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| Fiscal Year: | FY 2014 | Task Last Updated: FY 05/30/2014 | |
| PI Name: | Dinges, David F. Ph.D. | | |
| Project Title: | Psychomotor Vigilance Test (PVT) on ISS | | |
| Division Name: | Human Research | | |
| Program/Discipline: | HUMAN RESEARCH | | |
| Program/Discipline--Element/Subdiscipline: | HUMAN RESEARCH--Behavior and performance | | |
| Joint Agency Name: | | TechPort: | Yes |
| Human Research Program Elements: | (1) HFBP :Human Factors & Behavioral Performance (IRP Rev H) | | |
| Human Research Program Risks: | (1) BMed :Risk of Adverse Cognitive or Behavioral Conditions and Psychiatric Disorders (2) Sleep :Risk of Performance Decrements and Adverse Health Outcomes Resulting from Sleep Loss, Circadian Desynchronization, and Work Overload | | |
| Space Biology Element: | None | | |
| Space Biology Cross-Element Discipline: | None | | |
| Space Biology Special Category: | None | | |
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| Zip Code: | 19104-4209 | Congressional District: | 2 |
| Comments: | | | |
| Project Type: | FLIGHT | Solicitation / Funding Source: | Directed Research |
| Start Date: | 08/01/2008 | End Date: | 03/31/2017 |
| No. of Post Docs: | 1 | No. of PhD Degrees: | |
| No. of PhD Candidates: | | No. of Master' Degrees: | |
| No. of Master's Candidates: | | No. of Bachelor's Degrees: | |
| No. of Bachelor's Candidates: | | Monitoring Center: | NASA JSC |
| Contact Monitor: | Leveton, Lauren | Contact Phone: | |
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| Flight Program: | ISS | | |
| Flight Assignment: | ISS NOTE: End date is now 3/31/2017 per NSSC information (Ed., 5/5/14) NOTE: End date is now 7/31/2014 per PI (Ed., 5/3/2013) NOTE: start/end dates changed per J. Dardano/JSC --previously 4/30/2008-8/31/2013 (4/16/2009) | | |
| Key Personnel Changes/Previous PI: | | | |
| COI Name (Institution): | Basner, Mathias (University of Pennsylvania School of Medicine) | | |
| Grant/Contract No.: | NNX08AY09G | | |
| Performance Goal No.: | | | |
| Performance Goal Text: | | | |

