**PURPOSE**

The goal of the Information Presentation Directed Research Project (DRP) is to address design questions related to the presentation of information to the crew on flight vehicles, surface landers and habitats, and during extra-vehicular activity (EVA). Designers of displays and controls for exploration missions must be prepared to select the text formats, label styles, alarms, electronic procedure designs, and cursor control devices that provide for optimal crew performance on exploration tasks. The major areas of work, or subtasks, within the Information Presentation DRP are: 1) Controls, 2) Displays, 3) Procedures, and 4) EVA Operations.

**CONTROLS – Cursor Control**

The unique environmental challenges encountered by crewmembers on space missions (vibration, partial gravities, vacuum requiring pressurized suits) translate into special design requirements for crew interaction with information presented on computer displays. Cursor control devices (CCDs) must be specially designed to function under the variable, harsh conditions of space.

**Partnership with Stakeholders:** The cursor control device work described below has fed and supplemented concurrent work on Orion cursor control device design. Results of these studies have led Orion device down selection, and software developed for this effort is being used for Orion cursor control device evaluations.

**Text battery (Status – beta complete; revisions in work)**

One of the first goals of the IP project was to develop a computerized text battery that could be used to evaluate a number of different types of cursor control devices. The text battery provides a standard methodology for measurement, and will be of use to any researcher interested in evaluating cursor control devices.

A collection of 7 tasks assessing CPG coding and dragging time and accuracy. Many of the tasks are based on ISO-XXX.

**Glazed cursor control device evaluation**

Four devices were evaluated using the Text Battery, with and without EVA gloves: an aircraft trackball, a Logitech trackball, and a Hulapoint mouse. Recommendations for usability with a gloved hand were developed based on the results.

**Cursor movement study**

In addition to investigating cursor control device hardware, the behavior of the cursor on the computer screen is an area of investigation as well. An upcoming study will experimentally compare task performance with a cursor in the following modalities: continuous, discrete, gravity well. Later studies will examine advantages and disadvantages of type of cursor movement under different environmental conditions: vibration, microgravity. These studies will provide recommendations for cursor movement under different environmental conditions.

**DISPLAYS – Label orientation**

Display designers sometimes have to use vertical text when real estate is limited. The goal of this research is to examine the impact of different styles of vertically oriented text using short words, acronyms, and abbreviations.

**Test battery**

Test battery provides a standard methodology for measurement, and will be of use to any researcher interested in evaluating cursor control devices.

**Pressurized glazed cursor control study**

A study was performed in collaboration with the Orion Concept Validation Group using EVA gloves in a pressurized glovebox at JSC. Additional conclusions were developed to feed forward into the design of a cursor control device for Orion.

**Display Format Standards document, as well as other Constellation documentation (HSIR, HIDH).**

**PROCEDURES**

- An Electronic Procedure Viewer (EPV) is one of the most operationally critical interfaces for non-generation crewed space vehicles, particularly for man-in-the-loop hard and recovery Operations.
- We recently completed a human-in-the-loop evaluation of two fault management concepts, one (BESSI) where the EPV is functionally integrated with an advanced Caution and Warning (CAW) System, and another less advanced concept (ELSY) with no functional connections between the EPV power and the EPV.
- ELSIE Fault management display at the outset of Procedure Navigation.
- Participants made fault diagnoses by interpreting information from CAW fault messages (well left section of display) colored error indications in system summary display (upper right section of display) and list of faults found in EPV.
- Fault management display shows the point where participant has diagnosed malfunction and is awaiting to work procedures through the EPV.
- ELSIE Fault Management Display at the outset of Procedure Navigation. Advanced Caution and Warning System interfaces include “Root Cause” where automated fault diagnosis is provided. Magnetic box highlights system component associated with automated diagnosis. scrollable list of faults available for verification of automated diagnosis of malfunction.
- Fault management display shows the point where participant has accepted and selected the automated diagnosis, which has automatically brought up the appropriate checklist in the EPV.
- Number of steps reduced compared to ELSI due to automated checks for sensor failures.

**DISPLAYS – Label alignment**

Vehicle displays are often made up of many columns of labeled data values. Design decisions on alignment of these columns of data have significant effects on the user. The goal of this study was to evaluate and supplement concurrent work on Orion label alignment standards.

**Impact**

Results from these studies will form display standards for the Orion Display Format Standards document, as well as other Constellation documentation (HSIR, HIDH).