Nano-satellite Reliability and Standardization: Introduction of Lean Satellite Concept

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There is increasing demand of small/micro/nano/pico satellite development and utilization worldwide. Recent statistics shows that in 2014 nearly 140 satellites with less than 10kg mass were launched. These satellites have possibility to strengthen the basis of space sector and revolutionize space application, which benefits not only to the space sector, but humanity as well. To promote the growth further, their environment needs to be improved in various areas such as launch, satellite technology, ground station, development and testing infrastructure, international standard, investment promotion, and so on.

This talk will introduce recent international standard activities related to small satellites. The recent explosive growth of the small satellite launch has caused significant concerns among traditional space sector that utilizes space for business/military/civil purpose. Peaceful coexistence of traditional sector and the emerging sector is essential for the growth of space sector as a whole. There is a need to define “what is a small satellite” and lay out the requirements of small satellites. In 2014, an activity started at ISO/TC20/SC14 to make an ISO standard to describe definition and requirements of small satellites. A new study group was also initiated at International Academy of Astronautics (IAA) to examine the definitions of small satellites and identify the requirements every satellite should follow regardless its size. The study group report will become an important input to the ISO standard.

In the IAA study group, the definition of small satellite has been discussed extensively. The majority of the opinions are that mass nor size is not suitable for definition of small satellites and they should be defined by the philosophy of design, manufacturing, mission, program management and others. Tentatively, IAA study group came to conclusion that “lean satellite” is the most suitable word to describe a satellite that utilizes untraditional risk-taking development approaches to achieve low-cost and fast-delivery with a small number of team. The smallness is merely the result of the approaches.

At ISO/TC20/SC14, a standardization activity related to lean satellites testing is also under way.

The purpose of ISO/CD/19683, “Design Qualification and Acceptance Tests of Lean Satellites and Units” is to describe minimum test requirements and test methods to qualify the design and manufacturing methods of commercial lean satellites and their units, and to accept the final products. This standard places emphasis on achieving reliability against infant mortality after satellite launch to orbit while maintaining low-cost and fast-delivery. Kyushu Institute of Technology (Kyutech) is conducting environment testing of lean satellites from all over the world. Recently Kyutech has started an activity to do preliminary trials of certification testing of commercial units sold as lean satellite products based on the draft of ISO/DIS/19683. This activity along with other activities to improve lean satellite reliability will be introduced.