Center Independent Research & Development: JSC IRAD

Increasing Cognitive Reserve with Software - Pilot (ICARUS-Pilot)

Completed Technology Project (2022 - 2022)

Project Introduction

The ICARUS-Pilot study sought to quantify and assess the potential benefit of using commercial-off-the-shelf (COTS) cognitive training software to improve cognitive performance in an astronaut-like terrestrial population.

Five volunteer research subjects were recruited from the JSC employee population to mimic characteristics of the NASA astronaut population (age, education/discipline). Subject cognitive performance was assessed before and after executing eighteen sessions of remote cognitive training using six exercises within an adaptive app-based COTS software package (BrainHQ, Posit Science) on study-provided tablets. Pre- and post-training cognitive performance was measured using internal BrainHQ assessments as well as Cognition Test Battery (CTB), an independent software test developed specifically for NASA and used currently in research studies on astronauts. BrainHQ exercises were posited to map well or partially to several CTB sub-tests. Subjects provided feedback on their study experience formally via survey at the conclusion of testing and informally throughout the study if they encountered issues.

Anticipated Benefits

Astronauts will experience cognitive decline due to spaceflight stressors on long missions, and exploration crews must be more self-reliant so providing cognitive assessment and countermeasures becomes even more important. A successful training regimen preflight with minimal impact refreshers available inflight could mitigate declines and increase probability of mission success across multiple missions and durations but will be specifically valuable for long-duration Exploration missions.

The brain adapts and changes throughout a person's lifetime, creating new pathways in response to challenges (such as injury or disease) or training. Software training has shown cognitive performance improvement in healthy military and law-enforcement populations as well as terrestrial disease and aging populations, with performance data showing generalization outside the training program. Little cognitive training data is available specifically related to an astronaut-like population for tasks specifically relevant to crew autonomous operations. This study was the first step to provide that.

Logo for the ICARUS-Pilot study -- ICARUS wings surrounding a brain in the center, overlooking Earth with the Moon and Mars in the distance and a shield with the study name, sponsor and year in the foreground

Table of Contents

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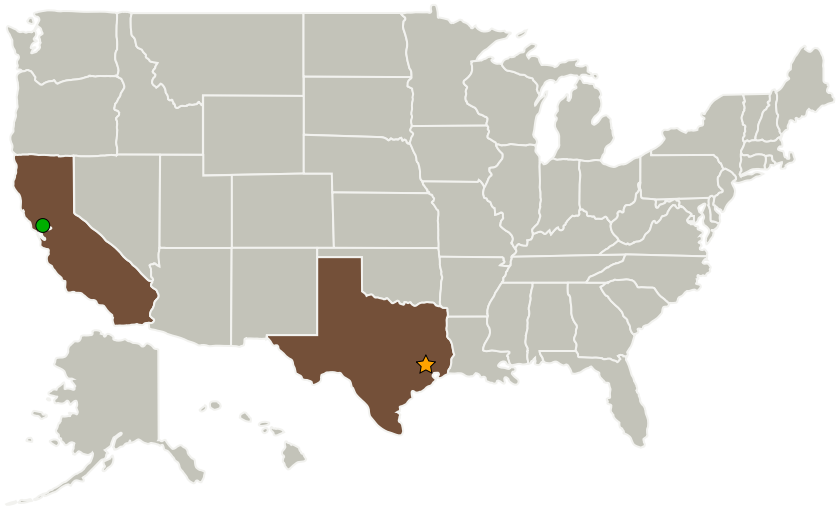
Completed Technology Project (2022 - 2022)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
●Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations	
California	Texas

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Center Independent Research & Development: JSC IRAD

Project Management

Program Manager:

Carlos H Westhelle

Project Manager:

Ronald G Clayton

Principal Investigator:

Carol A Mullenax

Co-Investigators:

Bettina L Beard
James S Garrett
Millennia H Young

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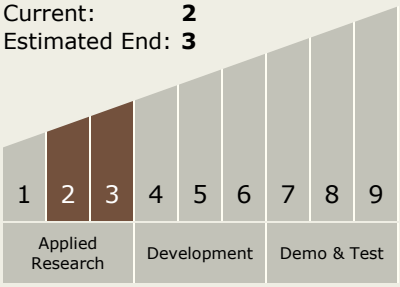
Images

ICARUS-Pilot study logo
Logo for the ICARUS-Pilot study -- ICARUS wings surrounding a brain in the center, overlooking Earth with the Moon and Mars in the distance and a shield with the study name, sponsor and year in the foreground *(https://techport.nasa.gov/image/145020)*

Technology Maturity (TRL)

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



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems

Target Destination

Mars

Supported Mission Type

Projected Mission (Pull)