

Everyone -

Thanks again for taking the time to meet this morning regarding our NASA-NRA research. As a follow-up to the meeting, below are the notes and the action items I recorded. Please advise if I've missed anything.

****General notes****

(0) The main objective of this research is to develop subjective and objective measures/metrics of clutter as vehicles for mitigating potential negative impacts of clutter on pilot performance through SVS/EVS display design.

(1) The 1st lab study will focus on the EVS/SVS HUD.

(2) 5 factors will be manipulated (each with two levels), including: (a) SVS/terrain wire-frame - on/off; (b) EVS imagery - on/off; (c) TCAS/traffic - on/off; (d) tunnel guidance - on/off; and (e) symbology - nominal/IMC. (There is an option to also manipulate obstacles in the display – e.g., hotels.)

(3) 4-8 expert/test pilots with HUD experience will be recruited from Langley or Pope AFB for participation (NASA (Regina) to assist with recruiting and payment).

(4) Subjects will participate in 2 sessions of 2 hrs. each on a single day at NC State.

(5) A full factorial design, including 32 display stimuli/configurations, or a fractional design (2^5-1 ; 1/2 replicate of 5 factors) involving 16 stimuli will be used. All stimuli must appear in each flight scenario with a single pilot.

(6) Pilots will be repeatedly exposed to the stimuli through 4 replications involving 4 different flight scenarios (e.g., straight-in, turn in approach, visual approach, ILS)

(7) Static images of the HUD will be used in the experiment (no videos or dynamics will be presented in this stage of the research).

(8) Pilots will be asked to identify descriptor terms that they would use to characterize each display stimulus at various stages of the approach and landing. They may also provide "low" or "high" ratings for each pair of descriptor terms.

(9) The entire study may be replicated to assess the qualities of display clutter in "breakout" scenarios (i.e., pilots emerging from clouds in landing scenarios causing dramatic changes in the background of the HUD display).

(10) Results will identify those descriptor terms to be used in subjective assessment of display clutter (i.e., what anchors we want to use for our "scales" as part of the 2nd study). The ratings data may also provide us with some insight into the sensitivity of the "scales" we define.

****Action items****

(1) Kaber/Alexander - Draft general flight scenarios for 1st study - multiple approaches (4) into Reno (e.g., STARs 16R - <http://www.airnav.com/airport/KRNO>), including initial approach, final approach and landing.

(2) Kaber/Alexander/Hsiang - Identify points in approaches at which display stimuli are to be presented. Develop schedules for presentation of various stimuli during trials. (Need unique schedule for each scenario. Pilot exposure to scenarios will be balanced and so will exposure to specific stimuli and certain points in landing.).

(3) Kim - Define reduced set of semantic descriptor terms for display evaluation. Remove those descriptors Aptima identified as "perceptually

similar". Remove those descriptors that semantic analysis (Hsiang) revealed to be highly redundant. Present reduced set to Aptima for survey development.

(4) Cowley – Summarize reviews of: (a) Keller et al. CTA; (b) Schnell report and paper; and (c) HUD specification. Identify importance of specific HUD features for each phase of landing. (Once trial schedules are developed, NASA can provide input as to what stimuli may or may not be acceptable for presentation at specific points in an approach, from a commercial pilot perspective.)

(5) Prinzel/R. Bailey – Provide images of various display configurations to be tested in experiment. (Need flight scenario and trial information.)

(6) Prinzel/R. Bailey - Identify one combination of SVS, EVS, TCAS, tunnel guidance and symbology that is least likely to be used by pilots (e.g., SVS "on", EVS "off", TCAS "on", tunnel guidance "off" and symbology "IMC") across phases of landing (initial, final, touchdown). (If we use a fractional factorial design (e.g., 2^{5-1}) for the experiment, this will represent the condition for which no clear effect on perceived clutter will be estimable.)

(7) N. Bailey/Stelzer – Define "staircase" protocol for presenting stimuli. (Need images of stimuli and constraints on when features should or should not be presented based on stage of landing.)

(8) N. Bailey/Stelzer – Draft subjective survey forms for structured interview protocol for 1st study. (NCSU will integrate in overall experimental protocol.)

(9) Prinzel/R. Bailey - Arrange for expert/test pilots for evaluation of clutter descriptive terminology in experiment at NCSU.

These are all the items that I noted or recalled from the meeting. If I have missed points, please add to the list and distribute to the group.

****Current Schedule****

Below is a draft schedule of current activities that we established. Please let me know of any changes.

12/31 – Present reduced set of semantic pairs of descriptor terms for survey development and NASA review.

1/15 – Draft flight scenarios.

1/15 – Draft schedule for presentation of stimuli for 4 scenarios.

1/15 – Draft subjective survey on descriptor terms for experiment.

1/15 – Summaries of technical reports. Draft of display feature criticality info.

1/30 – Display stimuli for experiment and identification of confounding condition.

1/30 – Protocol for stimuli presentation.

1/30-2/15 – Arrange for subjects.

2/30-5/15 - NCSU/Aptima conduct 1st lab study at NCSU, analyze data, and report results.

I would like to plan for our next monthly project meeting on 1/15 from 10am-12pm. Please let me know if you are not available. I will arrange for a "meet-me" number