Proposal of “Ig Satellite Design Contest” and Its Expected Effect

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This paper proposes to hold “Ig Satellite Design Contest,” in order to expand our space utilization by means of content-based satellites in the stream of recent microsatellite development. Going back to the history of the recent microsatellite, such a content-based satellite is positioned as the third-generation one. Ig Satellite Design Contest stands on the position of the two policies, that is, the satellite is chip in porridge for practical effect, but is to bring pleasure or happiness to people, or to stimulate access to the space and our future space activities.

Key Words: Ig Satellite Design Contest, Microsatellite, Content-Based Satellite, 3G Satellite

1. Introduction

The first-generation satellite (1G-SAT) was grown mainly in the CanSat and CubeSat: CanSat took a lead in the development of 1G-SAT and some universities started their CanSat projects and demonstrated them at the A Rocket Launch for International Student Satellite (ARLISS)¹ held in the Blackrock Desert. CanSat produced an effect to make them understand about system and its design, and eventually led to development of 1kg picosatellite, called CubeSat. The first CubeSats, XI-IV² and CUTE-I,³ were developed by the students in University of Tokyo and Tokyo Institute of Technology, and launched in 2003 with the EUROCOTK launcher. Their CubeSats introduced aggressive Commercial-Off-The-Shelf (COTS), and have been operative bravely since their launch and delivering appealing earth images or satellite status to our personal computers.⁴ These satellites aimed to prove probability of a satellite by unique development and to demonstrate its practicability.

The second-generation satellite (2G-SAT) has been building in the satellite projects progressed by universities or non-governmental organization such as the Space Oriented Higashi-Osaka Leading Association (SOHLA) since 2003, and the representative case is the MAIDO-1 Microsatellite by SOHLA launched in 2009 with the Japan Aerospace Exploration Agency (JAXA) H-IIA launcher. 2G-SATs are expected to achieve some practical missions as thunder observation or star mapping.

Accordingly, 1G- and 2G-SAT were significantly demonstrated that even universities or some organizations have ability and practicality to develop, launch, and utilize their own satellites with their technologies and know-how, and dozens of the satellite projects are now in progress in the world. However, we encounter a problem, that is, how will we utilize the satellite? and where should we go with them? One of the answers is in this paper where we explain the importance of various content of space missions, propose an unexampled contest for microsatellite and illustrate by an example.

2. Proposal of Ig Satellite Design Contest

Here, we propose the third-generation satellite (3G-SAT) positioned as CONTENT-BASED satellite, and the most promising item is Microsatellite because Microsatellite requires the smaller cost and the shorter period for its development than the conventional satellite. In order to maximize the vitality of 3G-SAT, it is necessary to create and expand various CONTENTS in terms of both quality and quantity as is the cases of VTR, INTERNET, or IP Television which had NOT become common until variety of contents provided. To that end, it is preferable that free-wheeling ideas should be proposed by a variety of people. This is partially actualized in the Satellite Design Contest (SatCon) and kinds of satellites were proposed in the 16-time SatCon by 2008. The satellites and their usages, however, tend to remain the items that some scientists, technical experts, or some specialists only find joy in their achievements. Also in the world, Lunar X Prize by Google⁵ is held but it specifies a content itself to send an explorer to the moon.

Therefore, we also propose to launch a competition called “Ig Satellite Design Contest (Ig SatCon)” in order to collect numerous designs and usages of satellite and space utilization. Ig SatCon welcomes the satellite satisfying the following:

1. Chip in porridge for practical effect,
2. But, bringing pleasure or happiness to people, or to stimulate access to the space and our future activities.

We are planning to set the following two categories in the Ig SatCon:

(a) Category of Graffiti-on-the-Desk, treats a satellite...
depending on at least one technological basis or breakthrough actualized or expected to be brought,
(b) Category of Being-Produced-in-the-Brain, treats a satellite depending on hypothetical.
While Category (a) depends on at least one technological basis in the current status or some breakthrough realized near future should be proposed, Satellites for Category (b) are essentially proposed by technological imagination.

3. Examples of Satellites for Ig SatCon

We show some good examples of such satellites as satisfy the Ig SatCon ethos here.

3.1. Gold Ingot Satellite (GIS)

3.1.1. Background and ideal mission

To promote academic and private initiatives, an effective scheme is required and one candidate of that is introducing the principle of competition. Successful examples are the prizes by the X-PRIZE foundation, and the Space Ship One won the prize for manned space flight in 2004, which brought a significant impact. It can be guessed that such a scheme will also function effectively in the fields of satellite development and will be dream maker.

Ideally, the satellite mounts a lot of gold ingots whose worth is open to the public and it is injected into an orbit. Then, some challengers try to retrieve the satellite by the smaller funds than the worth of the gold ingots to obtain the profit. However, it is not practical in the point of the cost because mounting a lot of gold ingot requires high launch cost. Furthermore, such a retrieve mission requires a lot of technological elements, e.g. rendezvous and reentry etc., and the success of all elements heightens the hurdle of the retrieve mission. Consequently the number of the entries into the mission may reduce.

3.1.2. Practical mission

The satellite series provide some technological trials for the prizes. Each of satellite provides a different trial and the money of prize about each trial is determined depending on the level of the problem. The challengers who clear the trial can obtain money. Taking the ideal mission purpose into account, gold ingots may be better than money for the winner. Eventually success in such a trial will realize a low cost docking technology.

