Proposed Session:
ICES300: ECLSS Modeling and Test Correlations

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Title: Assessment of the Impacts of ACLS on the ISS Life Support System using Dynamic Simulations in V-HAB

Abstract:
The Advanced Closed Loop System (ACLS) is currently under development by Airbus Defense and Space and is slated for launch to the International Space Station (ISS) in 2017. The addition of new hardware into an already complex system such as the ISS life support system (LSS) always poses operational risks. It is therefore important to understand the impacts ACLS will have on the existing systems to ensure smooth operations for the ISS. This analysis can be done by using dynamic computer simulations and one possible tool for such a simulation is the Virtual Habitat (V-HAB). Based on MATLAB®, V-HAB has been under development at the Institute of Astronautics of the Technical University of Munich (TUM) since 2004 and in the past has been successfully used to simulate the ISS life support systems.
The existing V-HAB ISS simulation model treated the interior volume of the space station as one large, ideally-stirred container. This model was improved to allow the calculation of the atmospheric composition inside individual

modules of the ISS by splitting it into twelve distinct volumes. The virtual volumes are connected by a simulation of the inter-module ventilation flows. This allows for a combined simulation of the LSS hardware and the atmospheric composition aboard the ISS.

A dynamic model of ACLS is added to the ISS Simulation and several different operating modes for both ACLS and the existing ISS life support systems are studied and the impacts of ACLS on the rest of the system are determined. The results suggest that the US, Russian and ACLS CO_2 systems can operate at the same time without impeding each other. Furthermore, based on the results of this analysis, the US and ACLS Sabatier systems can be operated in parallel as well to a achieve a very low CO_2 concentration in the cabin atmosphere.

310 words