

Everyone –

Below are my notes on the activities we accomplished as part of the “checkout” and the resulting action items. Most importantly, we have planned to run the updated VISTAS software in the Ergonomics Lab at NC State to verify the pilot training and testing can be completed within a 4 hr. period. I anticipate doing this on 5/22. We have also planned to complete the pilot briefing packet by 5/22 for distribution. We are awaiting still images from NASA for this purpose.

(1) Integrated PFD and ND display

All PFD and ND symbology was changed to green in color to more closely model the HUD displays investigated in the IFD in Y2.

The actual acceleration cue in the ND was changed from a blue circle to a small green circle.

The commanded acceleration cue in the ND was changed from a white circle to a large green circle.

The brown, textured terrain model was removed from the SVS condition.

The baseline PFD background was changed from a brown terrain and blue-sky representation to a completely black background like a HUD display. (The waterline was retained.)

The PFD was modified to present a black background under all display information feature conditions.

NASA added flight path guidance cues to the display, including a chevron representing the commanded path and an open triangle representing the actual path.

These cues were included to better reveal an early phase guidance system failure for pilots when the tunnel when is absent.

These actions are in-line with the experiment objective of validating the sensitivity of the new clutter measure to various cockpit display conditions under an alternate flight scenario and when flying a different type of craft. That is, the display concepts have been “held fixed” from Y2 to Y3 and we are only changing the nature of the flight task and system.

(2) Out-of-cockpit view

The 50% brownout condition was increased to 85% as the decision to land at 50% did not appear to require pilots to critically inspect the view.

(The brownout setting in the experiment trial condition tables needs to be changed from 50% to 85%.)

The elevation of the maximum opacity under the 100% brownout condition was increased to 110 AGL. The reason for this is that the landing site appeared visible with 100% brownout just prior to 100 ft AGL, when pilots were attempting to make their landing decision. Directly subsequent to 100 ft AGL, the ground cues were not visible.

(3) Experiment conditions

[Identifiers]

It is important for the experimenter, simulation operator and PNF to be aware that brownout will never occur in Phase 1 of a trial. Therefore, the third digit of a case identifier for Phase 1 will always be "0".

It is important for the experimenter, simulation operator and PNF to be aware that guidance failures will never occur in Phase 2 of a trial. Therefore, the second digit of a case identifier for Phase 2 will always be "0".

[Guidance failures]

The maximum lateral deviation for both early and late failures was adjusted to 2 dots over a 1 min. period.

The sensitivity of the LOC deviation indicator changes between the descent and hover phases.

The full LOC scale in the hover phase now represents 180 ft. or six times the width of the pad.

[The LOC and G/S sensitivity information for the descent phase needs to be included in pilot briefing packet.]

(2) Pilot briefing packet

A close-up picture of the side-stick needs to be included in the experiment briefing packet.

The hat-switch for the thrust (or rate of descent control) needs to be labeled. The left button, which re-cages/centers the tunnel in the display also needs to be labeled.

The right button, which toggles the PFD viewpoint needs to be labeled.

It should be noted in the briefing packet that pressing both buttons at the same time aligns the PFD waterline in the vertical center of the display.

Pilots should be informed that when the tunnel guidance is present in the PFD it points to the pad/landing site marker. When the tunnel is not present, the pad represents the tunnel guidance.

[This is important because when pilots need to detect for a guidance system error when the tunnel is not present, if they are flying the localizer, any deviation between the flight path vector and the landing site marker will be their cue to a system failure.]

Pilots should be instructed during coverage of the briefing packet that they can request the PNF to provide altitude callouts (as desired) and to advise of LOC and G/S deviations during trials.

The Roles and Responsibilities slide of the packet should be modified to reflect this.

(3) Training runs

[Initial training briefing]

An experimenter in the briefing room will give this across the hall from the VISTAS simulator.

An experimenter will use pictures of displays and controls when describing how the simulator works and the setup for each training trial.

(Throughout the training scenario document the terminology “white circle” needs to be changed to “large green circle”. The terminology “blue circle” needs to be changed to “small green circle”.)

The PNF will begin interacting with a test subject when they enter the VISTAS simulator room.

The PNF will read the training trial scripts to the test pilot.

The PNF will provide the same set of instructions to all pilots in each trial.

The case identifier for the first and second training trials should be 1004. This should be noted in the training scenario document.

The case identifiers for the third trial should be 1004 and 3014.

[The pilots should not experience a guidance system failure during the training trials to ensure they are perceived as completely novel events in the first test trials.]

[1st trial]

The first training trial will focus on pilot control of the thrust (rate of descent) using the hat-switch on the side stick controller. (They will not control fore/aft stick motions for acceleration or lateral stick motions for lateral path control. The simulator will automatically control the lateral flight path.) A forward push of the hat-switch increases descent rate. A rearward push of the hat-switch decreases descent rate.

In the training trials, pilots should focus on keeping the altitude bug setting in-line with the altitude marker on the display tape.

They should also be aware of the thrust control lag as revealed through the difference in position of the VSI arrow indicator and the target circle indicating the commanded VSI.

