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ORGANIZATIONALLY DISTRIBUTED REQUIREMENTS MANAGEMENT ON THE NASA EUROPA CLIPPER MISSION

Abstract

As more and more missions are executed by multi-organizational partnerships rather than prime and secondary contractors, the need for a clean requirements management approach across partnering institutions is paramount. NASA's Europa Clipper mission, set to launch in 2022 to perform multiple flybys of Jupiter's moon Europa, is implemented as a partnership between the California Institute of Technology Jet Propulsion Laboratory (JPL) and the Johns Hopkins University Applied Physics Laboratory (APL). As part of this collaboration, APL is responsible for two major sections of the Clipper spacecraft, the Radio Frequency (RF) Module (including telecommunications) and the Propulsion Module (including the propulsion subsystem). Both APL modules are multi-disciplinary implementations of elements from several subsystems (e.g., thermal and mechanical). Roughly 80% of the engineering for the mission by is provided by JPL. Engineering requirements are managed in a DOORS database residing at JPL, but mirrored on an APL server to facilitate proper requirements flowdown and traceability to lower level components within the RF and Propulsion modules, as well as verification and verification roll up to higher levels.

The modules, which are organizationally self-contained, act as funnels to ensure that all requirements pertaining to any element implemented within the module flow to the responsible implementer. Rather than a traditional requirements hierarchy reflected in a linear, vertical path through requirements levels, the organizationally distributed project implements a requirements matrix. This allows its modules to receive requirements both vertically along the conventional path (e.g. Spacecraft Requirements to RF Module Telecom Subsystem Requirements), and "around the corner" from subsystems with elements being implemented in the module (e.g., Thermal Subsystem Requirements to RF Module Thermal Elements Requirements). This paper discusses techniques implemented to ensure an accurate requirements flowdown and verification methodology. Initial flowdown, allocations, traceability, testability, and verification are discussed, along with processes for updates and configuration management. Challenges and solutions associated with implementing requirements in an organizationally distributed project are addressed.