

## Requirements for Observation Equipment Development on Small Satellite from Bus Side

Nobutada Sako<sup>1\*</sup>

<sup>1</sup>Shinshu University

### 1: Introduction

Artificial satellites are getting larger and larger every year and reached to several tons. This induces satellite high cost, long term development and high reliability requirements and large satellite development stalled. In this situation small satellite which weighs 1 to 100kg become conspicuous in astronautics. Especially, Japan is leading 1kg nano-satellite class in the world since we have developed and verify them first in the world. Mission at first stage was simple satellite bus performance check. Now there are technical demonstrations and high-level science observation missions similar to large satellites are taken place. This time, requirements from satellite side to observation equipment developers are reported.

### 2: Nano-satellite specifications

In this paper, nano-satellite means 1-50kg, 10-50 cm cubic size and it generates 1-50W power. (Common large satellite is several meter size.) Nano-satellite can provide 30 to 50 % resource for mission side.

In Japan, university one laboratory is a major player for nano-satellite development. And this means students are main force.

As referred in the above, usually nano-satellite has a single mission because of limited resources. And that means observers can use the satellite exclusively.

### 3: Requests for observation equipment developers

#### 3-1: Interface and use of resources

Nano-satellite developers are not bureaucratic. Interface can be determined based on discussion between bus and mission side and it can be changed it is needed.

#### 3-2: Information and motivation

For precise interface draw up, both sides should exchange design and development information each other. Since we work in a different area, we will start from understanding of terms of other side. Announcement of observation purpose, method and achievements are strongly welcome, it help to raise motivation. Main members of bus side are students, they are curious in science. When the explanation is enough, bus side will start to develop observation equipment part. This helps further mutual understanding and union of organization and knowledge speeds up.

#### 3-4: Development strategy

Ambition for precise observation deserves to be acclaimed. There is performance limit for nano-satellite. Future plan should be considered. Successive small satellite project or combination use of large satellite (high low mix) will be easy rather than on extremely high specification satellite.

#### 3-5: Redundancy

Since nano-satellite bus has little redundancy, too much careful design in mission side is useless.

#### 3-6: Launch delay

Small satellites are often launched as a piggy-back of large satellite. So launch will postpone in many cases by irresistible force. Prepare for launch delay on ahead.

#### 3-7: Ground test

The equipment tests are difficult since it will be used in vacuum and zero-gravity environment. But we can't fix them after the satellite in on the orbit. Verification for validation must be done before the launch no matter how hard it is.

### 4: Conclusion

Requirements for mission side from bus side are described in this paper. In recent years, many universities star satellite projects. You can contact UNISEC (University Space Engineering Consortium) for introducing satellite projects.

Keywords: nano-satellite