

# The Antarctic HDTV Broadcasting Station

JUNJI MATSUOKA, NAOYUKI TAKAHASHI

NHK  
Tokyo, JAPAN

## ABSTRACT

In 2003, to commemorate the 50th anniversary of TV broadcasting in Japan, NHK established the HDTV Broadcasting Station in Antarctica. This was the first time in the world for a broadcasting station to be set up in Antarctica, and also for a film crew to stay there for over a year. Over 150 live programs including a broadcast of the solar eclipse were successfully made, and the spectacular natural scenery of Antarctica including ethereal aurora and violent blizzards fascinated many viewers. This grand project was successful because NHK's crew overcame many technical challenges and prepared meticulously for the severe environment; special equipment was developed and operated without problem at temperatures as low as  $-40^{\circ}\text{C}$ . This paper reports on the preparation for, and operation of, the Antarctic HDTV Station for one year and four months.

## INTRODUCTION

Antarctica is the only continent where modern civilization has yet to leave its footprints, even though we live in an era where information can be accessed instantly anywhere in the world. Today, anyone with money and reasonable preparations can set foot on the white continent, but this does not mean that we understand Antarctica well. Take the ice shelf, for instance, a thick plate of ice that extends out into the sea from the continent. Of these shelves, the Ronne ice shelf covers a sea area larger than Japan. The coldest water in the world flows beneath this thick ice plate to the depths of the ocean, forming a submarine current that reaches as far as the Indian Ocean and the Pacific. This flow of cold water, called the Antarctic bottom layer, keeps the global sea temperature from rising. Antarctica is thus vital for the fine ecological balance of the globe.

To mark the 50th anniversary of television broadcasting in Japan, we considered what NHK as a broadcaster could do for society, and decided upon images of Antarctica. This vast continent, the last unexplored region of the world, and its untouched nature, might provide clues to solving today's global environmental threats. The HDTV Broadcasting Station in Antarctica involved the basics of broadcasting—to capture images never seen before and broadcast them live. The sun that never sets, howling blizzards, dancing auroras in the sky, the first complete solar eclipse seen from Antarctica—



Fig.1 Antarctic HDTV broadcasting station

the station captured all of these and distributed them worldwide.

## PLANNING AND PREPARATIONS

The plan was to construct a broadcasting center within the compound of Syowa Station ( $69^{\circ} 00'S$ ,  $39^{\circ} 35'E$ ), the center of Japan's Antarctic expeditions, and to commence broadcasting live from there for one year. In July 2001, talks between the Japanese government and satellite communications companies got underway, but a number of hurdles remained before this world-first attempt could be realized. One of the challenges was to develop dependable equipment for broadcasting and earth station operations that could function without problem at temperatures as low as  $-40^{\circ}\text{C}$ . Another concern was the transportation of materials and equipment from Japan to Antarctica. All these details were eventually resolved through countless meetings as NHK and other parties worked out the specifics of the plan.

From November 2001 to March 2002, NHK stationed two of its staff, an engineer and a director, at Syowa Station to conduct preliminary surveys on the construction of the HDTV Broadcasting Station. Based on the results, we began producing equipment for the station operations, broadcasting and other related activities. The five-member NHK crew included us, who were to produce programs through the winter there,

started strenuous training for the construction of the broadcasting station by snatching whatever time we could as preparations continued. In November 2002, we set sail for the white continent aboard the Shirase Antarctic observation vessel, loaded with 60 tons of equipment. About three weeks later the crew arrived at Syowa Station where we immediately started setting up antennas, cameras, VCRs and other equipment for live broadcasting, ironing out technical glitches along the way (Fig.2). On January 28, 2003, an HDTV circuit to Japan was established, only three days before the start of live broadcasting. Finally, on February 1, on the 50th anniversary of television broadcasting in Japan, the crew began telecasting the world's first HDTV images of glaciers live from Antarctica for the home audience.



Fig.2 Construction of the 4.8m parabolic antenna

## FACILITIES

As Fig. 1 shows, the Broadcasting Station comprises a building housing a studio and a control room (6m x 20m x 3m) and an earth station antenna (4.8m in diameter). The studio (4.5m x 4.5m) is equipped with a set of remote control cameras with a prompter and a set of handy cameras. The control room, shown in Fig. 3, is next to the studio. Inside the control room, HD-SDI signals are for video processing, and analog signals for audio. The following devices are installed in the room: a video switcher and an audio mixer (for program production), a video editing system, an optical circuit and a microwave receiver (for broadcasting from outside the studio), a controller and HPA of the satellite earth station. To provide power exclusively for station operations, two 71kVA diesel generators supply energy to all the equipment of the station through an uninterruptible power supply unit. The earth station antenna is a 4.8m parabola antenna (USA VertexRSI) and the HPA is a 3.3kW klystron (Canada CPI). The antenna is tailor-made, designed to withstand temperatures as low as  $-45^{\circ}\text{C}$  and icy winds of up to 65 meters per second. As the antenna is installed at a high latitude ( $69^{\circ} 00'S$ ), its angle is set at 10 degrees over

the horizon. Intelsat 904 (IOR60E) is used for live broadcasting.



Fig.3 Control room in the Antarctic HDTV station

Signals from the Antarctic station are beamed in one hop to an earth station in Japan, from which they are transmitted to the NHK Tokyo Broadcasting Center through a network of optical fibers. Figure 4 shows the transmission path, and Table 1 shows the parameters of the satellite transmission. Three lines are established for communication between Japan and Antarctica using Inmarsat satellite services. Of these three lines, one is for 24-hour exclusive private communication with the NHK Tokyo Broadcasting Center, multiplexed with four extension lines and an Intranet (32kbps transmission rate). To make telephone calls outdoors, we took with them a set of portable Inmarsat equipment and two sets of Iridium equipment.

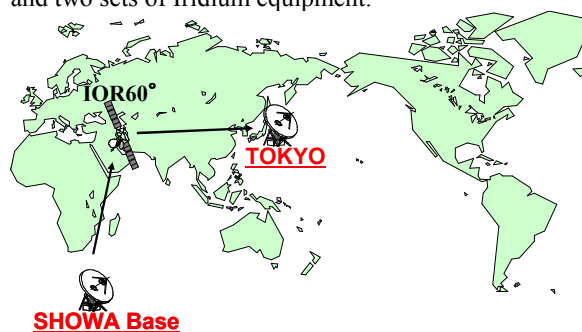


Fig.4 Satellite transmission path for HDTV

Table 1. Parameters of the satellite transmission

Bandwidth [MHz]	36
Modulation	QPSK
Date Rate [Mbps]	41.228
Symbol Rate [Msyn/s]	25.564
FEC	7/8
Roll-off	0.35





