

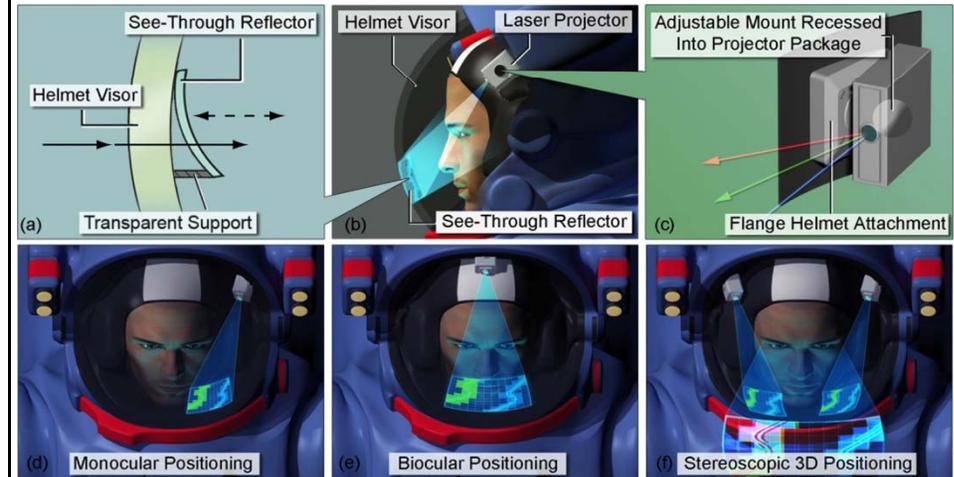
Projection/Reflection Heads-Up Display

Physical Optics Corporation
 1845 W. 205th St., Torrance, CA 90501-1821
 Proposal No.: **12 - H 4.0 2**

Identification and Significance of Innovation:

To address the NASA need for an EVA information display device, Physical Optics Corporation (POC) proposes to develop a new Projection/Reflection Heads-up Display (Pro/Ref-HUD) based on innovative integration of laser projectors and optics. This approach incorporates miniature full-color laser light sources and low-profile narrowband reflective, see-through toroid-shaped optics, to meet NASA EVA requirements for displays that are completely decoupled from the user's head and achieve full sunlight readability with automated rapid ambient light response. The Pro/Ref-HUD offers full-color, high-resolution collimated images, with large fields of view, highly suited to the space and weight constraints inside an astronaut's suit. POC plans to demonstrate the feasibility of the Pro/Ref-HUD system by building and testing a preliminary prototype to TRL-4 by the end of Phase I. POC will develop in Phase II a fully functional prototype to demonstrate sunlight readability and SXGA resolution, investigate thermal and radiation issues, and analyze ignition safety due to a 100% oxygen operating environment and vacuum and extreme temperature storage environments. The results demonstrated will offer NASA capabilities to perform EVAs with heads-up displays internal to the helmet to improve crew safety and comfort and prevent misalignment of the display.

TRL (begin): 3; TRL (end): 4



Technical Objectives

- Objective 1. Development of the full-color (RGB) Pro/Ref-HUD design by analytical computer modeling and optical ray-tracing.
- Objective 2. Demonstration of an aberration-corrected full-color reflector on curved substrate.
- Objective 3. Demonstration of the integrated Pro/Ref-HUD system inside a helmet.
- Objective 4. Exploration of the commercial scenario for Pro/Ref-HUD optics technology.

Work Plan

1. Develop System-Level Design for the Proposed Pro/Ref-HUD System
2. Design Pro/Ref-HUD Reflector Optics by Computer Modeling
3. Fabricate Pro/Ref-HUD Reflector Optics on Curved Substrate
4. Develop the Pro/Ref-HUD Image Projection Subsystem
5. Evaluate the Pro/Ref-HUD Electronics Subsystem
6. Demonstrate Integrated Pro/Ref-HUD Concept
7. Explore Commercial Potential
8. Prepare and Submit Reports

NASA Applications

The Pro/Ref-HUD technology will provide new capabilities for astronauts during EVA with a see-through display system that allows them to monitor the conditions around them while being provided visual instructions and direction in a hands-free format. Applications include space walks on the International Space Station (ISS) where navigating the structure can be completed with maps and repairs completed with heads-up manuals. Harsh-environment training can also be completed with the HUD by providing assistance and navigation for improved safety such as dealing with Martian dust storms and facilitating asteroid landings.

Non-NASA Applications

Military applications of the Pro/Ref-HUD system will include HUDs for pilots of high-altitude supersonic aircraft. The Pro/Ref-HUD can be used by the Air Force or the Navy and others aboard the current Apache helicopter and the CH-53K heavy lift helicopter under development, offering numerous benefits. Additionally, applications include commercial vehicle HUDs.

Firm Contacts

Mr. Jason Holmstedt
 jholmstedt@poc.com
 310-320-3088

NON-PROPRIETARY DATA