IAF SPACE SYSTEMS SYMPOSIUM (D1)
Lessons Learned in Space Systems: Achievements, Challenges, Best Practices, Standards. (5)

Author: Mr. Lianxiang Jiang
China Academy of Space Technology (CAST), China

Ms. Peipei Xu
China Academy of Space Technology, China
Mr. Teng Zhang
China Academy of Space Technology, China
Mr. Xiaohua Guo
China Academy of Space Technology, China

RESEARCH AND DEVELOPMENT OF INTEGRATED MODULAR AVIONICS FOR THE LOW-COST MICRO-SATELLITES

Abstract

Micro-satellites have been widely used in communication, remote sensing, electronic reconnaissance and other fields. NASA proposed faster, better, cheaper guidelines for microsatellites, which have been accepted by more and more international peers. Especially for sudden natural disasters or local military reconnaissance and communication application, it requires low-cost and short lifetime micro-satellites with rapid development, launch and application, which need to change and optimize the development mode of traditional micro-satellite avionics equipment. At the same time, it puts forward quicker satellite integrated testing and in orbit testing, which requires quick system integration and in orbit testing. In order to shorten the time of the payload's data to the users, on-board data processing equipment is employed for small satellite to process payload data in space. Low-cost and short-life micro-satellites bring new requirements for on-board avionics. In order to achieve better, faster and cheaper object in the development of the on-board avionics, we share our lessons learned in the development of on-board avionics for low cost remote sensing micro-satellites, whose life was 1 year. Specifically include:(1)the general requirement of avionics for microsatellites are summarized, and an integrated avionics system architecture is proposed, including OBC, PCDU, S-Band Transceiver, AIO, GPS receiver, routers and mass memory modules; furthermore, the other function modules are easily integrated in the system.(2) Standardization, modularization and serialization, the general modules of the avionics could be produced in batch mode and stored as off-the-shelf products, the different requirement of satellites were met through the combination of the different standardized modules. In this way, we can avoid repeated development cost and shorten the development cycle. (3) a new way for industry level components selection and quality assurance was explored to reduce the cost of components. The importance of the applied circuits, component level, on-board experience and the orbit altitude was considered. At the same time, the system level fault tolerant design were also strengthened; (4) Plug and play mechanism was put forward to make the OBC recognize the devices dynamically when they powered on, which accelerated the system integration; furthermore, the software modules are also allowed to install and uninstall dynamically on-line for new application requirements; (5)Built-in-test(BIT) methods are employed to shorten the test time during the integration and on-board test. The power-on test and cycle running test was designed, the detailed test could be executed by instruction when needed. The principle prototype avionics for the 1-year life micro-satellite is developed, its volume was 205mm*200mm*200mm, weights 4.5Kg and long term power was 10 watt. The above new technologies and methods are carried out in the development and testing of the prototype, the effectiveness of these techniques are demonstrated.