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BEST PRACTICE INVESTIGATIONS AND STUDY OUTLINE FOR THE THERMAL SIZING OF A PARAMETRIC PAYLOAD ON A PARAMETRIC LANDER ON THE LUNAR SURFACE

Abstract

The next lunar space race is already underway – apart from this time round commercial companies are in on it. In the United States, NASA's CLPS Initiative has sparked a wave of companies bidding for science missions by designing and building their own lunar lander. This has produced a demand once more for technological solutions for surviving the lunar environment. The thermal design of such landers is critical and in a competitive environment a range of solutions are developed. The European market is keen to develop in-house solutions and as such there is a demand for knowledge in lunar surface thermal analysis. At ESA, work has already been undertaken to develop knowledge in lunar surface modelling utilising ESATAN-TMS its thermal analysis software of choice. There exists a demand for a guide on how to utilise softwares such as ESATAN-TMS to model vehicles and payloads on the lunar surface. This report investigates some best practices when considering the planetary radiative case. In particular, studies conducted include mesh refinement, ray tracing and geometric feature analysis. It was found that whilst the refinement of the mesh may not impact the sink temperature of payloads and vehicles directly, it is an important consideration in terms of radiative exchange factors. Additionally, an experimental geometric feature, named a 'skirt', proved to be a practical and beneficial contribution to the model which enabled improved radiative exchange factors at varying distances. The lessons learned from these investigations have raised further recommendations for investigation, such as one-way ray tracing and experimenting further with the skirt geometry. Building on these recommendations is a study outline through which a thermal sizing guide can be produced. This could be supported through tools to enable simplified usability.