

Tokyo Broadcasting System, Inc  
Nippon Telegraph and Telephone Corporation  
NTT Communications Corporation  
NTT Electronics Corporation

**"HD-WAVEExp", International Multi-Relay HDTV Images Transfer  
Experiment performed by Tokyo Broadcasting System, Inc. and NTT  
Group, is on public view in "NAB2001"  
- The Dawn of Image Contents Global Distribution Age Supported by Broadband  
Network -**

Tokyo Broadcasting System, Inc (Minato-ku Tokyo, Representative Director and President: Yukio Sunahara), Nippon Telegraph and Telephone Corporation (NTT, Chiyoda-ku Tokyo, Representative Director and President: Junichiro Miyazu), NTT Communications Corporation (NTTCom, Chiyoda-ku Tokyo, Director and President: Masanobu Suzuki), and NTT Electronics Corporation (NEL, Shibuya-ku Tokyo, Representative Director and President: Tastuo Izawa) are going to perform "HD-WAVEExp", the experiment of two-way transfer/remote control of HDTV images relayed across international network links, at the site of "NAB2001 (The National Association of Broadcasters) ([\\*1](#))" held in Las Vegas Convention Center (Las Vegas, U.S.A.) for 4 days from 23<sup>rd</sup> (Monday) to 26<sup>th</sup> (Thursday), April of this year (U.S.A. time).

"HD-WAVEExp", which means "HD-WAVE Experience", highlights the possibilities of the global distribution of image content in the broadband age. It is basically represented by the global introduction of Japanese digital BS broadcasting in December of last year, and the trial of Japanese HD broadcasting at the site of NAB. During NAB, the exhibition site (Las Vegas) and the relay point (Tokyo: Akasaka) are connected by ATM service ([\\*2](#)). HDTV images compressed by MPEG-2 are bi-directionally transferred to/from HD relay cars located around Mt. Fuji, using the digital SNG format ([\\*3](#)). In another experiment, an HDTV camera located in Shibuya is remotely controlled by NAB attendees in Las Vegas.

### **1. Purpose**

The production of broadcast material is being globalized at this moment, and we need to produce high-quality HDTV image contents with no technical restrictions or snafus, and deliver them to the viewers. This has created strong demand for the development of digital broadcast technologies and equipment optimized for HDTV images, and the development of a suitable international infrastructure that allows digital HDTV image contents to be relayed and distributed at high quality.

Tokyo Broadcasting System, Inc. and the NTT Group transferred HDTV images between Japan and U.S.A. in "NAB2000" in April of last year, and confirmed the ability of ATM services to transfer HDTV image. This time, Tokyo Broadcasting System, Inc., NTT, NTT Com and NEL responded to the call of NTT by merging their technologies and know how. The latest goal was to fully verify the practicability of HDTV long distance transfer technology; the best example was simple to select, the bi-

directional relay of HDTV signals over multiple long distance international links (the total distance exceeds 15,000 km) between Japan and U.S.A.

## 2. Experiment Details

Las Vegas Convention Center, the site of "NAB2001" (U.S.A.) and a broadcast center of Tokyo Broadcasting System, Inc.(Akasaka, Tokyo), are connected by ATM service. By using the "Wireless HD camera", the world's smallest and lightest camera with [built-in HDTV MPEG-2 encoder \(\\*4\)](#) developed by NTT Cyber Communications Laboratory Group, live HDTV images are captured, broadcast, and displayed on multiple monitors at the site. They are transferred via optical lines using the digital SNG format.

There are three main parts: the "trial of the wireless HD camera - optical line - digital SNG connection", "the seamless and international bi-directional transfer using Arcstar global ATM service (international) and ATM mega live service (domestic)", "the overseas control of an HDTV camera". These well duplicate the functions needed for actual program creation and broadcasting.

The individual responsibilities of each member are as follows, Tokyo Broadcasting System, Inc. is producing the HDTV programs, developing the HD-TS bridge technology ([\\*5](#)) and is arranging a prototype, NTT Communication is validating the multiplexed transfer technology of ATM service for HDTV images, and the inter-carrier connection technology, NTT Cyber Communications Laboratory Group and NEL are confirming the connectivity of the portable HDTV MPEG-2 encoder to other relay systems.

