment 3

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# Description

- Objective:
  - To identify if any, the relationship between intensity of verbal task load stimulus (e.g. changing altitudes) and the presence of accidents or close call incidents (e.g. roll>180) during manual flight procedures.
- Questions:
  - To what extent does the intensity of verbal task loads (e.g. reporting flight condition) impact the performance of the main task of landing the plane?
  - How do verbal tasks affect a pilot's cognitive ability?
  - Is there a noticeable change in pilots' primary task performance when more verbal tasks are added?
  - What are some voluntary or involuntary responses pilots have toward the presence of increasing levels of verbal task loads?

# Experiment Overview

- Design Matrix
- Independent Variables
- Dependent Variables
    - Plane Behavior (xPlane; trial)
    - Pilot's eye fixation and condition (Tobii Eyetracker; trial)
    - Pilot's cognitive control modes as well as situation awareness (CCM Probe; trial)
    - Pilot's personal opinion (NASA TLX survey; post-trial)
- Tasks
    - Primary:
        - Subtasks:
    - Secondary:

# Experimental Procedure

- xPlane Flight Simulator

Primary Task: Follow Glide slope, retain 70 knots and land plane.
Subtasks: Report Altitude, climb, descend, speed up, slow down. Change runway.

Subtask Variances:

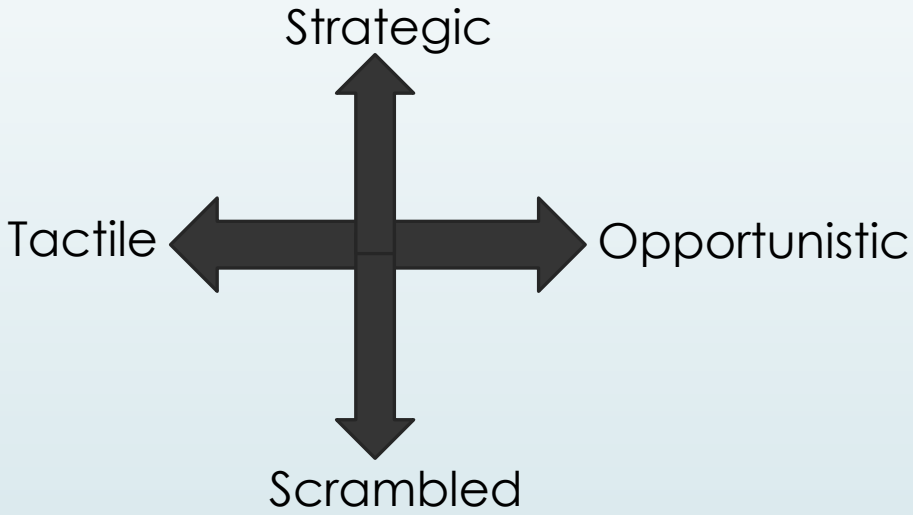
- Subtask 1: Report Altitude
- Subtask 2: Climb to 1100 feet
- Subtask 3: Descend 900 feet
- Subtask 4: Speed up to 80 knots
- Subtask 5: Slow down to 60 knots
- Subtask 6: Resume 70 knots
- Subtask 7: Report Runway Assignment
- Subtask 8: Change runway from 12R to 12L

Task Intensity and command list:

| Baseline | Low | Medium | Hard |
|---|---|---|---|
| No subtask. | Subtask 1 (0:55)<br>Subtask 5 (1:15)<br>Subtask 1 (1:45)<br>Subtask 6 (1:55) | Subtask 1 (0:15)<br>Subtask 2 (0:20)<br>Subtask 4 (0:55)<br>Subtask 1 (1:10)<br>Subtask 3 (1:20)<br>Subtask 6 (2:00) | Subtask 1 (0:10)<br>Subtask 2 (0:15)<br>Subtask 4 (0:35)<br>Subtask 1 (0:45)<br>Subtask 3 (1:00)<br>Subtask 7 (1:35)<br>Subtask 8 (1:45)<br>Subtask 6 (2:00) |

# Experimental Procedure

- Cognitive Control Mode Probe
- Potential Subtask responses:
  - Strategic - Full control, full anticipation,
  - Opportunistic - Some control, no anticipation
  - Tactile – Losing control, no anticipation
  - Scrambled – loss of control
  - No response – participant forgets to respond/does not have the inclination to respond.



