HEADS-UP DISPLAY TECHNOLOGY FOR DEEP-SPACE SPACEWALKS

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Introduction: The UC Davis Human/Robotics/Vehicle Integration and Performance (HRVIP) Lab is part of the NASA REVEALS SSERVI. The objective of the current research is the design and testing of a helmet-mounted display for spacesuit helmets that astronauts will use to monitor essential real-time data, such as their exposure to radiation during Extra-Vehicular Activities (EVAs). Real-time radiation levels will be measured from multiple dosimeters (also developed by the REVEALS SSERVI) on the spacesuit and the user display will show both the current and cumulative radiation dosage levels upon user prompting.

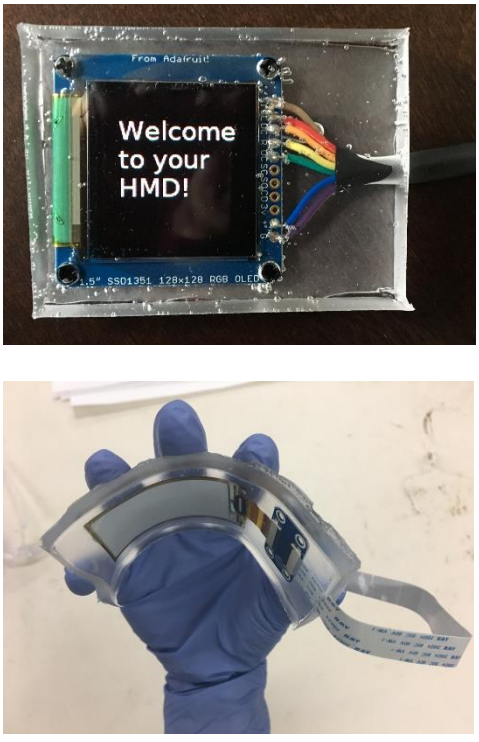
A heads-up display has never been incorporated into US spacesuit design, and so the current research must consider all aspects of real-time display technology:

- External display materials – readability, display latency, display optical properties, reliability, power requirements, waste heat generation and transfer.
- Helmet-mounting considerations such as surface bonding and display removal, flexibility for mounting on curved surfaces, wiring paths, power and data supply.
- Computational/software development to generate, transmit, and refresh display data, microcomputer programming, mounting, and redundancy/reliability.
- Human factors considerations such as display focal distance from the EVA astronaut's eyes, display information design, display-mode commanding method (voice-commanding vs manual switching), and size/location of display within field-of-view (direct-gaze data reading vs caution/warning peripheral signaling).

To approach these many aspects of an EVA Heads-Up Display, UC Davis has partnered with the NASA JSC EVA Office to develop pilot studies of display-technology candidates, to be tested underwater in the JSC Neutral Buoyancy Laboratory.

Underwater testing brings a host of additional engineering challenges, such as water-proofing the display, electrical, and microcomputer elements, affixing the display to the Extravehicular Mobility Unit (EMU) helmet visor, and performing extensive subsystem testing prior to in-suit human subject testing underwater.

The proposed presentation will include a detailed project plan for underwater testing at JSC, as well as current progress on all of the development challenges listed above. The presentation (via remote video) will include a live demonstration of the display technology.



REVEALS rigid (top) and flexible (bottom) EMU helmet display and driver electronics encased in waterproof housing for underwater testing at NASA Johnson Space Center.