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LESSONS LEARNED ON AN EARLY WARNING SYSTEM FOR PAYLOADS' OPERATIONS IN THE EUROPEAN ISS MODULE COLUMBUS

Abstract

Since the addition of the European Laboratory Columbus to the International Space Station (ISS) in 2008 it has been utilized by numerous scientists worldwide. Within the past 11 years numerous experiments were not only performed in the center aisle but also in special experiment racks for Fluid Physics, Biology, Human Research and Multi-Discipline experiment racks. The successful operation of payloads (P/Ls) in Columbus is expected to continue in the next 10 years since the discussion between the International Partners (IP)is aiming at the extension of ISS operation until 2030. Planning on the ISS (e.g. crew allocation, experiment operations) is organized in increment periods between 2.5 and 5 months. The increments are numbered and started with the launch of the first ISS module. At the beginning of planned P/Ls operations each individual P/L has to be evaluated concerning its compatibility with the ISS environment and all other P/Ls onboard. The analyses are mandatory and performed for each ISS increment in advance. Six months prior to increment start the analyses are kicked-off and 3 months later they are summarized and published in an overall GuideLines Constraints (GLC) report - the Early Warning. The ESA GLC report contains also the information for P/Ls accommodated in Columbus belonging to other IPs. ESA results relevant for NASA become part of the overall NASA GLC. That applies to JAXA as well. The analyses cover all relevant aspects: mechanical issues, data management, fluids consumables etc. One typical result of microgravity (g) analyses is that a g sensitive experiment cannot be operated simultaneously with a payload that uses a centrifuge. To ensure harmonic operations of all planned payloads, GLCs for individual experiments are generated by the analyses authors. The GLCs have to be taken into consideration by the Control Centers, the Payload Integration Managers, User Support and Operations Centers etc. They are mirrored in all operational products (e.g. Crew procedures, Flightrules) and ensure that each planned experiment does not prevent the successful performance of others or even damage them. After a description of the laboratory Columbus, examples of experiments and their associated GLCs, this paper will discuss lessons learned so far and future plans. Issues addressed include the actual usage of the GLCs, the introduction of a virtual reality tool for the visualization of all mechanical GLCs, the reduction of the analyses performed per increment, the documentation published and of problems challenges encountered.