# Experimental Procedure

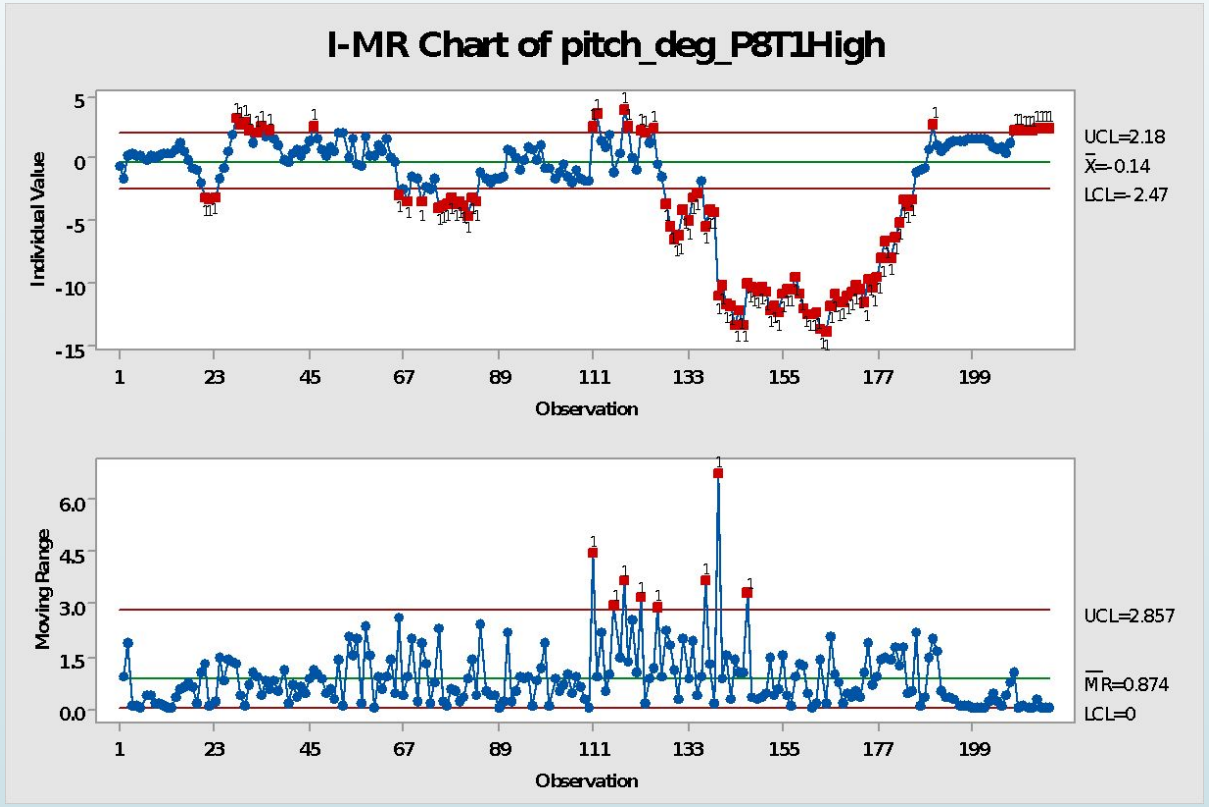
- Tobii Eyetracker
  - Sources of information:
    - Pupil Dilation
    - Fixation
    - Eye gaze position
  - Things to look out for:
    - Fatigue level
    - Loss of focus
    - Excessive blinking – possibility of eyestrain

# Planned Data Analyses

- Data Analyses
  - Finding anomalies using quality control charts
  - Gaze plots and visual heat maps
  - Cognitive control responses and response timings

# Data Analysis: xPlane

- Quality Control Charts to find anomalies
  - Pitch
  - Roll
  - Yaw
  - altitude



# Data Analysis: Tobii Eyetracker

- Fixation Data
  - Gaze Plots
  - Heat Maps
- Eye condition
  - Pupil Dilation
  - Blink rate/frequency

# Data Analysis: CCM Probe

- Recording responses (P16)

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TrialDate,Subject #,Trial #,Run #,Configuration,Scenario,TrialStartTime,ProbeDisplayTime (secs),ProbeRespTime (secs),Question,Q-Response
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# Remaining steps

- Comprehensive data analyses
  - Comparing the different difficulty levels in earnest
  - Correlating Results and association to varying task load levels
  - Breakdown of precise tasks and how they may affect cognitive control.
- Presentation of Data