Outline: Satellite Testing Short Course

1. Introduction
2. Vibration test
3. Shock test
4. Thermal test
5. Radiation test

Spacecraft need to operate in an environmental completely different from the terrestrial environment. Moreover, spacecraft are required to operate maintenance free for a long period of time, often longer than 10 years. Thorough environment testing of spacecraft system and components is required to assure a high degree of mission success. There are various tests to be conducted before the launch. But the real reasons why these tests are required are sometimes unclear as the tests are often carried out as routine procedures.

Currently, a revolutionary approach to develop small satellites at low-cost and with short delivery time is underway worldwide. Testing occupies a large fraction of the cost and the schedule in a spacecraft's life cycle. Rationales behind each test need to be well understood so that we can shorten (or even omit) some of the tests without substantially increasing the associated risks. This short course (tutorial) puts emphasis on the rationale behind each environment test. Description of each test will be also made taking the example of various spacecraft programs, especially small satellites programs. Practical aspects of testing methods will be introduced to prepare for hands-on training following lectures. Participants will understand the mechanism and outcomes of the interaction of the spacecraft with each space environment factor, and will learn what points should be taken into account when they create a verification plan for their spacecraft.

The short course consists of five lectures. Slides of more than 400 pages will be distributed.

Lecturer: Mengu Cho
Professor, Director, Laboratory of Spacecraft Environment Interaction Engineering, Kyushu Institute of Technology
Prof. Mengu Cho received the B.E. and M.E. degrees from the Department of Aeronautics,

University of Tokyo, Tokyo, Japan. He received his Ph.D. degree from the Department of Aeronautics and Astronautics, Massachusetts Institute of Technology, USA, in 1992. From 1992 to 1995, he was a Research Associate with Kobe University, Kobe, Japan. From 1995 to 1996, he was a Teaching Associate with International Space University, France. Since 1996, he has been with Kyushu Institute of Technology (Kyutech), Japan. Since 2004, he has been a Professor and also the Director of the Laboratory of Spacecraft Environment Interaction Engineering (LaSEINE) of Kyutech. LaSEINE is a research group with more than 10 academic staff and 30 graduate students.

His research interest includes spacecraft environmental interaction, especially spacecraft charging and nano-satellite reliability. He has authored or co-authored more than 120 papers in peer reviewed journals. He contributed two chapters in an AIAA text book, “Spacecraft Charging”. Currently he is teaching various graduate-level courses at Kyutech, such as Introduction to Satellite Engineering, Space Environment Testing, etc. He taught a similar subject at Nanyang Technological University, Singapore, and at the University of Wurzburg, Germany. He was a project lead of a standardization project for ISO-11221, “Space systems -- Space solar panels -- Spacecraft charging induced electrostatic discharge test methods” that was published in 2011. He is now leading an international effort on small satellite testing standardization as well as IAA study group on definition and requirements of small satellites. He supervised the KYUTECH satellite project teams that successfully launched and operated a 7-kg nano-satellite, HORYU-II, in 2012 and a 10-kg nano-satellite, HORYU-IV, in 2016.

He has organized various international conferences, including *Spacecraft Charging Technology Conference* and *International Workshop on Micro/Nano Satellite Testing Standardization.*