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REALISE – AUTOMATED PAYLOAD OPERATIONS ONBOARD THE LUNAR GATEWAY

Abstract

Intelligent Imaging Innovations (3i) together with BioServe Space Technologies within the University of Colorado Boulder (BioServe) are presenting the current development status of the fully autonomous science facility REALISE (Remote Experimentation and Analysis Laboratory In SpacE). The facility designed for suspended biological cultures is intended to both incubate organisms over long periods of time (30 days to 9 months) but also perform in-situ analysis of samples using bright-field and three-color fluorescence microscopy. REALISE is based heavily on functionality, components, and experience from past Shuttle, ISS, and Orion heritage flight hardware but is intended to set new standards for in-situ scientific analysis, long-term cell culturing, as well as automation. The in-situ automated microscopy compartment will allow characterizing cell adaptations in space over time as opposed to only start and end conditions. The fluorescent analysis -in addition to bright-field microscopy for morphological changes- will be used to characterize microbiological processes such as cell metabolism, cell health, and cell function. While REALISE is developed specifically for the Lunar Orbital Platform Gateway and its long untended mission durations, it will have future applications also on commercial space stations and lunar surface habitats both manned and unmanned as well as for more automated and less crew-intensive experiments onboard the International Space Station. REALISE is proposed to be a two-locker system that will be permanently deployed onboard the Lunar Orbital Platform Gateway and can store and actively support cell cultures fully thermally controlled for up to 9 months. Once an experiment or production is terminated, REALISE is designed to be serviced on-orbit while the crew is present for consumable swap out so that the unit can initiate another autonomous operation cycle. Potential applications are deep space radiation studies over multiple generations to characterize the response of organisms or the effectiveness of countermeasures for future long-term human spaceflights as well as cell production facilities for unique terrestrial cell culture treatments that can only be grown in the space environment. This work was made possible by the National Aeronautics and Space Administration under the STTR 2021 Phase I grant 80NSSC21C0369.