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DEFINITION AND INCOORPORATION OF A METHOD APPLYING A LEVEL-BASED APPROACH TO IMPROVE THE IMPLEMENTATION AND THE SUCCESS RATE OF TECHNOLOGY DEMONSTRATION IN NEW SPACE PROJECTS

Abstract

The preparation, integration, and operation of novel payloads focused towards technological development of space applications is a time-consuming, costly, and risky endeavor. Developers spend many hours researching, developing, testing, and qualifying new technologies to be demonstrated in space. To ensure that new technologies do not fail in space, common measures in the New Space domain include increased testing and qualification procedures and, in some cases, a reduction in the overall scope of activities to be performed in space. However, these measures require more effort and lead to higher costs, time delays, and reduced performance. In order to reduce the higher effort associated with the implementation of new technologies to be demonstrated in space and to increase their capacity, a novel method to optimize the preparation and subsequently the operation of innovative payloads within New Space projects is proposed. In the method proposed, each operational feature of the innovative payloads is divided into separate levels. Each level targets specific difficulty and feasibility aspects of the technology to be demonstrated. The overall goal is to progress from one level to the next, leading to the overall success of the objectives defined. This thought process gamifies the definition of the strategy behind payload operations, which allows to improve the focus during the development and implementation phases on both sides the developer and the integrator. In addition, each level accomplished provides further insides about the capacity and fault affinity of the innovative payloads. A literature review on methods for defining objectives, risk mitigation procedures, payload operation strategies, and testing sequences is performed to illustrate the baseline on state of the art methods for increasing the success rate of Technology Demonstration projects. Different methodologies, such as gamification and Pareto principle, are applied to estimate the feasibility and success rate of novel technologies and integrate them into the planning of payload operations.

The method presented in this paper is applied to New Space projects, including hybrid projects combining New Space and Conventional Space approaches, with the aim of evaluating and realistically validating it for its adaptation in the definition of requirements and the concept of operations of innovative technologies. The results show an increased concretization and integration of the technological use cases to be demonstrated in space.

This paper presents a novel method to improve the preparation of innovative technologies to be demonstrated onboard a spacecraft, their adaptation, and the success rate in New Space projects.