Following series of GIS also provide various kinds of technological trials as GIS-1 and GIS-2, shown in Fig. 2. It can be expected that such a kind of trial will attract a lot of engineers and effective development will be promoted. In addition, many audience will stand watch the competition and can be expected that such a kind of trial will attract a lot of engineers and effective development will be promoted. In addition, many audience will stand watch the competition and will be dream maker.

3.1.3. Satellite series

GIS-1: The mission of GIS-1 is realization of appearance inspection at low cost. GIS-1 is a very simple satellite which has graphical pattern on the surface of the satellite. A challenger who captures the graphical pattern on GIS-1 can win the prize. As long as the mission is achieved, it does not matter what kind of method is taken. Therefore, the team with higher resolution telescope on the ground may win the prize.

GIS-2: GIS-2 has a docking port, and the interface of the port is opened to the public. After the success of the docking between GIS-2 and the satellite launched by a challenger, some kinds of communications become possible. The data obtained by the communications become the proof for the winner of the prize. Eventually success in such a trial will realize a low cost docking technology.

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3.2. Instant RAMEN Timer Satellite (INRAMSAT)

3.2.1. Background and motivation

Nowadays, Japanese astronauts begin to stay in the international space station. Many kinds of Japanese space foods have been developed simultaneously with them. An instant ramen (a Japanese noodle dish) which is one of the most popular foods in the country and famous for this copy; “NO BORDER” was arrived in the space station. The traditional method of an instant ramen cooking is as follows: 1) pouring the hot water, 2) covering the pan by a dish, and 3) timing by a hourglass. For the space station crew, however, watch is an only way to know the time. If their watch is broken, do they know the optimum timing of the instant ramen to eat? It seems that the National Aeronautics and Space Administration (NASA) have rule out the communication without urgency to the ground crew by political reasons.

Many people know how terrible it is to miss the timing to eat ramen is. If other crews obstruct someone’s ramen timing, it may be not an exaggeration to say that it will be a bad influence on the relationship between the crews afterwards. As in these cases, it is important to know the timing in space is not only for their physical health but also their mental health. This is the motivation for the proposal of INRAMSAT. This satellite plays a role of a “speaking clock” service for International Space Station (ISS) crew.

3.2.2. Satellite design and breakthrough

- This satellite is orbiting at the same altitude of ISS to do on-demand communications.
- The hourglass is used as timing announcement as shown in Fig. 3. The hourglass status will be informed by digital image taken by a video camera or by an image
processing result (depend on the data transmission rate).
• Turning the hourglass upside down by a start command from ISS.
• Centrifugal force by spin
• How to move the sand to the other side of the hourglass in micro-gravity condition?
• If using magnetic fluid, it may move by magnetic force like sand.
• Some timer IC or clock IC will be used in satellite bus circuit.
• How should we count the effect predicted by the relativity theory?
• For ground users, speaking clock voice data which might be cute and charming will be served.

3.3. Second life in space
3.3.1. Mission purpose
The satellite provides a circumstance where we can experience the pseudo life in space, namely Second life in Space. It may simulate the life in space station and space colonies.

3.3.2. System of satellite
Satellite is filled with a lot of memories like USB memory as shown in Fig. 4. Each memory is purchased and the data of the person who purchases the memory are stored in the memory before its launch. For example, the data consist of their personality, house, belongings and so on. The satellite has a solar cell, radiation sensor, Temperature sensor and so on which can capture the change of circumstance of space. Then, the computer within the satellite manages their virtual life in space and the data of participants are managed by their memories. The data captured by the aforementioned sensors are used as event, disaster and so on. Thus, we call it Second Life in Space.

3.4. SNS satellite, kessler series
3.4.1. Background and motivation
This is a satellite proposed by one of the students taking a course of the author in the latter half of 2008. He reported that satellite itself was regarded as a content, and it would form developer’s community. There are the actual cases which have little meaning in actual life but succeed for something at a certain level such as Social Networking Service or Movie Delivery Service in the internet, and millions of people gather in them and use their functions or contents, and transmit information or contents on them. Here, this is an issue: Can a satellite be utilized similarly as a communication tool, and form its own community?

3.4.2. Operation of satellite
In accordance with the issue, a group of community satellites, Kessler series, was proposed. It may be called Social Networking Service (SNS) Satellite. The following is an example of function and operation of the Kesslers:
• Each Kessler satellite has a camera which shoots pictures and/or movies to arbitrary direction in arbitrary time, and can edit and open them.
• Operation of each satellite is entrusted to a person or a group of users, and acquires its core-users who have the ability of operation and development under the support to provide specification and development environments of hardware and software.
• A set of hardware and software is provided as a kit and API (Application Programming Interface).
• Each satellite is programmable and accessible by uplink and downlink from/to ground station.
• Each satellite is operated across the Internet by the core-users, and communication among the users is facilitated through chat or blog.

Once collaborative activity in the operation is established, a community is naturally formed and united tightly, as shown in Fig. 5.

Some satellites were also reported in the course by the students as follows:
● Traffic Control Satellite

● Satellite, Saving the World Quickly

● System by using a satellite which gives people simulated experiences of space or becoming an astronaut at this very moment in real time

5. Conclusion

We are now preparing to hold the first Ig SatCon in 2009, and organize the steering committee. Intended satellites will range from a technical one to a product of fantasy, so that the committee would seek the opinions of specialists from a variety of fields including not only space engineers but also artists or cartoonists, for example, so that we would like to ask for everyone's cooperation.

Thus, we would like to create a new way of promoting the next-generation space activities with satellites based on a variety of contents we have never seen, and we are sure that they will be common in the future. These satellites are expected to be beyond all conception at the year 2009.

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