**INFORMATION PRESENTATION**

**Human Research Program - Space Human Factors & Habitability**

**Space Human Factors Engineering Project**

**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 activities (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, and others, within the Information Presentation DRP are: 1) Controls, 2) Displays, 3) Procedures, and 4) EVA Operations.

**AUTHORS**

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**CONTROLS – Cursor Control**

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

**Display with Strokes:** The cursor control device work described below has led to supplemental concurrent work on Orion cursor control device evaluations. Results of these studies have aided Orion device down selection, and software developed for this effort is being used for Orion cursor control device evaluations.

**DISPLAYS - Text Orientation**

Text orientation matters. Text on computer displays must be easy to read in a variety of orientations, in general, utilizing the above accepted principles of optimal reading orientation. The major areas of work, and others, within the Information Presentation DRP are: 1) Controls, 2) Displays, 3) Procedures, and 4) EVA Operations.

**PROCEDURES**

- **An Electronic Procedure Viewer (EPV)** is one of the most operationally critical interfaces for next-generation crewed space vehicles, particularly for maximum fault isolation and recovery operations.
- We recently completed a human-in-the-loop evaluation of two fault management concepts, see (BES) where the EPV is functionally integrated with an advanced Caution and Warning (CAW) System, and another less advanced concept (ELSIE) with its functional connections between the EPV viewer and the CAW system.
- The EPV was designed with a variety of fault management displays, including the root cause list, which is a critical tool for the crew to identify the cause of the failure and take appropriate actions to correct it. The EPV also provided a graphical interface for the crew to follow the steps of the procedure checklist.
- The EPV was evaluated in a series of experiments using a simulated space mission environment. The results of these experiments showed that the EPV was effective in supporting crew performance and decision making.

**DISPLAYS - Label alignment**

- **Label alignment**
  - Auditory alarms
  - Visual alarms

**DISPLAYS - Auditory alarms**

The goal of this study was to investigate and develop human factors design guidelines and interface strategies for auditory alarms in space exploration environments. The study used a variety of auditory alarm scenarios and evaluated the effects of different alarm characteristics on crew performance. The results of this study will be used to inform the design of auditory alarms for future space missions.

**EVA OPERATIONS**

Work in spacecraft, and in extreme environments, presents great challenges in terms of visual displays, controls, and situational awareness, especially in the harsh lunar environment. This is a new world for FY19.

Work will be completed in the areas of:
- EVA display design
- Lunar lander and EVA vehicle control during ground operations
- Interface design for EVA activities.