

IAF SPACE SYSTEMS SYMPOSIUM (D1)

Lessons Learned in Space Systems: Achievements, Challenges, Best Practices, Standards. (5)

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LESSONS LEARNED ON SYSTEMS OF SYSTEMS ENGINEERING: SYSTEMS CONCURRENT
ENGINEERING OF A CONSTELLATION OF CUBESAT FORMATIONS**Abstract**

This paper presents results of the application of the Systems Concurrent Engineering (SCE) process in a System of Systems scenario, focused on the space segment of a satellite constellation designed to detect and monitor conflagrations of fire at the Brazilian Amazon rain forest. The project consists of a constellation of formations of CubeSats which are capable of performing the necessary tasks at a lower cost and with smaller revisit times, allowing almost real time monitoring of the rain forest by forest surveillance teams and other stakeholders. By taking advantage of the systems concurrent engineering method, it was possible to anticipate relevant issues which would not have been dealt with during the initial systems engineering phases of the process. The method provided a way to systematically analyze stakeholders, requirements, functions and architectures for the product and the organization life cycle comprised of systems engineering activities for a complex satellite system. This paper describes the process instantiation for the product nominal operational scenario, while the complete project contains several product life cycle process scenarios of different perspectives, including development and non-development organizations as well as operational and non-operational product scenarios. We also identify possible method improvements based on data science and artificial intelligence techniques, as a historical analysis of the development data would be valuable and could bring predictions of periods that require more resources to handle critical situations, and that could lead to new requirements for the mission. Practical example of the method application also involves the TIM (Telematics International Mission) project, related to a formation of small satellites. This presents the Systems Concurrent Engineering (SCE) process as an alternative to traditional Systems Engineering, and it shows the lessons learned when applying the method for System of Systems.