National Aeronautics and Space Administration

Tactile Display for EVA

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HAT: 4.7.a-E, 6.2.a-E, 6.2.b/c-E **TA:** 6.2.3 – Extravehicular Activity Systems **TRL:** start 2 / current 3

OVERVIEW

As human spaceflight crews engage in more complex missions beyond low Earth orbit, their need for autonomy increases. ISS-like operations in which Earth-based mission control monitors life-critical systems and provides real time support for crew tasks will be limited by communication bandwidth and delays, forcing the crew to take on a subset of these responsibilities. This presents the biggest challenge during Extravehicular Activity (EVA)s, where the crew is already overloaded and their ability to interact with information systems is severely limited. Tactile displays, which present information using the sense of touch, expand the users' communication bandwidth. This untapped interface modality can be used for a wide range of interactions during EVA, including emergency alerts, non-emergency situational awareness, and simple instruction.

INNOVATION

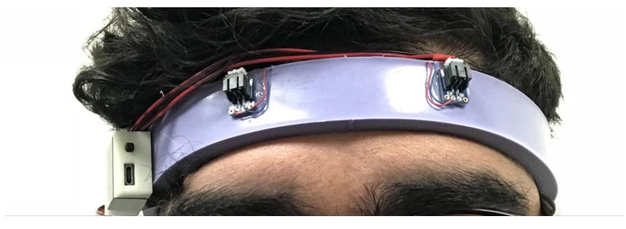
This technology enables an investigation on this untapped communication modality that can be integrated into the Exploration EVA Mobility Unit (xEMU) Informatics Subsystem.

OUTCOME

- Partnered with Somatic Labs to develop tactile display technology for use in a future Mission Control Center (MCC) investigation
- 1st generation in-house tactile display prototype completed - 8/2018

INFUSION SPACE / EARTH

- First use of this untapped communication modality will be used in an MCC investigation to determine the disparity between audio vs tactile cues



Tactile display headband developed by Somatic Labs

1st generation in-house tactile display prototype

PARTNERSHIPS / COLLABORATIONS

An evaluation of initial products developed by Pratt Institute and Somatic labs served as a starting point in investigating tactile communication. A collaboration with Somatic Labs was established to develop custom tactile display hardware and to utilize their application programming interface (API) to create tactile encoding schemes. A custom high resolution tactile armband and waistband are currently under development by Somatic Labs and will determine the form factor used in the upcoming flight control simulation.

FUTURE WORK

- Further evaluation of candidate hardware for implementing a tactile display system in an xEMU
- Development of the appropriate information encoding schemes for EVA and MCC operations
- MCC investigation to determine feasibility of such technology in a high stress environment

Tactile Display for EVA

Active Technology Project (2018 - 2018)

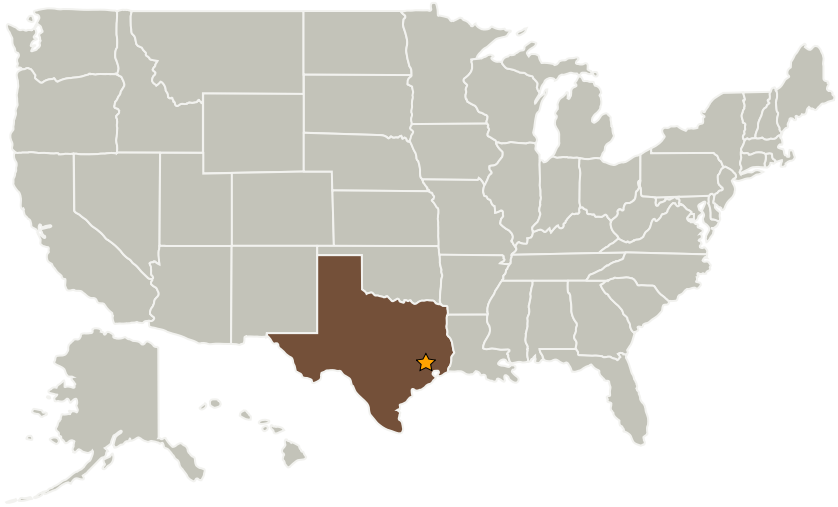
Project Introduction

As human spaceflight crews engage in more complex missions beyond low Earth orbit, their need for autonomy increases. ISS-like operations in which mission control monitors life-critical systems and provides real time support for crew tasks will be limited by communication bandwidth and delays, forcing the crew to take on a subset of these responsibilities. This presents the biggest challenge during EVAs, where the crew is already overloaded and their ability to interact with information systems is severely limited. Tactile displays, which present information using the sense of touch, expand the users' communication bandwidth. This untapped interface modality can be used for a wide range of interactions during EVA, including emergency alerts, non-emergency situational awareness, and simple instruction. This proposal will evaluate, integrate, and build upon preliminary investigations into tactile display for EVA conducted by two university collaborators and a start-up company.

Anticipated Benefits

The team will evaluate candidate hardware for implementing a tactile display system in an EMU, develop a tactile display prototype, and capture lessons learned, design challenges, and risks in a final report.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Center Independent Research & Development: JSC IRAD

Tactile Display for EVA

Active Technology Project (2018 - 2018)

Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, TX

Primary U.S. Work Locations
Texas

Project Management

Principal Investigator:

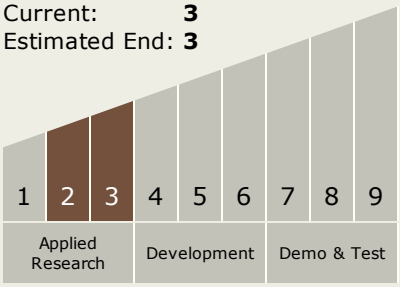
Carlos R Aceves

Co-Investigator:

Christopher E Gerty

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- Robotics and Autonomous Systems (TA 4)

Other/Cross-cutting:

- Robotics and Autonomous Systems (TA 4)
  - └ Sensing and Perception (TA 4.1)
  - └ Human-System Interaction (TA 4.4)

Target Destinations

Earth, The Moon, Mars

Tactile Display for EVA

Active Technology Project (2018 - 2018)

Supported Mission Type

Projected Mission (Pull)