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<th>Fiscal Year:</th>
<th>FY 2015</th>
<th>Task Last Updated:</th>
<th>FY 10/29/2014</th>
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<tr>
<td>PI Name:</td>
<td>Holden, Kritina Ph.D.</td>
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<tr>
<td>Project Title:</td>
<td>Effects of Long-duration Microgravity on Fine Motor Control Skills</td>
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<tr>
<td>Division Name:</td>
<td>Human Research</td>
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<td>Program/Discipline:</td>
<td>HUMAN RESEARCH</td>
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<tr>
<td>Joint Agency Name:</td>
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<td>TechPort:</td>
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**Human Research Program Elements:**
(1) **HFBP**: Human Factors & Behavioral Performance (IRP Rev H)

**Human Research Program Risks:**
(1) **Bmed**: Risk of Adverse Behavioral Conditions and Psychiatric Disorders
(2) **HCI**: Risk of Inadequate Human-Computer Interaction
(3) **Sensorimotor (SM)**: Risk of Impaired Control of Spacecraft, Associated Systems and Immediate Vehicle Egress Due to Vestibular/Sensorimotor Alterations Associated with Space Flight

<table>
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<th>Space Biology Element:</th>
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<tr>
<td>Space Biology Cross-Element Discipline:</td>
<td>None</td>
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<td>Space Biology Special Category:</td>
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**PI Email:** kritina.l.holden@nasa.gov  
**Fax:** FY

**PI Organization Type:** NASA CENTER  
**Phone:** 281-483-8829

**Organization Name:** Leidos Corporation at NASA Johnson Space Center

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**PI Address 2:**  
Mail Code: C46

**City:** Houston  
**State:** TX  
**Zip Code:** 77058-3607  
**Congressional District:** 22

**Comments:**
**Project Type:** FLIGHT  
**Solicitation:** Directed Research

**Start Date:** 10/01/2013  
**End Date:** 12/30/2016

**No. of Post Docs:** 0  
**No. of PhD Degrees:** 0

**No. of PhD Candidates:** 0  
**No. of Master's Degrees:** 0

**No. of Master's Candidates:** 0  
**No. of Bachelor's Degrees:** 0

**No. of Bachelor's Candidates:** 0  
**Monitoring Center:** NASA JSC

**Contact Monitor:** Whitmore, Mihriban  
**Contact Phone:** 281-244-1004

**Contact Email:** mihriban.whitmore-1@nasa.gov

**Flight Program:** ISS

**Flight Assignment:**  
ISS  
NOTE: Risk/Gaps per E. Connell/HRP (Ed., 3/20/14)  
NOTE: Start date changed to 10/1/13 (from 6/25/13) per M. Whitmore/JSC (Ed., 2/24/14)

**Key Personnel Changes/Previous PI:** None

**COI Name (Institution):**  
Thompson, Shelby (NASA JSC/Lockheed Martin)  
Sandor, Aniko (NASA JSC/Lockheed Martin)

**Grant/Contract No.:** Directed Research

**Performance Goal No.:** Directed Research

**Performance Goal Text:**
### Task Description:

Fine motor skills will be critical during long-duration space missions, particularly those skills needed to interact with new technologies required for autonomous operations in next-generation space vehicles, spacesuits, and habitats. Few, arguably no, studies have been completed to investigate this type of functional fine motor performance in microgravity. There has also not been a complete, systematic study of fine motor performance to include different phases of microgravity adaptation, long-term microgravity, and the sensorimotor recovery period after transition to Earth gravity (post landing). In addition, the studies conducted to date have not been conclusive regarding the effects of microgravity on fine motor control.

The opportunity to systematically collect fine motor performance data throughout a long-duration mission is of great value. It will add to our knowledgebase and provide a vastly improved capability to judge the risk of performance decrements due to long-duration microgravity. The proposed investigation will also supplement two other sensorimotor 1-yr investigations by providing an additional measure of functional performance post-flight, and a new sensorimotor functional test in-flight. These data will contribute to closure of several research gaps and may drive in-flight mitigations and/or design decisions for future vehicles/habitats.

### Specific Aims:

**Aim 1:** Determine the effects of long-duration microgravity on fine motor performance.

- How does fine motor performance in microgravity trend/vary over the duration of a six-month, and year-long space mission?
- How does fine motor performance on orbit compare with that of a closely matched subject on Earth?

**Aim 2:** Determine the effects of different gravitational transitions on fine motor performance.

- How does performance trend/vary before and after gravitational transitions, including the periods of early flight adaptation, and very early/near immediate post-flight periods?

### Rationale for HRP Directed Research:

This research is directed due to a time constraint. This proposal focuses on the research opportunity afforded by the 2015 year-long mission of two crewmembers aboard the International Space Station (ISS).

### Research Impact/Earth Benefits:

The Fine Motor Skills computer-based tasks could be used to measure fine motor decrements in elderly or diseased populations. The tasks may also prove beneficial in rehabilitation of fine motor skills in elderly patients, people with motor disorders, and patients with brain injuries.

The handhold developed to keep the iPad stable during task performance could be commercialized for general use with iPads.

### Task Progress:

The Fine Motor Skills study is planned to launch in March, 2015 as part of the first ISS one-year mission. Standard duration subjects on subsequent missions will participate as well, for a total of 6 standard duration and 2 one-year mission subjects. The study will be conducted on an iPad, using the finger and a stylus to complete 4 types of fine motor tasks. The past year (FY14) has been spent preparing the hardware, software, and documentation required for the study to fly on ISS.

A custom handhold for the iPad was designed, prototyped, tested, and manufactured for use with the study. A commercial stylus was selected and purchased.

The custom task software was completed, and it includes four fine motor tasks: pointing, dragging, tracing, and pinch-rotate. The software quality certification paperwork was developed and approved, usability and functionality tests were completed successfully, and the final software was delivered for installation on the ISS iPads.

Experiment documentation was developed, and Informed Consent Briefings (ICBs) were completed for the 2 one-year crewmembers, and 4 standard-duration crew. ICBs will continue until the full set of subjects has been run. Familiarization and baseline data collection sessions will be held in the coming months for the one-year and standard duration crew who have agreed to participate in the study.

### Bibliography Type:

**Description:** (Last Updated: 08/31/2018)

### Abstracts for Journals and Proceedings
