



HUMAN HEALTH AND PERFORMANCE

Exploring Space | Enhancing Life

Human-In-The Loop Evaluations

Collaborative Evaluation for Optimized Design

Early and iterative human-in-the-loop (HITL) evaluations:

- Reveal design and integration problems, and opportunities for cost efficient improvements
- Extend the design process beyond 2D modeling to include interactive 3D human task performance
- Spearhead verification planning

Focused HITL evaluations leading to design improvements:

- Displays & Controls
- Seat design, ingress and egress
- Crew vehicle egress & survival operations
- Stowage
- Habitability & environmental systems
- Net Habitable Volume
- Hatches & hatch height
- Equipment access and use



Johnson Space Center

Human Engineering: Example Success Stories

Displays and Controls: HITL testing of the display formats occurs continually to ensure successful crew interaction for the breadth of tasks required. Significant work on display colors has resulted in a suite of displays that can be successfully operated from multiple orientations. All hand controllers have undergone extensive testing to ensure that all controls are operable under the conditions required.

Hand controller placement: HITL testing identification of in-board suited hand controller interference resulted in a design change to the mounts to eliminate the interference.

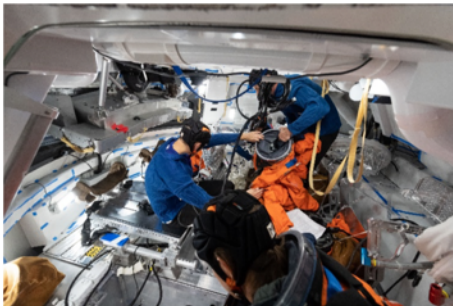
Legibility: HE developed a new legibility method that is affordable for the Orion program and uses real flight-like displays, and validated the method through HITL testing. The HITL testing also led to identification of a glare issue that has since

been resolved through revised light locations. Legibility testing under Orion ascent vibration levels was conducted to determine whether the crew could read the ascent displays. HITL testing has also led to identification of lighting levels for the console backlighting and LED indicators to support different phases of flight and operations, including sleep.

Net Habitable Volume: HITL testing has led to development of hardware improvements around the cabin to support on-orbit operations, including restraints, radiation shelter concepts, exercise feasibility, and hygiene operations.

Vehicle egress: HITL testing has improved the efficiency with which the crew can safely egress the capsule, through modifications to hardware placement and operability.

Docking hatch operations: Build-up and evaluation of the docking hatch opening and partial egress testing has led to significant changes in the tunnel and on the hatch.



Net Habitable Volume Configuration



Vehicle Ingress Egress



Displays and Controls



For the benefit of all

For more information:
NASA Human Health and Performance Directorate
www.nasa.gov/hhp/

Point of Contact:
Kristine Ohnesorge
kristine.k.ohnesorge@nasa.gov
281.483.1101