Abstract submission to HCI International 2020 (Virtual Only)
Title: Preliminary Design of an 'Autonomous Medical Response Agent' Interface Prototype for Long Duration Spaceflight
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Major challenges for astronauts in future long-duration exploration missions (LDEMs) will be that crewmembers are not expected to be medical professionals, may be under high workload and stress, are facing physiological challenges caused by spaceflight, and will have limited, delayed voice communications with medical support from Earth. An autonomous medical response agent (AMRA) is envisioned to help astronauts address medical complaints, develop a differential diagnosis, and guide self-treatment until a healthy state is restored. AMRA develops a process of personalized diagnosis and treatment through a Bayesian predictive control system that recommends therapeutic control actions including diagnostic tests and treatments to crewmembers (Menon, 2020). The Human Computer Interaction (HCI) lab from NASA Ames Research Center's Human Systems Integration Division (Code TH) has collaborated with Nahlia Inc in human-centered design augmentation research for AMRA. The project, titled *Design of 'Autonomous Medical Response Agent Interface Prototype for Long Duration Spaceflight*, has been funded by the Translational Research Institute for Space Health (TRISH) and introduces an interactive user-interface prototype that guides astronauts through self-diagnosis, treatment, and rehabilitation while communicating with remote specialists in ground support (most notably a patient's flight surgeon). Our project develops the interaction design for the crewmember using AMRA through user research, iterative design, and usability testing to evaluate the user interface and workflow designed.

The interface design deliverable for this project, titled AMRA Aggregate Information Display (AMRA AID) is an integrated information display system for comprehensive autonomous medical guidance, diagnosis, and treatment of in-flight medical conditions experienced by crewmembers. AMRA AID demonstrates how we might ensure crew autonomy, increase the crew's medical capabilities, and decrease cognitive burden within a front-end user interface. AMRA AID refrains from relying on input from ground or mission control for self-treatment of medical issues—though ground awareness and communication with ground is maintained as a means of ensuring trust between mission control and crew. AMRA AID demonstrates how the crew's on-board medical system might integrate with information from vehicle monitoring and crew schedule, without assuming causal relationships. AMRA AID's comprehensive view enables efficient information access for both crew and ground support, reducing cognitive burden in the event of an unplanned or emergency medical incident and enabling informed analytical decisions to be made based on both crew and vehicle health. Human-centered design augmentation advanced within the prototype included: enhanced workflow and treatment guidance for two medical scenarios for a non-specialist user base with various levels of medical training, interaction design which considered speech (conversational user interface) elements and on-screen interactions to be developed in future iterations of the project, communication design and functional requirements relevant to self-care versus caring for another astronaut, as

well as user testing of the prototype with an international space medical community. This project arrives at critical findings regarding usability needs, communication requirements, and integrated information requirements for a future technology interface functioning to increase confidence between ground support and LDEM crewmembers.