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| Task Description: | <p>The Psychomotor Vigilance (PVT) Self Test (operational name on ISS is Reaction Self Test) is intended to provide astronauts with objective feedback on neurobehavioral changes in vigilant attention, psychomotor speed, state stability, and impulsivity while on ISS missions, as well as recording their subjective ratings of workload, sleep timing and quality, tiredness, fatigue, and stress. The PVT Self Test is suited for repeated use in spaceflight because unlike other cognitive tests, it is very brief (3-5 minutes) while being free of learning effects and aptitude differences that make interpretation of other cognitive measures difficult.</p> <p>The ultimate goal of the Reaction Self Test project is to validate the sensitivity of the PVT Self Test on astronauts on ISS so they can use it to objectively identify when their performance capability is degraded by various fatigue-related conditions that can occur as a result of ISS operations and time in space. The following are the objectives (specific aims) of the project:</p> <ol style="list-style-type: none"> 1) To evaluate the extent to which PVT Self Test performance of astronauts is sensitive to fatigue from sleep loss and circadian disruption during ISS missions. This will include the following conditions evaluated individually and in aggregate: i) extended wake duration above 16 hours; ii) sleep restriction defined as total sleep time >0 and <6 hours per 24-hour period; and iii) circadian perturbation associated with night work and slam shifting. 2) To evaluate the extent to which PVT Self Test performance of astronauts is sensitive to fatigue from work intensity during ISS missions. This will include the following conditions evaluated individually and in aggregate: i) extend work durations up to 16 hours per day; ii) more than 6 consecutive work days without a day off for rest; and iii) work requiring extravehicular activity (EVA). 3) To evaluate the extent to which PVT Self Test performance of astronauts declines with time in mission. 4) To explore the extent to which PVT Self Test performance of astronauts will be sensitive to the carry-over effects of medications for sleep on ISS. 5) To evaluate the extent to which PVT Self Test performance feedback (via a graphical interface) is perceived by ISS astronauts as a useful tool for assessing performance capability. |
| Rationale for HRP Directed Research: | <p>The PI developed the original 10-minute Psychomotor Vigilance Test (PVT), which the Reaction Self Test was derived from, to measure changes in psychomotor speed, lapses of attention, wake state instability, and impulsivity induced by fatigue and other performance-degrading factors commonly found in operational environments. Based on research supported by federal and non-US federal agencies, as well as the pharmaceutical industry, the 10-minute PVT has been extensively validated in laboratory studies, simulators, and operational environments to be sensitive to a variety of performance-degrading fatigue-related factors. There are currently 180 published peer-review papers on the sensitivity of the 10-min. PVT to fatigue-related factors.</p> <p>The Reaction Self Test is a 3-minute PVT Self Test that contains special timing and algorithm characteristics and that has been validated against the 10-minute PVT. The 3-minute Reaction Self Test will have utility in a wide array of safety-sensitive environments on Earth. Potentially any occupation in which alertness and fatigue management are essential to prevent errors on critical tasks will benefit from adaptations of the PVT SelfTest technology (e.g., certain military personnel, airport security screeners, physicians on night shifts and prolonged call).</p> |
| Research Impact/Earth Benefits: | <p>Data acquisition began in September 2009 with Expedition 21-22. The target sample size was N=24. As of July 31, 2012, all 24 astronauts have given informed consent for the project. On the date of the last data download from ISS (April 14, 2014), baseline data collection has been completed in all N=24 astronauts. N=24 astronauts have completed (3 during the past year) in-flight data acquisition. N=23 astronauts have completed and N=1 astronaut has started post-flight data acquisition. 507 Reaction Self Tests were performed pre-flight, 2086 Reaction Self Tests were performed in-flight, and 338 Reaction Self Tests were performed post-flight. In-flight data from the N=24 astronauts yielded an average of 86 Reaction Self Tests per subject. We have de-briefed 23 astronauts post-flight and gained important insights on astronauts' perception of the Reaction Self Test. To allow for the completion of data collection and analysis the project has been extended through 3/31/2017.</p> <p>Preliminary results were shown to Dr. Mark Shelhamer (NASA) at his request to supply evidence for the need of longer duration missions on ISS (i.e., 1 year mission) to study the dynamic behavioral changes of astronauts living and working on ISS. The PI gave permission to Dr. Shelhamer to present preliminary data at the Aerospace Medicine conference. Additionally, preliminary results were also shown to Dr. Lauren Leveton (NASA Behavioral Health & Performance Element).</p> |
| Task Progress: | |
| Bibliography Type: | Description: (Last Updated: 03/24/2024) |
| Abstracts for Journals and Proceedings | Dinges DF, Basner M, Mollicone DJ, Jones CW, Ecker AJ, Bartels R, Mott C. "Elevated workload and reduced sleep duration." Talk July 9, 2013 at 19th IAA Humans in Space Symposium, Cologne, Germany, July 7-13, 2013. 19th IAA Humans in Space Symposium, Cologne, Germany, July 7-13, 2013. Abstract #136. , Jul-2013 |
| Abstracts for Journals and Proceedings | Dinges DF, Basner M, Mollicone DJ, Jones CW, Ecker AJ, Bartels R, Mott C. "Effects of time in mission: ISS astronauts ratings of stress." Talk at International Academy of Astronautics (IAA) Space Exploration Conference, Washington, DC, January 9, 2014. International Academy of Astronautics (IAA) Space Exploration Conference, Washington, DC, January 9, 2014. , Jan-2014 |
| Abstracts for Journals and Proceedings | Dinges DF, Basner M, Mollicone DJ, Jones CW, Ecker AJ, Bartels R, Mott C. "Effects of time in mission: ISS astronauts ratings of stress." Talk at 2014 NASA Human Research Program Investigators' Workshop, Galveston, TX, February 12-13, 2014. 2014 NASA Human Research Program Investigators' Workshop, Galveston, TX, February 12-13, 2014. http://www.hou.usra.edu/meetings/hrp2014/pdf/3256.pdf , Feb-2014 |

**Abstracts for Journals and
Proceedings**

Mollicone DJ, Sutbna MD, Kan KGW, Mott CG, Basner M, Dinges DF, Pickard S. "Software system for real-time medical operational support on ISS." Talk at 2014 NASA Human Research Program Investigators' Workshop, Galveston, TX, February 12-13, 2014.
2014 NASA Human Research Program Investigators' Workshop, Galveston, TX, February 12-13, 2014.
<http://www.hou.usra.edu/meetings/hrp2014/pdf/3265.pdf> , Feb-2014