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| **Fiscal Year:** | FY 2009 | **Task Last Updated:** | FY 07/13/2009 |
| **PI Name:** | Duda, Kevin R Ph.D. | | |
| **Project Title:** | Human-Automation Interactions and Performance Analysis of Lunar Lander Supervisory Control | | |
| **Division Name:** | Human Research | | |
| **Program/Discipline:** | NSBRI | | |
| **Program/Discipline--Element/Subdiscipline:** | NSBRI--Human Factors and Performance Team | | |
| **Joint Agency Name:** | | **TechPort:** | No |
| **Human Research Program Elements:** | (1) **SHFH**:Space Human Factors & Habitability (archival in 2017) | | |
| **Human Research Program Risks:** | (1) **HSIA**:Risk of Adverse Outcomes Due to Inadequate Human Systems Integration Architecture | | |
| **Space Biology Element:** | None | | |
| **Space Biology Cross-Element Discipline:** | None | | |
| **Space Biology Special Category:** | None | | |
| **PI Email:** | kduda@draper.com | **Fax:** | FY 617-258-2772 |
| **PI Organization Type:** | NON-PROFIT | **Phone:** | 617-258-4385 |
| **Organization Name:** | The Charles Stark Draper Laboratory, Inc. | | |
| **PI Address 1:** | 555 Technology Sq | | |
| **PI Address 2:** | MS 27 | | |
| **PI Web Page:** | | | |
| **City:** | Cambridge | **State:** | MA |
| **Zip Code:** | 02139-3539 | **Congressional District:** | 7 |
| **Comments:** | | | |
| **Project Type:** | GROUND | **Solicitation / Funding Source:** | 2008 Crew Health NNJ08ZSA002N |
| **Start Date:** | 07/01/2009 | **End Date:** | 06/30/2013 |
| **No. of Post Docs:** | | **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:** | NSBRI |
| **Contact Monitor:** | | **Contact Phone:** | |
| **Contact Email:** | | | |
| **Flight Program:** | | | |
| **Flight Assignment:** | | | |
| **Key Personnel Changes/Previous PI:** | | | |
| **COI Name (Institution):** | Bortolami, Simone ( Draper Laboratory )<br>Oman, Charles ( Massachusetts Institute of Technology )<br>Marquez, Jessica ( NASA Ames Research Center ) | | |
| **Grant/Contract No.:** | NCC 9-58-HFP02001 | | |
| **Performance Goal No.:** | | | |
| **Performance Goal Text:** | | | |
| | Safe and precise lunar landing will require complex interactions between the astronauts and the vehicle automation. This level of involvement will change from lunar orbit through terminal descent to touchdown. Although the exact tasks for the astronaut and the automation have yet to be specified, we can begin to define human-automation task allocation and model and predict supervisory control performance. This proposed research will quantify the effects of both human and automation errors as they propagate through a supervisory control system, as well as the effects of information display on mission and pilot-vehicle system performance through dynamic modeling and experimentation.<br>There are four integrated specific aims:<br><br>(1) Perform a critical analysis of Apollo human-automation interactions and task allocation during terminal descent | | |

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| **Task Description:** | through touchdown, as well as the information requirements, decision making process and selection of action,<br><br>(2) Develop a closed-loop pilot-vehicle model, integrating vehicle dynamics, human perception, decision making and action, and analyzed using reliability analysis techniques in MATLAB/Simulink® to quantify system performance.<br><br>(3) Conduct experiments in the Draper Laboratory fixed-base lunar landing cockpit simulator to validate critical parameters within the integrated pilot-vehicle model, and determine decrements in flight control performance and pilot workload during nominal and off-nominal scenarios.<br><br>(4) Extend the dynamic model to include the effect of spatial orientation on system performance and conduct experiments on the NASA Ames Vertical Motion Simulator to investigate the effects of motion cues on pilot perception, decision making, and control during instrument failures, or loss of visual references during terminal descent through touchdown.<br><br>This proposed research will produce an integrated human-system model that includes perception, decision making, and action as an early-stage model-based simulation design tool to identify the appropriate human-automation task allocation and information requirements to enable safe and successful lunar landing. |
| **Rationale for HRP Directed Research:** | |
| **Research Impact/Earth Benefits:** | |
| **Task Progress:** | New project for FY2009. |
| **Bibliography Type:** | Description: (Last Updated: 09/04/2023) |