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TELEDYNE AND BRADFORD ENGINEERING'S MULTI-PURPOSE GLOVEBOX FOR DEEP SPACE GATEWAY – EVOLUTION OF SPACE GLOVEBOX TECHNOLOGY

Abstract

Teledyne Brown Engineering, Inc. (Teledyne) and Bradford Engineering BV (Bradford), Inc. have been successfully designing, developing, fabricating, and operating spaceflight gloveboxes for over 25 years. The Microgravity Science Glovebox (MSG) and Life Science Glovebox (LSG) are key facilities currently operating on the ISS. They are used frequently for science and technology experiments which require multiple levels of containment, stable thermal environment, reduced particulate environment, and microbial free environment. Teledyne and Bradford are the industry leaders in US and European Spaceflight Glovebox Design and Operations. This extensive past experience will be applied to the development of gloveboxes for NASA's next phase of Manned Space Exploration. The Multi-Purpose Glovebox (MPG) is a concept for the Deep Space Gateway (DSG). The first element of DSG is scheduled to be launched in 2022. The DSG will host humans and cargo in cis lunar orbit. DSG is the major mission for NASA's Space Launch System. This paper describes the concept of operation and system design of the MPG. In addition, the interfaces (e.g., electrical, mechanical, command and data handling, etc.) between the MPG and DSG pressurized modules are defined for early planning and design considerations. Multi-use payload facilities such as MPG defines the resources to be provided by the DSG's major elements to the on-board payloads/customers planned for DSG utilization. The DSG's concept of operations is driving innovation in the design of MPG. Since DSG is only manned for up to 30 days per year, autonomous operations are a key requirement for MPG design. The paper describes new design features for MPG and glovebox payloads that have never been used in the pressurized/manned environment to aid in autonomous operations. Greatly reduced crew time and other lessons-learned from MSG and LSG on ISS are also applied to MPG design. Automated and integrated ultraviolet decontamination for intra-glovebox microbial control is described in conjunction with the related subsystem hardware. The MPG modular design is described; a feature which facilitates reduced payload volume launch configurations in the pressurized DSG elements. The MPG has been a key element of DSG science demonstrations in 2019. The paper will discuss the lessons learned during these demonstrations including a plan to incorporate the new features requested NASA science researchers and flight crew representatives in critical DSG reviews.