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National Aeronautics and Space Administration

Crew Interface Rapid Prototyping Lab (RPL)

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EXECUTIVE SUMMARY

As part of the Astronaut Office, the NASA Rapid Prototyping Lab (RPL) has been designing crew display and control interfaces since the Shuttle Cockpit Avionics Upgrade (CAU). RPL is adept at using immediate feedback and close collaboration between crew, contractors, and NASA partners to rapidly prototype effective, innovative cockpits. Our work includes:

- Prototype displays and controls for Orion, Gateway, and HLS programs
- Astronaut-vetted software interface designs
- Documentation services
- Hardware prototyping and fabrication

INNOVATION

Common Crew Display & Control Interfaces Across Spacecraft Cockpits

The RPL rapidly prototypes spacecraft crew display & control designs in partnership with key stakeholders from the crew office, flight control and prime contractor, to human engineering, safety and others.

The RPL tests designs early, often, and inexpensively to build the best display & control interfaces. This process also serves as a requirements refinement tool, putting words into action by way of flight similar evaluation experiences to better validate the requirement.

An RPL goal is to facilitate "commonality" of crew display & control interfaces as crews move between different vehicles, including Orion, Gateway, Lander, Suits, Rover, and Habitats.

The RPL takes advantage of new technology while ensuring a common operational look & feel to ensure good SA, minimize crew errors, reduce workload as well as training time and cost.

COLLABORATION

1. U.S. Air Force Test Pilot School
2. U.S. Navy Test Pilot School
3. U.S. Space Force Test School
4. U.S. Naval Academy (Annapolis)
5. U.S. Military Academy (West Point)

Collaborating test pilots and systems personnel provide unique insights gained from flying high performance aircraft that is applied to prototype spacecraft interface designs.

In return, the participants gain experience with the unique rapid prototyping techniques of the RPL, and get exposure to human spaceflight.

U.S. Navy Test Pilot School

U.S. Space Force Test School

Rapid Prototyping Lab

OUTCOMES & INFUSION

1. Pioneered Electronic procedures to reduce crew workload, prevent entire classes of crew errors, and save training time & money
2. Prototyped all 63 Orion Crew Software Displays
3. Infusing common Orion Display & Control design into every Gateway display element
4. Designed lower cost RHCs, THCs, CCDs, and hardware display units (DUs) that are used all over the Orion program from RPL, to Bldg. 5, Bldg. 9, LM and others
5. Hardware experience gained has been used to design & build LTV GTU prototype display units

Orion Program

Prototyped Orion's glass cockpit, combining subsystem displays, Caution & Warning, and a myriad of hardware controls into software crew interfaces. Pioneered Electronic Procedures (eProc), which are crew flight procedures fully integrated with the display software suite.

Gateway Program

Currently designing crew software interfaces with an eye toward ensuring common human interfaces between Gateway and Orion. Built the prototype design of the HALO Interface Panel (HIP).

HLS Programs

Provided feedback to multiple teams building Artemis HLS cockpits. Realized the design concepts of our partners while considering ways to integrate with Orion and Gateway.

FUTURE WORK

1. Complete steps toward final FSW verification of Orion crew display software
2. Support FOD with software tools, display and eProc checkout, and lesson development
3. Prototype Gateway crew software displays and evaluate with crew and other stakeholders
4. Provide HLS programs with requested crew display software and hardware designs
5. Pursue and prototype cockpit display interface commonality across entire Artemis enterprise, including landers, rovers, suits and habitat

DAA# 20230017815

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