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 activities (EVA). Designers of displays and controls for exploration missions must be prepared to select the text formats, label styles, alarms, electronic procedure subtasks, within the Information Presentation DRP are: 1) Controls, 2) Displays, 3) Procedures, and 4) EVA Operations.

CONTROLS – Cursor Control

The unique environmental conditions encountered by crewmembers on space missions (vibration, varied g-levels, vacuum requiring pressurized T-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 definitions. Results of these studies have led Orion device down-selection, and software development for the effort being using the Orion cursor control device evaluations.

Text battery (Example – partly complete; revisions in work)

One of the first goals of the IP project was to develop a controlled text battery that could be used to evaluate a number of different types of cursor control devices. This text battery provides a standard methodology for measurement, and will be in use in any researchers interested in evaluating cursor control devices. A collection of 7 texts containing 100 words, and 200+ words text studies were developed to feed forward into the design of a cursor control device for Orion.

Gloved cursor control device evaluation

Four devices were evaluated using the Text Battery, with and without EVA gloves – an aircraft trackball, a Logitech trackball, a Logitech mouse, 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 ongoing study will experimentally compare task performance with a cursor in the following conditions: continuous, discrete, gravity well. Later studies will examine advantage 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.

RESULTS - Cursor Control

- Wrapped labels are responded to more slowly than unwrapped labels.
- Wrapped labels also had lower hit rates than unwrapped labels.
- Short labels were responded to faster than long labels.
- Left-aligned data were responded to faster than right-aligned data.

Additional studies need to be done to further evaluate vertical text styling, incorporating more complex displays, additional practice, and time pressure.

DISPLAYS - Label alignment

Vehicle displays are often made up of many columns of labeled data values. Design direction on alignment of these columns of data values is in the details. The goal of this study was to evaluate the impact of alignment on ease of reading on vehicle displays, especially in the harsh lunar environment.

RESULTS - Label alignment

- Left-aligned data were responded to faster than right-aligned data.
- Left-aligned data also had higher hit rates than right-aligned data.
- Short labels were responded to faster than long labels.
- Data from these studies will form display standards for the Orion Display Format Standards document, as well as other Constellation documentation (HIVS, HIDS).

DISPLAYS - Auditory alarms

The goal of this study was to investigate the use of auditory alarms to alert the crew to fault management reporting of system events using suitability ratings.

RESULTS - Auditory alarms

- The use of auditory alarms is effective in alerting the crew to potential issues.
- Crew participants are currently being run in the Lab with the test audibility.
- Each participant is currently being run in the Lab with the test audibility.

EVA OPERATIONS

Working in extravehicular activity presents great challenges in terms of displays, controls, and suit informatics, especially in the harsh lunar environment. This is a new subject for FY19.

Work will be completed in the areas of:
- suit display design
- visor heads-up and line-of-sight control during EVA operations
- visor eyes and auditory displays