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OPTIMIZING PAYLOAD SPECIALIST TRAINING AND PREPAREDNESS FOR HUMAN-TENDED PAYLOAD MISSIONS ON SUBORBITAL SPACEFLIGHT VEHICLES: LESSONS FROM THE IIAS-01/GALACTIC-05 MISSION

Abstract

Crewed suborbital spaceflight has emerged as a novel avenue for conducting research with human-tended payloads, offering a more streamlined alternative to the complexities associated with orbital missions. While orbital flights typically involve intricate logistics and significant lead time, commercial suborbital spaceflights provide the capability to launch human-tended payloads in a remarkably shorter period. This presents a unique set of challenges related to mission preparedness for both the payloads and the astronauts involved. The International Institute for Astronautical Sciences (IIAS), a non-profit research institute with members from over 50 nations, utilizes citizen-science methods for research and education projects, including spaceflight missions.

In this talk, we showcase IIAS's approach to preparing a collection of payloads and a payload specialist for a suborbital flight facilitated by Virgin Galactic (VG) using their Unity spacecraft, known as mission IIAS-01/GAL-05. Notably, IIAS-01/GAL-05 marked significant milestones for both IIAS and VG. It was the first mission to feature seasoned researchers alongside a spaceflight participant as the crew makeup. Additionally, it marked the inaugural instance of a payload free-floating untethered inside the VG Unity cabin. These milestones, however, came with operational and technical challenges that required collaborative efforts between IIAS and VG to ensure a successful mission.

Preceding the IIAS-01/GAL-05 mission, IIAS had been utilizing the Falcon-20 reduced gravity research aircraft operated by the National Research Council of Canada for nine years. This aircraft provides a high-quality, near-weightless environment, akin to that of Unity but on a smaller scale. IIAS utilized the Falcon-20 to train its members, mature research payloads, and develop operational expertise in handling payloads in a weightless environment. Consequently, IIAS assembled a collection of payloads and trained payload specialists ready for spaceflight.

Three payloads with sufficient technology readiness level (TRL) advancement and microgravity heritage were identified for the IIAS-01/GAL-05 mission, capitalizing on the unique flight characteristics of the mission, and aligned with the expertise of the IIAS member participating as the payload specialist. These

payloads included a fluid configuration experiment, a biomonitoring smart shirt, and a continuous blood glucose monitor. The presented methods, encompassing payload development, IIAS astronaut training, and mission execution, offer valuable insights for researchers preparing for spaceflight. This experience opens avenues for future collaborative endeavors in the burgeoning field of crewed suborbital space research.