## 3. Technical Points of the Experiment

(1) Bi-directional HDTV using ATM service and digital SNG across multiple links  
The basic infrastructure of this experiment consists of the high-speed and broadband ATM service and digital SNG relay provided by the NTT Group. HD images are captured by the "wireless HD camera" as MPEG-2 compressed signals (TS), sent from Las Vegas as ATM cells, and passed to a broadcasting center of Tokyo Broadcasting System, Inc. in Akasaka Tokyo, then by using digital SNG, delivered to the HD relay cars located around Mt. Fuji. Thus bidirectional live relay can be realized. Conventional multiple relay transfer requires repeated baseband conversion, but transfer in this experiment is smooth since the optical line is well supported by the digital ONE wireless link ([\\*6](#)).

(2) Capture by "Wireless HD camera" (prototype) with [internal HDTV MPEG-2 encoder](#)  
HDTV capture and transfer is now feasible with the world's first "Wireless HD camera" (prototype), the smallest and lightest camera, with [internal HDTV MPEG-2 encoder](#). The encoder was developed by NTT Cyber Communications Laboratory Group, the digital wireless transfer module and the "HD-TS bridge" were developed by Tokyo Broadcasting System, Inc. and NEL.

(3) Overseas control of HDTV camera  
In this experiment, an HDTV camera located in Shibuya will be remotely controlled from the Las Vegas site by using the ATM-CLAD device ([\\*7](#)), which multiplexes the signals of the TV-LAN Ver.3 system, developed by Tokyo Broadcasting System, Inc., and transfers them over one ATM line.

## 4. Future Activities

After the experiments in "NAB2001", further field experiments shall be performed to confirm the connectivity needed for image transfer.

### **<Explanation of terms>**

#### **\*1: NAB**

The National Association of Broadcasters. The world's biggest broadcast related equipment exhibition. It was originally a conference of broadcasters, to which a makers' exhibition was added, and finally the current style was established. The main exhibitors are broadcast equipment makers and professional sound equipment makers etc.

#### **\*2: ATM service**

The communication service of NTT Group is based on ATM transfer mode (asynchronous) rather than the conventional transfer mode (synchronous). This service can satisfy the needs of high-speed and broadband communication by splitting the various information streams like sounds and images into 53 byte blocks called "Cells" and transferring them as cells.

#### **\*3: Digital SNG (Satellite News Gathering)**

This has been derived from the broadcast program production method called ENG (ENG: Electric News Gathering), and represents a satellite line program production method that uses satellite links. The initial transfer technology was analog, but with the recent development of digital transfer/reception equipment, compressed HD signals can now be transferred.

#### **\*4: [Built-in HDTV MPEG-2 encoder](#)**

Developed by NTT Cyber Communications Laboratory Group, this MPEG-2 encoder uses nine parallel-connected "Super ENC II chips. Specialized for portable camera use, it achieves the world's minimum size (75% to 87.5 smaller) and offer low power consumption (50% less). It also achieves high-quality image, high-compression rates and low-delay encoding by optimizing the distribution of data between each Super ENC II chip.

#### **\*5: HD-TS bridge**

Software developed by Tokyo Broadcasting System, Inc. and NEL. It realizes IP conversion for the HD-TS signal (DVB-ASI) via a general LAN interface on a general PC. An MPEG-2 compressed signal (TS) can be converted into the signals of various general LAN interfaces, and vice versa.

#### **\*6: Digital ONE link**

The method of transferring digital signals without intermediate conversion. As there is no analog conversion, deterioration of the signal is minimized. This method is suitable for high-quality image transfer.

#### **\*7: ATM-CLAD**

The interface device to transfer the various signals carried over the ATM line. In this experiment, the targets of ATM transfer are IP-based control signals and MPEG-2 compressed HDTV images.



HDTV with built-in MPEG-2 Encoder

- [International HDTV broadcast trial \[ HD-WAVExp \]](#)

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