Abstract
The goal of the Information Presentation Directed Research Project (DRP) is to design context questions related to the presentation of information to the crew. The major areas of work, or subtasks, within this DRP are: 1) Displays, 2) Controls, 3) Electronic Procedures and Fault Management, and 4) Human Performance Modeling. This DRP is a collaborative effort between researchers at Johnson Space Center and Ames Research Center.

Visual displays
Label Alignment and Label-Value Distinction
The purpose of the FY08-FY09 studies was to investigate the effects of label orientation and label alignment on visual search. FY08 studies looked at the effect of label orientation, alignment, label length, and wrapping of text on visual search in various display group sizes. To inform development of best-practice guidelines for label formatting, the study in FY09 examined the effects of the visual distinction of labels and values, label length, and label alignment on visual search times.

Auditory displays
Alarms
In this study alarms currently in use with NASA flight deck displays and proposed candidate alarms have been evaluated. Eleven non-crew and 3 crew subjects were asked to rate six candidate alarms in comparison to the current alarm for each category of alert use: caution, warning, fire/smoke, and depressurization. Five of the candidate alarms were based on the standard alarm or a runner-up alarm sound from previous studies. The sixth sound included a speech component that gave specific information about the situation. The sound of choice for each category was then rated on perceived urgency level, overall satisfaction, and the perceived value of a potential speech component. The results show that the use of a speech component is preferred by both crew and non-crew.

VIBROVOX: Evaluation of speech communications under simulated launch vibration (0.7 g)
The potential effects of extreme acceleration and vibration during Ares-I launch scenarios may impact the crew’s speech production. We studied the effect of 0.5 and 0.7 g whole body vibration on the speech production of words (using the standardized Diagnostic Rhyme Test word list). Six subjects were recorded in a supine position using a specially designed chair and vibration platform. Vocal warbling, pitch modulation, and other acoustic distortion were observed.

The effect of vibration can be seen by comparing the right and left halves of the graphs below. Under vibration, the voice’s temporal waveform becomes “rougher” due to the addition of higher frequency vibrations and greater amplitude modulation. In the spectral plots (bottom), these effects correspond to interruption of the horizontal red and yellow lines (representative of acoustical energy at specific frequency regions). This temporal and spectral distortion under vibration results in perceptual effects (e.g., vocal warbling, pitch modulation) that may impact intelligibility.

Fault management studies
We analyzed eye-movement data (collected during a previous human-in-the-loop Fault Management study) at a more granular level. This allowed us to subdivide originally identified “regions of interest” into more specific “areas of interest” corresponding to individual display elements, such as edge-key labels. We then used the temporal sequences of fixations to these areas of interest as input to develop a visualization tool. This tool allows us to visualize (given the current area of interest), the likelihood that each area of interest will be the next fixation target.

The visualization tool’s next-fixation likelihoods, given the operator’s current fixation (yellow bar) on the velocity tape of the Primary Flight Display (PFD). The operator is most likely to fixate next on the PFD’s altitude tape (34.1%) or the g-meter (20.6%).

This tool feeds into SHFE’s multi-year research effort to develop a human performance model capable of predicting completion times and completion accuracy for a wide variety of targeted spacecraft tasks, with a wide variety of user interface and human/machine functional allocation choices. The analyses of operator information acquisition patterns at this more detailed level, along with the ability to visualize those patterns, are enabling direct empirical comparisons between the information acquisition strategies of human operators and the strategies generated by the human performance model, as currently configured. Ongoing identification of systematic discrepancies between model-derived patterns and operator-derived patterns are informing and shaping model development efforts in 2010 and beyond.