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

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THE PRACTICE OF REDUCING COST IN THE DEVELOPMENT OF SMALLSATS

Abstract

With the development of smallsats technology, short-development-cycle, low-cost and high reliability have become its trend. New Space brings a new way of thinking about space which involves marshaling technological innovations to create new more cost-efficient space systems that can open entirely new markets. Technology innovations have led to new ways of designing and building satellites. Skybox and Planet Labs have found ways to undertake remote sensing in ways that were ten times less costly than the commercial enterprises highly reliant on government customers that preceded them. In the era of new space, the ability to reduce cost represents the core competitiveness of enterprises. The development of a small satellite can generally be divided into design, devices development, assembly integration, and test, launch into orbit, operation, etc. with the practice of more than 30 smallsats developed, this paper analyzes the main cost composition in the satellite development, methods of reducing cost were put forward. In the primary design and critical design phase, the philosophy that cost was decided by design was followed, and both the technology and cost were considered at the same time. An integrated optimization design was adopted to break the boundaries of subsystems and make full use of hardware resources. System design based on off-the-shelf products was encouraged and new products were strictly restricted. Simulation and analysis of on-orbit flight data were used instead of the qualification test model to improve the design accuracy. Modulization was an effective way to control development cost. In the process of device development, cautious selection of COTS parts has become popular. The industrial parts verified by flight experiences have been proven to be applicable to low orbit space missions through necessary qualification, software and hardware fault-tolerant design, and system level fault-tolerant design was helpful to mitigate the single event effects. The manufacturability and testability of products were paid much more attention to improve the efficiency of manufacture and testing. In the manufacturing process, an automatic production line is used to improve manufacturing efficiency. The 3D model-based digital assembly technology was used to verify the feasibility of the assembly process. Electrical cables were pre-assembled and managed as an independent component. In the test phase, it is important to make full use of automatic test and parallel test tools to optimize test items and test processes.