NCSU/Aptima – NASA NRA-09 Research

4/9/09

Team Members: Alexander, Kaber, Kaufmann, Kim, Naylor Stelzer

Guest: Arthur

Agenda:

Review of current tasks for Year 3

- Draft flight scenario and simulator review (Kaufmann, Naylor)
  - Weather - Fog in out-the-window view. Visibility is 0/0. Breakout at 500 ft AFL in descent phase. (Clear night in transition phase. Brownout begins at 150/100 ft AFL.)
  - Defined trajectory.
  - Modes of flight control in each phase (descent, transition, hover) – Hand-fly, autopilot?
  - (Due date: Extended to 4/9.)
- Pilot briefing and intro to experiment (Kaber, Kim, Naylor)
  - Overall configuration of displays and controls.
  - Training procedure
  - Test procedure and interaction with confederate co-pilot.
  - (Due date: Draft by 5/1.)
- Development of graphical object models (Kim)
  - Models must be in OpenFlight format.
  - There must be a list of where to place the models (i.e., lat/lon or range bearing from Apollo 15 landing site).
  - Models must be static and should consist of hangar, building, landing pad, trees, etc.
  - (Due date: Basic set of objects with location information by 4/16.)
- IRB Protocol (Kaber, Kim) - DONE
- Brownout model specification for simulator (Kaber, Naylor) – DRAFT DONE
  - Starting at 150 ft. with 5% opacity and transitioning to 100% opacity by 100ft.

Starting at 100 ft. with 5% opacity and transitioning to 50% opacity by 50ft.

(Need to confirm with Arthur.)

Guidance system failure specification (Kaufmann, Naylor)

Early left shift of tunnel (or directional indicator on ND), late left shift, early right shift, late right shift.

Need to specify extent of shift over time or distance (e.g., 1 dot off LOC over 1 min. or 3nm).

(Due date: Details to Arthur by 4/16.)

Experiment design (Alexander, Stelzer and Kim) – DRAFT DONE

IV settings and general design of experiment

One display/trial

One guidance error/trial – One error state detection

One landing decision/trial

16 trials/subject = 8 display configurations (3 clutter groups) * 2 environment settings (brownout conditions)

Condition randomization procedure

Experiment stimuli/HUD configurations to be studied (Kaber, Prinzel, Kim, Arthur, Williams) – DRAFT CONCEPTS COMPLETE.

Description of low, medium and high clutter conditions.

Specific display properties.

SVS wireframe only (no photo-realistic terrain) – “green”

Tunnel – “magenta” (removed at 450ft AFL

Terrain – “brown”

Sky – “blue”

<u>New tasks:</u>

Recruiting of subjects (Regina Johns)

According to criteria defined (by Alexander and Kaufmann) – n=16 active, FW line pilots with >=15 years experience and familiarity with glass cockpits.

(Due date: 5/29)

Identify and define response measures to be collected during experiment (Alexander, Stelzer, Kaufmann, Naylor)

Display clutter ratings (timing, frequency)

One rating in descent, following hit/miss on guidance failure.

Second rating following landing decision and trial termination.

Clutter score/index calculated based on ratings –

Is index sensitive to changes in pilot perceptions due to display conditions?

Do index values fluctuate at different rates due to different feature manipulations?

Pilot performance?

Flight path deviations

Speed control/rate of descent

Failure signal detection

Landing decision accuracy

Pilot workload? – Measure was not particularly sensitive to manipulations in Y2 study.

(Due date: 4/30)

Preparation of experiment materials (Kim, Alexander, Stelzer)

Develop spreadsheet of conditions, including settings of brownout and guidance failure.

Create code system to represent each unique combination of IVs (as in Y2 study).

Prepare pilot background survey.

Prepare forms for response measure collection – clutter ratings, clutter index, observed behavior recording, etc.

Prepare forms for structured interviews with pilot (post-experiment).

(Due date: 5/25)

<u>Current issues:</u>

Who can attend checkout at Langley on 5/15?

Who can participate in full experiment at Langley 6/1-12?

2 pilots/day, 4 days/week, 2 weeks of testing

Year 2 and 3 Outcomes:

(Need to stay focused on these goals.)

Prepare journal article on Y2 results (ASEM)

Identify differences in visual properties between Y3 and Y2 displays.

- Use HUD image analysis software.
- Use predictive model of clutter to project impact of visual properties on pilot perceptions of clutter.
- Validate predictions based on experiment data.

Identify differences in relevance of display information across phases of flight (from FW approach to V/TOL approach).

- Make predictions on how differences in information relevance will impact performance and perceptions of clutter.

Validate multidimensional measure of clutter.

- Conduct correlation analyses on clutter scores with measures of display visual properties.
- Assess consistency in clutter scores across pilots for specific display condition.