8K Satellite Broadcasting Experiment

NHK has been developing the production equipment and transmission technologies of 8K Super Hi-Vision (8K) broadcasting, including video and sound encoders, multiplexing devices, transmitters and receivers. The Ministry of Internal Affairs and Communications released the 8K broadcasting roadmap last year, which calls for 8K test broadcasting over satellite channels to begin in 2016. In response, we are accelerating our efforts to put 8K broadcasting to practical use. During the Open House, we linked together all the broadcasting equipment, from the production equipment, encoder and multiplexer, to the transmitter, satellite, and display, and used them to broadcast 8K to the visitors. This was the first broadcast of 8K over a working broadcast satellite.

8K Camera System

We are continuing with our studies on 8K camera systems in preparation for the 8K test broadcasting. We have developed various cameras and a demosaicing processor that makes a camera system for full-resolution 8K content production practical.

U-SDI - Signal Interface for 8K/4K Video and 22.2 Multichannel Sound

We have developed an ultra high-definition interface, “U-SDI” (Ultrahigh-definition Signal/Data Interface), that can transmit full-specification 8K video signals, which have about 100 times the data volume of Hi-Vision, over a single cable. We have also developed a 22.2 multichannel sound multiplexing device that enables simultaneous transmission of video and sound signals for program production.

8K Encoder and Decoder

We are researching technologies to efficiently compress and transmit 8K video and 22.2 multichannel (22.2 ch) sound while maintaining its high quality. We have developed an encoder and decoder that can compress and transmit video and audio using schemes compliant with both domestic and international standards.

Advanced Conditional Access System

We are researching the next generation of CAS (Conditional Access System) technology that provides rights protection and conditional access to content. We have developed a high-performance scrambler capable of real-time processing of 8K signals in compliance with ARIB standards.

Advanced Wide Band Satellite Transmission System

We have been developing large-capacity satellite transmission technology for 8K broadcasting. We were conducting transmission experiments using a 12-GHz-band broadcasting satellite in anticipation of 8K test broadcasting starting in 2016. In this exhibit, signals were transmitted from the NHK Broadcast Center and received at NHK STRL via the actual broadcasting satellite.

New Closed Captioning and Character Superimposition

We are studying a new closed-captioning system for 8K broadcasting. This exhibit showed the new closed-captioning and character superimposition technology using an extended encoding scheme based on TTML (Timed Text Markup Language).

Cable TV Transmission System for 8K Broadcasting

We are working to enable re-broadcast of the 8K test broadcasting on cable television when it starts in 2016. We have succeeded in taking 8K signals coming from working satellite and transmitting them through a cable television system.
Transmission Technologies for the Next Generation of Digital Terrestrial Broadcasting

We have been studying large-capacity transmission technologies for 8K Super Hi-Vision (8K) terrestrial broadcasting. This exhibit demonstrated the 8K transmission experiment we were conducting and displayed the technologies to improve the reception characteristics.

MMT, New Media Transport Technology

We are studying media transport technologies to provide hybrid 8K Super Hi-Vision broadcasting services enhanced with information from broadband networks. This exhibit showed examples of hybrid services using the transmitters and receivers supporting MMT.

Program Contribution Technologies for Live Broadcasts of 8K

We are studying program contribution transmission technologies capable of supporting live broadcasts of 8K Super Hi-Vision. This exhibit showed two types of FPUs using the millimeter-wave band and wired gigabit-class transmission technology for program contributions.

Real-time Video Coding System with Super-resolution Reconstruction

We are conducting research on Super Hi-Vision transmission systems with super-resolution techniques aiming at reducing the requisite bit rate to 1/3 that of existing video codecs. Parameters optimized with a criterion that models the human vision system were transmitted in a compressed format to receivers in which super-resolution processes suppress the image degradation due to the high compression ratio.

8K Recorder with 120-Hz Frame Rate

We are conducting research on 8K Super Hi-Vision (8K) compression recorders for 8K program production at a 120-Hz frame rate. This exhibit displayed a compression recorder that can input/output an 8K signal over a single optical cable and record the data in a removable memory package.

Longer Lifetime Technologies for OLED Displays

We are researching large, thin, and lightweight sheet-type displays for 8K Super Hi-Vision. This exhibit displayed driving technology for adaptive temporal aperture control and an inverted OLED (Organic Light-emitting Diode) that will extend the lifetime of displays.

High-density Holographic Memory

We are conducting research into high-density holographic memory for long-term storage of 8K Super Hi-Vision (8K) programs. This exhibit showed the technology to increase recording density, including a method of multiplexing data recorded onto a holographic medium, as well as the process of reading compressed 8K signal data from the medium and showing it as video.

Advances on Hybridcast Services for 8K Displays

We are developing various interactive services that take advantage of large-screen, high-resolution displays to offer Hybridcast services for 8K Super Hi-Vision. During our Open House, we demonstrated how we can offer complementary information such as the names of artists and order of play of a music show, and also a feature where viewers can switch between videos from multiple cameras to record and replay their favorite moments of a program, all making the most out of the wide screens of 8K.
**Commercial broadcasters’ services under development**

**We are developing new ways to use broadcast content in various services. By promoting the distribution of program-related data, we introduced a framework where third parties can make the most out of Hybridcast and other Internet-based services. We also introduced technologies so that viewers can enjoy programs on any device of their choice.**

**Advanced Program Viewing System Based on Cloud Computing Technologies**

We are developing a new video-on-demand service using cloud computing technologies to allow viewers to access programs from the past. Here we demonstrated how viewers can easily find their favorite programs from a vast archive of broadcast content.

