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ADOPTING AN OBJECTIVES-DRIVEN ASSURANCE CASE APPROACH FOR ACHIEVING SPACE FLIGHT MISSION PLANETARY PROTECTION OBJECTIVES

Abstract

Traditionally, NASA has utilized prescriptive technical and process requirements to ensure safety and mission assurance performance objectives for space flight missions are achieved. While prescriptive requirements may be easier to communicate and manage throughout the systems engineering process, the highly-constrained nature of prescriptive requirements can limit the ability to take advantage of cost-saving opportunities and offer limited ability to explore other options or alternative designs, processes, and methods. It can also be difficult to develop prescriptive requirements for objectives that are probabilistic in nature or that cannot be satisfied by direct verification. In contrast, the development of an assurance case allows for a compelling, comprehensible, and valid argument to be developed with supporting evidence that shows safety and mission assurance objectives have been satisfied. Analogous to how patent applications are constructed for inventions, an assurance case has a high-level claim of meeting a safety and mission assurance objective, followed by a more specific set of sub-claims and technical evidence which supports the claims. The objectives-driven assurance case approach allows for a better understanding and exploration of the trade space, more flexibility to balance trades, and the ability to realize and implement technical and process innovations for resource, time, and cost savings. The assurance case is a living case that evolves over the entire program life cycle. Recently, NASA's Office of Planetary Protection (OPP) has adopted the assurance case approach as an acceptable methodology for demonstrating avoidance of contamination of target solar system bodies explored by NASA space flight missions. This methodology has been incorporated into NASA's new technical standard for planetary protection and is currently being utilized by the Mars Sample Return campaign for safe sample containment during sample return. This presentation will explore the development and implementation of an assurance case approach in the context of planetary protection, the shift from prescriptive requirements and the ongoing culture change in the technical community, and the support and guidance from NASA's OPP in adopting the assurance case approach for achieving planetary protection objectives on NASA's space flight missions.