The pilot should achieve 0 VSI at the top of hover while the lateral and forward position of the vehicle is stabilized over the pad.

The pilot should be reminded that each push of the hat-switch increases or decreases descent rate by 30 ft/s. In the hover phase the pilot should push the switch no more than 5 to 6 times to achieve a descent rate.

During the first training trial, the pilots should be informed that the control inputs the autopilot makes will be reflected through the side-stick controller. They should hold their hand on the controller to feel the magnitude of the fore/aft and lateral control inputs that may be necessary in the approach.

The pilots should also be instructed to make note of any correspondence between their thrust control actions and the longitudinal inputs the autopilot makes at the stick.

[2nd trial]

The second training trial will focus on pilot control of the lateral flight path and the simulator will automatically control the thrust for the proper rate of descent to achieve the glideslope.

[3rd trial]

In the third training trial, pilots will be required to manually control the thrust of the craft, the lateral path and acceleration.

They should be reminded that the hat-switch controls the thrust and that fore/aft movements of the stick correspond to acceleration and deceleration. They should focus on keeping the air speed bug setting in-line with the speed marker on the display tape using fore/aft stick movements.

They should focus on maintaining the LOC using lateral inputs.

Pilots should be informed that they can fly the guidance by making small left/right nudges of the stick to keep the flight path vector in the center of the tunnel.

At this time, they should be reminded that the LOC represents true information and that the tunnel is driven by on-board guidance data.

(We may want to inform pilots that the only reason why lateral inputs may be needed in the approach is due to pilot-induced lateral perturbations with the stick when controlling acceleration.)

Again, the pilots should focus on keeping the altitude bug setting in-line with the altitude marker on the display tape by using the hat-switch.

Pilots should be informed that the acceleration cues will appear in the ND at approximately 0.5 DME from the landing site.

It should be noted for pilots that in the transition to hover, the G/S deviation indicator will go to full-scale deflection because the vehicle is not descending fast enough relative to the glideslope.

At 100 ft AGL, pilots should be reminded that they need to verbalize their landing decisions based on whether they can see ground cues through the out-of-cockpit view.

[During the checkout, the experimenters noted that the language in the initial training scenario description was quite complicated and should be revised in laymen's terms.]

(4) Test condition runs

The test conditions that were viewed during the checkout included A-1 – A-8. All modified displays were correct according to the experiment design.

The test conditions that were run during the checkout included:

1208 – early, left, fully loaded + 3028 – Phase 2, early, 100%, fully loaded

1101 – early, right, baseline

1105 – early, right, SVS only

1102 – early, right, TUNNEL only

2102 - late, right, TUNNEL only + 4022 – Phase 2, late, 100%, TUNNEL only

2101 – late, right, baseline

2105 – late, right, SVS only

2208 – late, left, fully loaded

The PNF will callout LOC and G/S deviations of 1 dot or greater during the descent phase of the test trials (prior to 0.5 DME from the landing site).

If full-scale deflection occurs for either LOC or G/S (outside 0.5 DME from touch-down), the diamond deviation indicator will turn “orange” and the test trial should be terminated and restarted from the beginning of the descent.

During the hover phase of test trials, the PNF will watch for forward or aft velocities of 4 kts or pitch/roll of 20 degrees or greater. If any of these conditions occur, the trial will be reset and the pilot will start again from the beginning of the hover phase.

(5) Activities of experimenter, simulation operator and PNF

If the PNF calls out LOC and G/S deviations during trials, the experimenter must record these manually.

If the PNF resets and trial during the descent or hover phases due to pilot error, the experimenter must record this on the manual observation sheet.

The PNF must press the “confirm” button on the cockpit tablet PC display to record when a pilot detects a guidance failure.

The experimenter or PNF must reset the simulator after a guidance failure is detected or 1 min. of travel time elapses past the DME set for the failure (2.39NM or 0.9NM).

The experimenter should use a stopwatch to track the travel time from the onset of a failure up to 1 min. Once 1 min. has elapsed the experimenter should call “reset” or “hold”. (We may want to preserve the last display image on screen for pilots to refer to during the clutter rating.)

The experimenter must convey to the simulation operator the correct case identifier for Phase 2 of the trial and the simulation is resumed.

(6) Performance measures

The team needs to determine the sampling rate for the performance measures collected during the simulation runs. The maximum recording rate is 20HZ.

Is this necessary for our analyses?

Action items:

- Revised VISTAS software from NASA to NC State (Arthur, Williams - 5/21)
- Revise training scenario (Naylor, Kaber - 5/21)
- Run pilot tests to establish experiment time/subject (Kaufmann, Naylor, Kim - 5/22)
- Still display images from NASA for pilot briefing packet (Arthur, Williams - 5/21)
- Completed pilot briefing packet (Kim, Kaber - 5/22)
- Experiment forms for all subjects (Alexander, Stelzer, Kim - 5/29 COB)

Let me know if you have any additions or questions on these lists. If necessary, I will schedule another team meeting or telecon before the data collection period from 6/1-6/12.

Dave Kaber