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HUMAN EXPLORATION OF THE SOLAR SYSTEM SYMPOSIUM (A5)
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FOUR IS NOT ENOUGH: MARS MISSION CREW SIZE RECOMMENDATIONS FOLLOWING ACTUAL EMERGENCY EXPERIENCE AT MARS ANALOG SIMULATION.

Abstract

Astronauts will soon travel to Mars. They may be serving on a mission sanctioned by NASA, or they may be sent as colonists by private companies like SpaceX and Mars One. The number of crew members aboard the first missions will be limited by many factors. Typical Mars mission plans focus on engineering capabilities. This is an incomplete strategy. A successful, sustainable Mars mission also depends on a properly balanced crew. Mission planners must not let traditional trade study requirements such as spacecraft systems, launch vehicle payload capabilities, and crew accommodations drive the choice of crew size. Instead, group dynamic and emergency response lessons from Mars analog simulation missions must guide the crew size. Two crews were selected for missions at the Mars Desert Research Station (MDRS) from a pool of individual candidates with no prior personal connections between each member. Each crew was comprised of a commander and a combination of scientists, engineers, and artists. The crew dynamic results presented are a supplemental outcome to the mission as witnessed by the commander. An investigation of crew capabilities highlights a variety of human factors benefits of a seven-person crew and shortcomings of a four-person crew. Commander leadership is more effective with a larger crew to delegate regular workload, as evidenced by the diversity of talent on seven-person MDRS Crew 132. A larger crew enables more complex extra-vehicular activities because more permutations exist which maintain a minimum of three crew always together for safety. Small crews cannot safely respond to serious emergency, as evidenced by first-hand experience fighting the greenhouse fire that occurred during four-person MDRS Crew 146. Four is not enough to properly handle the myriad of actions necessary to resolve the emergency during the event. Four is also problematic for team unity in that it easily leads to crew separation into two pairs of opposing ideas. A human mission to Mars will be difficult, dangerous, and require advanced skills performed by broadly-talented astronaut explorers. Send seven. Four is not enough.