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THE COLUMBUS GROUND SEGMENT – A PRECURSOR FOR FUTURE MANNED MISSIONS

Abstract

The European decentralized operations concept enables all participating countries to establish a transnational centre of competence that actively cooperates in European participation to the International Space Station (ISS). To this end eighteen European facilities and three International Partner centres are interconnected by a Ground Segment providing data, voice and video services via the central hub at the Columbus-Control Centre.

Operating this Ground Segment is a significant challenge for the Ground Operations Team at Col-CC, not only due to the vast number of facilities and the related world-wide distribution, but also because of the number of different users (Columbus and ATV flight control, payload facilities, engineering support, PR) with their specific operational needs and constraints. In contrast to previous short duration missions with sequential mission phases, the continuous ISS operations support requires consideration to the current increment execution in parallel with preparation and training of following increment(s) and post increment evaluation. The long lifetime duration of 12+x years requires continuous maintenance and sustaining engineering of the ground segment infrastructure with focus on the life-span of individual components as well as life-cycles of entire technologies. Replacement of equipment or systems must be performed with minimal impact on real-time operations, and in coordination with increment execution/preparation activities. An important component of this structure is the application of human resources. An experienced team of qualified operators and engineers is to be trained to maintain a level of proficiency that is applied over this long period.

The above is reproduced in a system architecture is required supporting parallel real-time operations, simulation (preparation) and test (sustaining engineering) activities with varying instances of system configurations. For some systems however, like voice and video, different instances are not feasible, therefore rigid configurations are applied. The organisational approach of the Col-CC was established by running three main control rooms with individual ground operations performed in dedicated rooms. This concept required the ground operations team to be organised in a new approach. New processes and a suite of tools for anomaly resolution and configuration control were developed with everything is tied together by a powerful ground operations and resource planning.

This Columbus Ground Segment required a new approach, which shall be discussed here. Its distribution capability and requirement implementation is unique in the human space exploitation activities but can indeed be seen and applied as a precursor for future manned space missions, which require multi-national collaboration