

TRENDS IN SATELLITE BROADCASTING

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In this article, 'satellite broadcasts' refer to satellite broadcasting in the BSS (broadcasting satellite service) band.

1. Introduction

The Broadcasting Satellite System Corporation (B-SAT), based in Tokyo's Shibuya ward, is private-sector firm that was established in 1993 for the purpose of procuring and operating the BSAT-1 satellite for the analogue satellite broadcasts provided by NHK and WOWOW. The current President & CEO is Kenji Nagai. The firm subsequently launched the BSAT-1a and BSAT-1b satellites in 1997 and 1998, each of which offers 4 channels and has a service life of 10 years. B-SAT was given the task of procuring and operating the BSAT-2a and BSAT-2c satellites with the commencement of digital satellite broadcasts in 2000. Each of these satellites offers 4 channels and has a service life of 10 years; BSAT-2c was designed to replace BSAT-2b. In this article, B-SAT reports on trends in satellite broadcasting, with particular attention to the developments which took place in 2007.

2. BSAT-3a Starts Operation

BSAT-3a, which was designed to replace BSAT-1a, was launched on an Ariane 5 rocket from French Guiana at 8.44 p.m. on 14 August 2007 (local time), or 8.44 a.m. on 15 August (JST). Conducting In-Orbit-Test after BSAT-3a was placed in geostationary orbit at 110° E longitude on 24 August, and demonstrating that BSAT-3a was capable of fulfilling its specification, the satellite maker Lockheed Martin transferred BSAT-3a to B-SAT at 10pm 29th September, which commenced its operation.

B-SAT had earlier submitted to the Internal Affairs & Communications Ministry (MIC) an application to be a satellite station (facility-supplying BS broadcaster) for fifth-generation satellite broadcasts. The application was submitted in the period 16 April – 7 May 2004, and a preliminary licence was granted on 9 June of that year, after the application was screened by the Radio Regulatory Council. The preliminary licence enabled B-SAT to proceed with the procurement of BSAT-3a, which could offer 8 channels and have a service life of 13 years.

BSAT-3a has the following feature:

- (1) Zero momentum three-axis stabilisation control, in which the satellite's attitude is automatically adjusted by the satellite's onboard computer system.
- (2) 14:8 transmitter configuration (6 in reserve), enabling at least 2 reserve TWTAs to be assigned to each channel.
- (3) Autonomous recovery functions provided by the high-performance onboard computer system, which will automatically switch over to reserve transmitters in the event of a mishap, automatic attitude recovery of the satellite from attitude loss, battery management functions such as Pressure-Temperature Charge control, Over-temperature charge inhibit, monitor batteries, and so forth..
- (4) A service life of at least 13 years, with enough fuel for at least 16 years of service.
- (5) Efficient solar cells, which will provide a surplus power margin of at least 10% (at the time of the summer solstice) at the end of satellite's service life.
- (6) Batteries which enable 8 channels to operate during eclipses.



Fig. 1: BSAT-3a satellite (Courtesy of Lockheed Martin)

3. New Broadcasts from BSAT-3a*

The analogue satellite broadcasts for domestic audiences on BSAT-1a (the NHK BS-1 and BS-2 services on channels 7 and 11, and WOWOW on channel 5) were switched over to BSAT-3a on 1 November 2007. The analogue HDTV service on channel 9 (NHK Hi-Vision) ceased at 11.30 p.m. on 31 October. “Star Channel”, a program-supplying BS broadcaster commenced a digital satellite service, for domestic audiences, on channel 9 on 26 November, followed by “Nippon BS Broadcasting Corporation”, and “World Hi-Vision Channel “ on 1 December.

Figure 2 shows the channels allocated to each satellite. BSAT-3a currently handles the analogue satellite services (channels 5, 7, and 11), and the digital satellite services on channel

9, and is held in reserve for the digital satellite services that commenced in 2000 on channels 1, 3, 13, and 15. Figure 3 shows the providers of the services on each of the digital satellite channels.

* On 19 March 2003, MIC announced a partial amendment to the Basic Broadcasting Plan and a partial amendment to the Plan for the Available Frequencies Allocated to Broadcasting : (1) analogue HDTV satellite broadcasts would cease

Fig. 2: Channel Allocation by Satellite

(Up to 31 Oct. 2007)

Satellite (Launch date) DDMMYY	No. of available channels	Channels							
		1	3	5	7	9	11	13	15
BSAT-1a (17.4.97)	4			□	□	□	□		
BSAT-1b (29.4.98)	4			○	○	○	○		
BSAT-2a (9.3.01)	4	□	□					□	□
BSAT-2c (12.6.03)	4	○	○					○	○



(From 1 Nov.2007)

Satellite (Launch date) DDMMYY	No. of availabl e channel s	Channels							
		1	3	5	7	9	11	13	15
BSAT-3a (15.8.07)	8	○	○	□	□	□	□	○	○
BSAT-2c (12.6.03)	4	□	□					□	□
BSAT-2a (9.3.01)	4			○	○	○	○		

□ in operation ○ in reserve

in 2007; and (2) all other analogue satellite broadcasts would cease by 2011. On 15 March 2006, it announced the forthcoming changes to broadcasting frequencies, which set a specific date for the cessation of analogue HDTV satellite broadcasts. Following the report on 17 December 2003 from “a panel examining the introduction of digital satellite services”, MIC announced on 16 April 2004 that a contractor would be responsible for the fifth-generation satellite broadcasts, which would be provided from the replacement for BSAT-1a (which handles the analogue satellite broadcasts, including channel 9), which was due to come to the

broadcasts.

