Interview

Satellite Communications and I

Seiko Arizumi, who works at the B-SAT Kawaguchi Broadcasting Satellite Control Center, talked to us about her first experience with satellites, and about current satellite control operations.

Seiko Arizumi
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I joined Broadcasting Satellite System Corporation (B-SAT) in April of 2001, so a year has passed since I first started out in the satellite industry.

Satellite broadcasts are used broadly by a great number of viewers, as a versatile, dynamic media that differs from ground wave television, enabling high-definition broadcasts and other diverse, high-quality broadcasts with a service area spanning all parts of Japan. We are about to enter an entirely new era of satellite broadcasting.

B-SAT was established in April 1993 with the mission of conducting economical purchase and control of satellites, to ensure continuous, stable satellite broadcast services.

Two broadcast satellites (BSAT-1a & 1b), both manufactured by America's Hughes Space and Communications Company (HSC), were launched with Ariane rockets on April 17, 1997, and April 28, 1998, respectively. BSAT-2a, manufactured by America's Orbital Sciences Corp., was launched on March 9, 2001, with an Ariane 5 rocket; on April 26, BSAT-2a took over the digital satellite broadcast services that began on December 1, 2000, with BSAT-1b.

In addition to these three satellites, the BS-3N, manufactured by America's Lockheed Martin, has remained in full operation longer than the originally projected design life, and is still maintained as a backup satellite.

These satellites are positioned in geo-stationary orbit at 110 degrees east longitude, providing analog broadcast services using

four of the eight broadcast satellite channels allocated to Japan – channels 5, 7, 9, and 11 – and digital broadcast services using channels 1, 3, 13, and 15.

My first experience with satellites dates back to when I was a student at the Tokyo Metropolitan College of Aeronautical Engineering, and I participated in a satellite design contest. The contest has been held since 1993 by the Japan Space Forum, NASDA, and various space-related societies, as part of efforts to increase interest in research targeting small satellites that utilize the available space in large rockets. Students from technical colleges, universities, and graduate schools across Japan compete in two divisions: Ideas and Design. The contest is held each year at my college, and most of the participants are graduate research students in communications from faculties of electronic engineering. Each year, in the Idea division, students present unique concepts for new satellites; there have been presentations for power generator satellites and global appreciation satellites, for example. One of the past award-winning presentations, which described an observation satellite designed to observe the natural habitat of whales, has been scheduled for a future application.

In this same contest, I gave a presentation on "Population Density Distribution Observations using Satellite Photographs." The principle was to derive the correlation between population density and lightness in several cities of a given country, based on light images taken at night by existing satellites. Then, by drawing an approximation line, or "best-fit" line, based using this correlation; it is possible to estimate in real time the population density of non-surveyed regions. The premise of my proposal was that this information could be used as data when investigating energy problems or population problems. I received the Institute of Space and Astronautical Science Award for my presentation.

I currently work in the Control Group at the B-SAT Kawaguchi Broadcasting Satellite Control Center. The Control Group analyzes signals from satellites to monitor the satellites' status; we send control commands to the satellites according to the results of orbit and

attitude analyses, manipulating the actual satellites' movements. The Kawaguchi Broadcast Satellite Control Center was established in April 1997; as of April 2002, we will be conducting around-the-clock management and operation of four broadcast satellites – the BSAT-1a, BSAT1b, BSAT-2a, and BS-3N.

The B-SAT satellite control system is comprised of the Kawaguchi Broadcast Satellite Control Center, which is the main station, and the Kimitsu Broadcast Satellite Control Station, which acts as a backup station. Generally, operations are handled from the Kawaguchi Control Center. If there is ever a problem with transmissions between the Center and the satellites, either due to the weather or some kind of equipment failure, then operations are transferred from the Kawaguchi Control Center to the Kimitsu Control Station. As for the broadcast programs, digital BS programs are transmitted from the B-SAT Uplink Center, and analog BS broadcast programs are transmitted from NHK and WOWOW.

At the Control Center, we work in two shifts, from 9:30 a.m. to 6:00 p.m., and from 5:00 p.m. to 10:00 a.m. We enter commands based on the orbit and attitude of the satellites, sometimes during the day, and sometimes at night. We enter these commands while confirming wobbles in the satellites' position and other factors using graphs displayed on a monitor. When the wobble is really significant, things can get pretty tense at the Control Center, even if we know something we have already predicted is going to happen.

Before I came to the Kawaguchi Control Center, I thought that satellites mostly just spun around in a stationary orbit, so I imagined most of the work would just involve monitoring operations. Since I started working here, though, I found out that there is a huge range of work to be done. Some of our tasks include conducting attitude control on one spin satellite twice a week, and orbit control several times a month; taking data for orbit determination; and making adjustments when the earth or the moon comes between the satellite and the sun, which means that a shadow is cast on the solar panels preventing power generation. We are also responsible for the stable operation of ground facilities used to control and monitor satellite status.

The most difficult part of our work is getting satellites and ground facilities back on line after a failure – this often requires a wide range of high-level technical skills and knowledge. Whenever I see one of the satellite manufacturers or Control Center engineers who has been here much longer than myself analyzing the movements of a satellite that they can't really see as though it were rolling around in the palm of their hand, I feel a great respect for them, and at the same time I realize how much I have to learn.

Recently, we hear a lot of news about the likelihood that subscriptions to BS digital broadcasts will increase with the winter Olympics and the World Cup coming up this year,

and that's a sign that satellite broadcasts have a very bright future. As an employee at a company that is solely responsible for controlling broadcast satellites, I intend to approach my work with a clear awareness of my own responsibilities to the viewers – who are expected to grow to 15 million or more in number – in the context of satellite operations.