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ENABLING HUMAN SPACEFLIGHT EXPLORATION MISSIONS THROUGH PROGRESSIVELY EARTH INDEPENDENT MEDICAL OPERATIONS

Abstract

Distance from Earth is the primary hazard that drives the need for an exploration medical operations paradigm shift. Increasingly complex exploration missions will be limited by resource constraints (e.g., mass, power, volume, data, etc.), little to no resupply or evacuation capability, and significant real-time communications challenges. In order to evolve into a more autonomous medical approach, a multi-faceted strategy will need to be employed to optimize all aspects of human health and performance in space. This strategy will include: increasing onboard medical autonomy through the development of new crew health and performance systems; decision support capabilities to assist the astronauts in preventing, diagnosing, and treating medical conditions with reduced Earth support; creating new procedures and training tools for skill maintenance and just-in-time training; and enabling rapid crew access to data from all on-board systems, leading to better-informed, real-time, autonomous decisions.

Collectively, this paradigm shift can be referred to as "Earth Independent Medical Operations" (EIMO). Achieving EIMO will require input from all relevant partners and stakeholders within the broader human spaceflight community. This paper will provide relevant highlights of these inputs and how they informed an EIMO Concept of Operations (ConOps). The EIMO ConOps outlined in this paper will describe the vision for autonomous exploration medical care as well as the future work associated with achieving EIMO, including a tactical plan which will use an iterative process to demonstrate progressive medical self-reliance in ground testbeds and analog environments (including the International Space Station). The deliverable targets for these autonomous medical capabilities will be the future long-duration Artemis missions that will be used as a steppingstone to the first human Mars mission.