

IAF SPACE SYSTEMS SYMPOSIUM (D1)
Interactive Presentations - IAF SPACE SYSTEMS SYMPOSIUM (IPB)

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AN INTEGRATED DESIGN PLATFORM TO ANALYZE AND SIZE PLANETARY EXPLORATION
SYSTEMS APPLIED TO LUNAR LAVA TUBE EXPLORATION.

Abstract

The new upcoming era in space exploration will be historical for mankind, the 2020s marking the decade when humankind will step foot on the moon once more, and right now, diverse solutions and mission architectures are being investigated and analysed in depth. Therefore, a compendium of rules to quickly and efficiently size the main system budgets of space exploration systems could improve the analysis, planning and choice of different mission concepts.

The objective of the study is to create an integrated sizing tool that can derive mass, power, data and thermal budgets for different elements inside the “system of systems” of different envisioned exploration missions. The tool will then be able to suggest possible feasible configurations with the respective budgets, based on the main mission requirements, which can afterwards be used in a trade off analysis. In this paper, the authors create and describe the main sizing rules that have been exploited for an integrated rover platform and a transfer vehicle, then going into more detail about different configurations.

The sizing tool functions will then be applied to a lunar exploration scenario: the lava tube exploration mission; namely, the robotic exploration of the geological environment inside lunar lava tubes in order to assess their future human habitability. The user inputs both categorical and numerical parameters of the mission and its functioning, those being the type of mission, the expected mission timeline, the desired payload mass and power (if known) and the number of envisioned launches. The tool then sizes the main subsystems, computes the budgets (mass, power, thermal, data), and proposes technological solutions to satisfy the user’s requests. If more than one technological solution is identified, the tool outputs the budgets for the different configurations so that the user has all the data to carry out further analysis.

The research that has been done and this integrated design platform will help mission designers plan the next generation of planetary space missions to support the exploration of the Moon and Mars.