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APPLICATION OF THE ECLSS RELIABILITY ANALYSIS TOOL RELISSA FOR LONG DURATION
HUMAN SPACE FLIGHTS**Abstract**

Space Agencies' future plans include human space flight missions to further destinations such as asteroids or Mars. Due to the increase on mission duration and distance from the Earth, reliability will play an even more important role in these missions than it does nowadays. Thus, for these future missions, the Environmental Control and Life Support System (ECLSS) not only will have to provide and recycle the consumables required with a high degree of system-closure but also ensure proper operation during the entire mission. At the Institute of Space Systems / University of Stuttgart, a new simulation tool has been introduced to analyze the **reliability of ECLSS** for long duration missions. This software, *Reliability Environment for Life-Support System Simulation and Analysis* (RELISSA), is based on the Institute's ECLSS simulation tool ELISSA, including a wide library of physico-chemical and biological components for air, water, food and waste management, focusing on existing and projective ECLSS for long duration missions. RELISSA allows to select the components for a specific ECLSS design as well as other mission specific parameters (e.g. crew size, mission duration, initial consumables) and carries out a stochastic dynamic simulation to estimate the reliability of the entire system over mission time, considering the synergies between different components and the use of spare parts to repair the system. As a result, RELISSA provides for a given ECLSS model the Equivalent System Mass and its estimated reliability both at end of mission and its evolution over time. This paper reports on how the tool is now applied to analyze and compare existing and planned ECLSS designs for long duration missions and select the technologies to be used in a conceptual design phase.