Everyone -

Below are the notes and items I recorded during our telecon. Let me know if you have any other items or questions. I will ask Sang-Hwan to update the current task list posted to the project website. Everyone should keep track of the task set and due dates.

(1) Simulator configuration (To be completed by 5/15 – Arthur, Williams):

The control mode will be hdot.manual throughout the course of the approach.
Pilots will control both lateral inputs and the acceleration of the aircraft with the side-stick.
Velocity will be controlled using the hat switch on the stick.

The ND will not include a flight guidance cue during the descent phase of the approach.
This is intended to cause pilots to rely on the LOC and G/S deviation indicators during the descent phase of the approach.
The "white" circle (guidance cue) will only be presented in the ND during the hover phase.
The cue is necessary in order for the pilots to control the aircraft in hover.

"Dog bones", indicating flight path deviations from the center of the tunnel, should not be presented on the LOC and G/S deviation indicator scales in the PFD.
This would reveal guidance system failures for pilots and make the error detection task too simplistic.
We want the guidance system failure to be challenging to detect in order to reveal any potential differences among the display conditions for supporting error detection.

The tunnel (HITS) should have the same configuration as investigated in the IFD HUD in Year 2.
The tunnel will be removed from the display at 450ft AFL.
The guidance cue ("white" circle) will appear in the ND at the same time. (This is actually a form of adaptive display technology to provide the right information at the right time.)

(2) Flight scenario (Due date extended to 4/13 – Kaufmann, Naylor)

Identify start position and points on trajectory at which events are to occur (e.g., clearance, guidance failures, clutter ratings, transition to hover, on set of brownout, decision height).
Scenario should also identify expected states of aircraft at each point (altitude, heading, speed).

Landing clearance will occur 1 min. into the trial.

(3) Guidance failure specification (To be completed by 5/1 – Kaufmann, Naylor, Arthur)

Failures will either occur early in the scenario (1.5 min. after the start of descent) or late (after 3 min.).

Failures will involve a deviation of the tunnel from the path defined by the LOC and G/S.

Failures will also be revealed by a shift in the direction of the flight trajectory in the ND from the predefined destination. (This will be a critical cue for pilots when the tunnel is not present in a display configuration.)

The deviation of the tunnel will occur over a period of 1 min. and to the extent of 1 dot on the LOC scale in the PFD.

As soon as a pilot detects a guidance system failure, the test trial will be halted and the clutter rating administered.

If a pilot does not detect the guidance failure, the trial will be halted when the tunnel reaches the maximum, programmed deviation from the flight path. The clutter rating will then be administered. (The pilot will be informed of the missed guidance system failure, as the display will be reset to "all normal" upon restart of the simulator.)

For specifying the guidance system failure, we need to determine:

the location of the aircraft (in DME from the pad) at 1.5 and 3 min. after the start of the descent;

the velocity of the aircraft at the same positions; and

the rate of deviation of the tunnel from the true flight path in order to achieve 1 dot on the LOC scale in 1 min.

Arthur will implement the guidance failures in the VISTAS simulator along with setting-up a hardware of software event marker.

Experimenters will need to mark the exact time at which a guidance failure occurs and the time at which a pilot detects the failure.

If a pilot does not detect a guidance failure, only the beginning of the failure will be marked.

(4) Cognitive task analysis (To be completed by 6/18 – Kaber, Kim, Naylor)

With respect to assessing the influence of "top-down" or contextual factors in pilot perceptions of display clutter, there is a need to specify the importance or relevance of each piece of information in the display in the various phases of flight (descent and hover) and to relate overall display relevance to pilot clutter ratings.

Two researchers will interview an expert V/TOL pilot and identify the functions of each piece of information in each phase.

Pilots will also be asked if any one piece of information is "relevant or irrelevant to a phase of flight" (binary response).

The pilot will then be asked to make pair-wise comparisons of the relative importance among all pieces of display information considered to be relevant in a particular phase of flight.

During these comparisons, the pilot will be reminded of the functional uses of each piece of information in a specific phase.

The results of these comparisons will be used as a basis for establishing relevance-weighting factors for each piece of information in each phase.

A total relevance factor will be established for each display by summing the relevance weights across pieces of information present in a display for a certain phase.

In the event that a display configuration includes a piece of information considered to be irrelevant by a pilot in particular phase, the relevance weight for the information established in the context of another phase of flight will be subtracted from the overall relevance score for the phase under study.

[There is a need to define a measure of the degree of irrelevance of each piece of information in a display in each leg.]

The total display relevance score will be analyzed in a correlation analysis with the overall clutter ratings from pilots and the clutter index values.

This procedure and analysis will be replicated with an expert FW pilot in order to the determine the relative importance of information features included in the IFD HUD in the Year 2 study for the various phases of flight.

The overall weighting factors for each display configuration in each phase will be analyzed in a correlation analysis with the overall clutter ratings from pilots and the clutter index values on a phase-by-phase basis

The clutter ratings and index scores for the HUD configurations investigated in Y2 are already available.

If the clutter index is robust to display, task and domain types, there should be similar correlation analysis results across the Y2 and Y3 studies.

