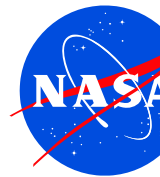


Foot Pedals for Spacecraft Manual Control



PROJECT MANAGEMENT

Stanley G. Love (CB and YA), Lee M. Morin (CB), and Mary McCabe (EV)

Phone: 281-244-2618 ; e-mail stanley.g.love@nasa.gov

PROJECT OVERVIEW

Fifty years ago, NASA decided that the cockpit controls in spacecraft should be like the ones in airplanes. But controls based on the stick and rudder may not be best way to manually control a vehicle in space. A different method is based on submersible vehicles controlled with foot pedals. A new pilot can learn the sub's control scheme in minutes and drive it hands-free. We are building a pair of foot pedals for spacecraft control, and will test them in a spacecraft flight simulator.

RELEVANCE/ VALUE TO NASA

Engineers at JSC are now designing the cockpits of future spacecraft. A novel scheme for manual vehicle control may be of great value for their work.

OBJECTIVES & OUTCOMES

- Mechanical fabrication of the first prototype (four control axes) is now in work. Electronics fabrication is complete.
- The first prototype will be complete and available for simulator "test flights" by September 2012.

INFUSION POTENTIAL

- This project is directly applicable to the Flight Deck of the Future, the Multi-Mission Space Exploration Vehicle, and other JSC future vehicle projects. If successful here, it could find wider application in commercial spaceflight.



The DeepWorker 2000 submersible is a simple and successful vehicle that uses foot pedals for 4-axis motion control.

Pedals, articulation mechanisms, centering mechanisms, and microswitch wiring harnesses for this project as of July 9.



NASA TECHNOLOGY AREA ROADMAP

This project aligns with the following NASA Technology Area Roadmap areas:

- TA 06-12, Human Health and Performance.
- TA 04-9, Human-Systems Interfaces.

PROJECT DEVELOPMENT SCHEDULE



Project Start TRL (1-9): 6 (marine environment)
Current TRL (1-9): 6 (spacecraft simulator)

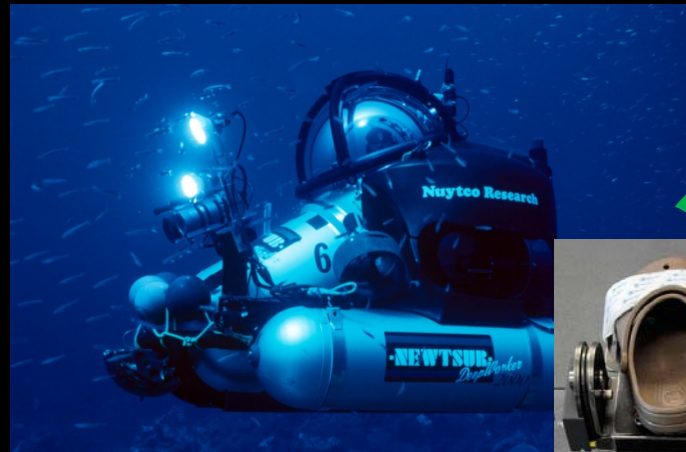




211



211



Fly with your Feet 90 second elevator pitch

Fifty years ago, NASA decided to hire test pilots as astronauts and design the cockpit controls in spacecraft to be like the ones in airplanes. But controls based on the old stick-and-rudder rotations in roll, pitch, and yaw may not be best way to manually control a vehicle in space.

A different method comes from the Deep Worker submersible craft. Like real space vehicles, it moves primarily in translation: forward and backward, left and right, up and down. Its controls are nothing like those of an airplane: you drive it with your feet.

The controls are so simple and intuitive that a person with no experience can learn them in minutes and solo safety on the first mission. Compare that to the months of training required to master an airplane! Foot controls have another advantage. They leave the operator's hands free for other tasks, which are becoming ever more numerous as modern cockpits fill up with gadgets.

We have built a pair of foot pedals articulated for six-axis vehicle control, and are preparing to test them using existing spacecraft flight simulators.

The tests will determine which foot motions should correspond to which spacecraft motions, and will gauge the effectiveness of foot controls compared to hand controls.

As it stands today, this technology could improve the cockpits of future spacecraft. If developed further, it could inspire a new generation of sophisticated video games, enable people with upper-limb disabilities to operate cars and other machines, and improve operations of a wide range of remotely-piloted vehicles.