

SPACE SYSTEMS SYMPOSIUM (D1)
Innovative and Visionary Space Systems (1)

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SYSTEMS ENGINEERING FOR INNOVATIVE SPACE CLOTHING SOLUTION

Abstract

This paper presents the use of a structured model-based systems engineering approach, for the development of an innovative system for people clothing in space.

During space missions, systems and crew shall cope with different situations. Development teams shall address more restrictions to create systems suitable for long-term space missions (as the case for the upcoming endeavor of going to Mars), by altering existing sub-systems addressing vital resources such as food and fuel, but also incorporating new needs as those related to clothing.

A Structured Model Based Systems Engineering approach helping to dwell among competitive integrative variables, such as payload and resources availability (impacting crew health comfort), can provide a path for developing innovative solutions that will enhance autonomy range success expectation for such missions. Consequently, developing a new clothing system will provide more room for payloads and increase crew comfort.

The approach considers product and service elements as part of the socio-technical solution and has a clean sheet open minded approach for problem analysis and solution seeking. The approach defines the need, analyses stakeholders and their requirements by using adapted use case and IDEF0 notations. Then system requirements are derived by using a structured analysis approach with exception handling analysis. Solution architecture is then proposed by outlining the product and service elements of the solution, using SysML.

Interesting issues were identified during the analysis such as: the demand from different perspectives (i.e. life-cycle, organization, scenarios) acting as a key-contributor for innovation; complex and even unknown scenarios and circumstances leading to hybrid solutions that compatibilize current knowledge and innovation, mitigating risks, reducing costs and timing; validation of the system in real conditions, perhaps taking advantage of ISS appear to be of high relevance; preconceived premises valid for Earth environment are threats to be neutralized systematically.

Conclusions are that systems engineering can be used for innovative space systems with the same effectiveness as it has been used for canonic space systems development. Therefore, the clothing system development path specify characteristics and requirements for its development.