If the display relevance scores across both years of research correlate with the perceived clutter ratings, this would serve as an indicator of the validity of the clutter measure for application to different aviation displays and flight conditions.

(5) Pilot briefing packet (To be completed by 5/15 – Kim, Kaufmann, Naylor)

Kim will use the notes prepared by Kaufmann on the VISTAS simulator review as a basis for developing a slide packet to introduce the subject pilots to the displays and controls.

Kim and Kaufmann will prepare outlines of the training and test procedures for inclusion in the subject pilot briefing packet.

One part-task training session will be conducted focusing on lateral input control.

Pilots will use the MANUAL + HdotAuto mode of simulator control – pilot control lateral inputs and autopilot controls sink rate.

A second part-task training session will be conducted focusing on pilot vertical input/deceleration control using the side-stick.

Pilots will use the AUTOPILOT + HdotMan mode of simulator control – pilot will control the deceleration of the aircraft and the autopilot will control the lateral position.

(In both part-task sessions, pilots will be required to control the aircraft velocity using the hat-switch on the side-stick control.)

A final training session will involve whole-task training in which pilots will be required to control both the lateral position and deceleration of the aircraft using the side-stick.

In general, because of the available experiment time, the training will be limited to three approaches.

All training trials will be completed under "VMC" (blue OTW) and all test trials will be completed under "IMC" (black OTW).

Kim, Kaufmann and Naylor will prepare an outline of the duties of the PNF during the experiment for briefing the test pilots.

(6) Brownout condition modeling (To be completed by 5/15 – Arthur, Williams):

There was agreement among the team members on the modeling of brownout in the simulation.

(Hover phase will start at 250ft AFL.)
Go-around condition - Starting at 150 ft. with 5% opacity and transitioning to 100% opacity by 100ft.
Land condition - Starting at 150 ft. with 5% opacity and transitioning to 50% opacity by 100ft.

(Models assume all landing decisions must be made at EVS minimums of 100 ft AFL.)

(7) Models of ground objects (Due date extended to 5/1 - Kim)

Naylor noted that there must be a clear visual cue from the ground for pilots to land (some visible object).
Kaufmann noted in the VISTAS simulator review that some ground features are needed as visual references in addition to the current landing site visual.

On the landing site features, what are more typical helicopter landing site markings? (Kim to discuss with Naylor)

Kim to convert graphical objects developed in 3DS Max to FLT file format using MultiGen Creator.

Kim to define bearing and range of objects relative to Apollo 15 landing site.

(8) Response measures (To be completed by 5/15 - Alexander, Stelzer, Kim)

Surveys and subjective rating forms will be prepared by Aptima, including a pilot background survey, clutter rating forms for the test trials, and an open-ended questionnaire for post-experiment administration.

The VISTAS simulator will automatically record pilot performance measures, including LOC and G/S deviations and side-stick lateral and front-to-back inputs.

- The update rate of the displays is currently set to 20Hz.
- A single simulation update rate and recording rate must be used.

Experimenters will need to make manual observation of:

- the number of times LOC and G/S deviations beyond 1 dot occur during test trials; and
- the number of times test trials that are terminated due to full-scale deviations in LOC or G/S.

Kim will prepare another recording form for this data collection.

(All forms should provide fields including subject and condition identifiers.)

The team decided not to collect workload ratings this year due to the observed insensitivity of experienced pilots to the flight workload manipulations in the Y2 study.

- The Y3 study will involve only highly experienced FW pilots.
- Forgoing the workload rating recording will also reduce overall experiment time.

(9) Case identifiers (To be completed by 5/8 - Kim)

Kim will develop a numeric code system to represent each unique experiment condition.

The conditions to be represented by the code will include SVS, EVS, Tunnel, guidance failure type, and brownout condition.

The draft code system will be presented to Arthur for review and implementation.

(10) Checkout participation (5/15 - All)

All persons participating in actual experiment will need to attend.

Stelzer and Alexander are both available.

All NCSU team members are welcome to attend.

(Note: In order to conserve on travel funds, only one vehicle will be used for this trip.)

Team will run through experiment procedures:

Sample pilot briefing

Sample training session [includes simulator configuration testing]

Sample test sessions [includes simulator configuration testing]

Sample post-experiment interview and debrief.

(11) Experiment schedule and staffing (6/1-6/12 - All)

Two weeks of testing.

2 pilots/day, 4 days/week = 16 subjects

Primary experimenter – Pilot briefing, case specification for each trial, ATC role play, halting test trials, subjective rating form administration, manual observations on performance, post-experiment interview, debriefing.

Kaber – 6/1-2

Alexander – 6/2-4

Kaber – 6/8-10

Stelzer – 6/10-11

Confederate PNF – Directing training session, serving as PNF during all test trials.

Naylor – 6/1-4

Naylor – 6/8-11

(Kaufmann – Committed to GSRP and ACM-DAS studies.
Kim – Graduation and possible employment outside NCSU.)

Lets have our next team meeting on May 1 from 3:30-5:00p. Let me know your availability.

Dave Kaber