IAF SPACE SYSTEMS SYMPOSIUM (D1)
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"SYSTEM ENGINEERING CHALLENGES IN ISRO'S MODULAR I-3K SPACECRAFT BUS DESIGN"

Abstract

Good system engineering practices are essential for the effective design, fabrication, testing and operations of complex systems such as spacecraft and aircrafts. Spacecraft design has always been optimized to perform the intended mission with the lowest possible mass and volume meeting the functional requirements. Process for iterative designing and building spacecraft more efficiently with minimum time, complexity, cost and with optimal performance is usually associated with the aspects of system engineering. Traditionally, the design, fabrication testing of spacecraft has been around "Monolithic Fractionated architecture" which has been very costly and time consuming. This was primarily due to the fact that the number of satellites being less, each spacecraft was custom designed and built for a particular application. Now the spacecraft design realization has evolved from its nascent stage to a much more advanced stage with the experience gathered and maturity gained over a period of time. With the newer application evolving every day and governmental push to have an outreach to inaccessible locations to meet the larger objective of "Digital India", the requirement of the number of satellites have increased exponentially. Thus, there is a need to adopt a strategy for building a spacecraft in a more cost effective manner with minimal realization time. This can be achieved by optimization of design and use of standardized hardware which can be productionized both at circuit level as well as at system level. Modern spacecraft are built around "Modular architecture". Modularizing and standardizing spacecraft subsystems / systems will definitely fetch advantages in terms of system integrity, optimality of realization and cost effectiveness. Modular design is intended to reduce the complexity and lead time on missions providing a reliable characterized system that can carry a variety of payloads. Modularity describes the degree to which electrical and mechanical architectures are standardized and systematically partitioned. It is also designed with a goal for ease of manufacturing, assembly and testing activities. Complete modularization of the whole spacecraft requires an extensive relook at design, realization testing approach. This paper describes the system engineering challenges in developing ISRO's I-3k spacecraft on modular architecture referred as "Modular Bus" with independent platform and payload system modules. This Modular bus is designed keeping in view the spacecraft handling, accessibility reworkability aspects, apart from the optimization

and system integrity in the realization. This paper also describes the feasibility, design requirement and capabilities of a modular bus as well as the requirements for the payload to utilize this bus in an optimal way.