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IAF SPACE SYSTEMS SYMPOSIUM (D1)
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TECHNOLOGY ROADMAP METHODOLOGY AND TOOLS TO SUPPORT A SUSTAINABLE HUMAN EXPLORATION OF THE MOON

Abstract

Defined as a dynamic schedule capable to support strategic and long-range planning, aligning at the same time short- and long-term goals with specific technological solutions, technological roadmaps are essential for managing and organizing complex projects, particularly in the ever-changing space exploration industry. In common practices, the adopted approaches are totally or partially based on experts' opinion. Personal and political interests could significantly limit the effectiveness of the overall process, introducing subjective preferences, thus leading to non-technically justified choices. This abstract introduces the new capabilities of TRIS (Technology RoadmappIng Strategy), a methodology initially developed by Politecnico di Torino in collaboration with the European Space Agency (ESA) and now further refined in partnership with Thales Alenia Space – Italia. As intended in TRIS, a technology roadmap is the result of complex and strictly interwoven activities aiming at identifying, prioritizing, selecting and combining elements belonging to the following categories (also known as technology roadmap pillars). At first, a stakeholders' analysis, that aims at identifying and characterizing the stakeholders and their related needs, is carried out. Then, the stakeholders' requests are used on one side to identify and characterize the list of technologies and mission concepts in terms of Technology Readiness Level (TRL), Cost at Completion (CaC), and Time at Completion (TaC), and on the other side to assign different priorities to those elements. These activities enable the definition of a nominal technological development plan which can be further analysed to understand the impact of uncertainties. This paper aims at describing the latest updates of TRIS to better support the generation of feasible technology roadmaps for a sustainable human exploration of the Moon. In particular, TRIS has been upgraded (1) by implementing an automatic data retrieval from a database that can directly extract information from Arcadia Capella models (a Model-Based Systems Engineering tool); (2) by improving the time and budget resources estimation routines to better cover the advancing lunar exploration scenarios; (3) by assessing the variability of the schedule due to uncertainties in technical aspects as well as in socio-economic and geopolitical events which might cause serious delays to the technological development; and (4) by generating alternative technology roadmaps to be followed in cases of constrained budgets, considering both time and financial limitations.