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THE IMPACT OF COMMUNICATION LATENCIES ON HUMAN SCIENTIFIC EXPLORATION – LESSONS FROM PAVILION LAKE RESEARCH PROJECT FIELD DEPLOYMENTS.

Abstract

Current road mapping of NASA's future human space flight destinations has resulted in lunar, and Near Earth Asteroids (NEAs) emerging as an initial targets en route to our ultimate destination of Mars. Regardless of when humans ultimately venture beyond Low Earth Orbit, and regardless of where we explore, there will be certain operational, technical and scientific parameters that will cross-cut the exploration architecture regardless of the destination. Communications, and specifically the design principles and operational methodologies required to manage unavoidable time-delayed communications during human scientific exploration, will be critical to our future successes in human space flight regardless of exploration target.

Given that science will undoubtedly be a key driver in future human exploration of the Moon, NEAs and beyond, the effects of time-delayed communications on science, science operations and productivity, mission operations and technological management require focused examination as these effects are not yet understood. Here we present results and lessons learnt from a real (non-simulated) field science program within which simulated time-delayed communications experiments were performed to assess the impact of these latencies on scientifically driven exploration. This research was aimed at measuring the impact of lunar, and NEA communications delays on both scientific productivity and human factors, such as workload, during our real science operations. We also examined the infrastructure and communications protocols required to manage tethered Science Divers, Surface Support Crews, and a distributed Science Backroom Team. Our research was conducted during the 2011 and 2014 Pavilion Lake Research Project (PLRP) field deployments to Kelly and Pavilion lakes in British Columbia, Canada. The field activities involved a mix of DeepWorker submersibles, SCUBA divers, and Remotely Operated Vehicles (ROVs), which were used to study microbialite morphogenesis in Pavilion and Kelly lakes, and the potential for biosignature preservation in these carbonate rocks. Further background on the field deployment activities will also be presented.