Fig. 3: Broadcasters on the Satellite Channels

Ch 1	Ch 3	Ch 9	Ch 13	Ch 15
BS Asahi (24)	WOWOW (24)	Nippon BS (18)	BS Nippon (24)	NHK BS-1 (11)
		Star Channel (15)		NHK BS-2 (9)
BS-i (24)	BS Japan (24)	World Hi-Vision Channel (15)	BS Fuji (24)	Dpa (2)
				WX24 (1.5)
				NHK BShi (24)
11.727480 GHz	11.765840 GHz	11.880920 GHz	11.957640 GHz	

(Figures in the parentheses denote the no. of slots allocated to each broadcaster)

4. Beyond 2011

MIC's "Study Group on Future Images of satellite Broadcasting" compiled its findings as a report on 19 October 2006. The report put forward a number of proposals regarding the additional frequencies that would become available for digital satellite broadcasts. The proposals included, first, the inviting of submissions for the use of these frequencies, not only for the three frequencies that would become available with the termination of analogue satellite broadcasts, but also for the four new frequencies that were internationally allocated to Japan at ITU WRC-2000. The submissions would be sought from the perspective of efficient use of spectrum, the introduction of new services, and the enhancement of the existing ones. Second, it was suggested that a specific commencement date be set for the additional frequencies by the time the procurement of new satellites starts.

In line with this respect, MIC invites proposals on utilization of new channels for BS digital broadcasting during the period from October 19 through December 28, 2006. It received 24 relating to frequencies, of which 16 dealt with new programmes, while three proposed an increase of data-rate to enhance existing services. Amongst the proposals relating to video encoding, 17 advocated the conventional MPEG-2 (including an increase of data-rate), while one advocated the H.264, while two others proposed an examination of both methods.

On 11 July 2007, MIC consulted the Radio Regulatory Council on a draft partial amendment to the Basic Broadcasting Plan and a draft partial amendment to the Plan for the Available Frequencies Allocated to Broadcasting, in which 12 frequencies would become available for digital satellite broadcasting from 2011. MIC received a report from the council stating that the draft amendment is appropriate. MIC immediately changed and enacted the related MIC notices

To secure a successor satellite for the BSAT-2 broadcasting satellite that will reach the end of its design life in 2011, MIC accepted license applications for broadcasting satellite stations during the application period that started on Wednesday, August 1 and ended at 5 p.m. on Friday, September 14, 2007.

B-SAT’s application mentioned three satellites – the effective use of the existing BSAT-3a, which would be in service for at least 13 years, and the launch of two new satellites, BSAT-3b and BSAT-3c. B-SAT was granted a preliminary licence on 14 November, the same day the application was endorsed by the Radio Regulatory Council.

Figure 4 shows the planned allocation of channels for the three satellites. BSAT-3b and BSAT-3c would be launched in 2011, and have a service life of 13 years up to 2024. BSAT-3a, which would be held in reserve, is designed to be in service until 2020, the year B-SAT plans to launch a 12-channel replacement.

Fig. 4: Planned Allocation of Channels from 2011

Satellite	No. of available channels	Channels											
		1	3	5	7	9	11	13	15	17	19	21	23
BSAT-3a	8	○	○	○	○	○	○	○	○				
BSAT-3b	8	□	□					□	□	○	○	○	○
BSAT-3c	8			□	□	□	□			□	□	□	□

□ in operation ○ in reserve

BSAT-3b would operate 8 channels, similar to BSAT-3a, while BSAT-3c would be a hybrid satellite for the BSS and the FSS bands.

The payload for the FSS band would be used by JSAT Corporation as a back-up unit for JCSAT-110.

B-SAT has reached an agreement with JSAT Corporation to procure this satellite, which will be operated by B-SAT. Tentatively, the satellite is named “BSAT-3c/JCSAT-110R” as a unique label for both firms

5. Postscript

B-SAT, in addition to the abovementioned business, is planning experiments with BSAT-3a so that it can examine the technical criteria for advanced digital broadcasts which are currently being discussed by the MIC's Telecommunications Council and by the Association of Radio Industries and Businesses (ARIB). B-SAT is committed to the development of satellite broadcasts as part of the overall development of the media. ■