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**New Broadcasting Technologies Utilizing Broadband**

**The New Media Player for MPEG-DASH, and Contents Delivery Technologies**

We have developed an MPEG-DASH player and delivery technology to allow content to be viewed on various devices including TV and mobile terminals. This exhibit presented the technology along with a video-on-demand (VOD) service supported by Hybridcast and a new video delivery service.

**Synchronization Technology for Broadcast Programs and Internet Content**

To give Hybridcast a higher level of functionality, we are working on technologies to synchronize Internet-based content with broadcast programs. This exhibit showed an example of how we can customize live sports coverage by offering additional features via the Internet, such as alternative camera footage and various data corresponding to the ongoing game, to give viewers more excitement and a better understanding of the content they are watching.

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**Laser-backlit Wide-gamut LCD and Color Gamut Mapping**

4K and 8K ultra HD incorporates a wide-gamut colorimetry system that is able to reproduce wider range of colors compared to current HD systems. We have created the world’s first laser-backlit LCD display for 4K using this wide-gamut colorimetry.

**Full-specification 8K Projector**

We have developed a laser diode projector that can project full-spec 8K (8K full resolution, frame rate of 120Hz, and wide-gamut colorimetry) video on a large screen. Visitors enjoyed a truly immersive high-res 8K video on a 450 inch screen boasting enhanced vividness and less motion blur.

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**8K Super Hi-Vision Theatre**

Our 8K screening will deliver the 3rd movement of Tchaikovsky’s Symphony No.6, “Pathetique” — from NHK Symphony Orchestra’s performance in September 2014 — with Honorary Conductor Herbert Blomstedt. The immersive 33-megapixel ultra-high-definition video captured by three 8K cameras accompanied by 22.2 multichannel sound was marveled at also by Maestro Blomstedt himself. It will instantly take you on a virtual trip to one of the greatest concert halls in the world.

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Video Bank to Enable More Efficient and Effective Image Manipulation
We are studying how technology can better support program production in terms of image searches and manipulation. So far, various information about video, called metadata, has been created manually. Our latest video bank system uses light-sensing and video analyzing technologies to automatically generate and attach metadata to a piece of video.

Bidirectional Digital FPU for Reliable High-speed Transmissions
We are striving to make the FPU systems used for live coverage and news gathering to work bidirectionally. It will enable capabilities like faster file transfer and remote controls of cameras. Our exhibit showed that we can transmit videos faster by sending information about reception quality and transmission status back to the origin. We also introduced new technologies such as a system where it automatically adjusts modulations according to the transmission environment. This is one of the ways to improve the reliability of the bidirectional FPU system.

Integral Three-dimensional Television
NHK has been working on creating an Integral 3D Television as part of our future broadcast offerings. The system does not require viewers to wear special glasses and are more natural and less eye-straining to watch. Here we introduced a technology to increase the number of pixels in filming and display by using multiple cameras and display devices, and all aimed at improving the quality of our three-dimensional images.

Spatial Light Modulators Driven by Spin Transfer Switching
We have been studying ultra-high-density spatial light modulators (SLMs) with very large numbers of pixels, which is considered a crucial technology for holographic 3D televisions. Our latest development is a narrow pixel-pitch SLM driven by spin transfer switching, which uses an active matrix driving method and can operate under low driving current.

22.2 Multi-channel Loudness Meter
This meter monitors loudness levels during production and broadcasting of 8K Super Hi-Vision. It is fully compatible with loudness meters for stereo and 5.1 surround.

Multi-viewpoint Robotic Cameras
We have been researching robotic cameras to capture multi-viewpoint images of moving subjects by controlling multiple cameras in unison. Not only have we improved the overall performance of the system, we also presented a technology where the operator can easily choose the camera that best captures the movements of the subjects in order to produce more engaging images.

Enhancing Production

Sensor camera for lighting estimation
Speech Recognition for Live Captioning Inarticulate Program Speech
Closed captions of program audio are essential to aid viewers, especially the hearing impaired, but conventional methods require a “re-speaker” in order to create accurate captions, especially when content includes expressive and unscripted speech. We are working on applying speech recognition technologies to produce live closed captioning directly from program audio by developing ways to reduce background noise and improve recognition of inarticulate speech.

Automatic Sign Language Animation System Using External Weather Data
We have developed a system that can read weather forecasts distributed by the Japan Meteorological Agency and coded in XML format and have animated characters using sign language present them. It automatically generates and updates the sign language animation based on the latest weather forecast received through the Internet.

Human-friendly Broadcasting Service

Automatic Rewriting of News into Easy Japanese
We are conducting research in support of NHK’s “NEWSWEB EASY”*, which is a news site aimed at children and foreigners learning Japanese. NEWSWEB EASY presents news in easier to understand language than in the regular news. As this entails a labor-intensive task, i.e., rewriting the regular news, we are developing a system that can automatically perform it.

* NEWSWEB EASY: http://www.nhk.or.jp/news/easy/

Broadcasting Service

Smart Close-up System
Many of the photos and images we receive or borrow from third parties are now in digital format. The Smart Close-up System can simulate camera movements upon such images, add special effects like shadows and pixelation, and output the result in a movie format.

Utilization and Development of NHK’s Technologies

NHK Engineering Systems, Inc. promotes NHK’s patents and other technical expertise and engages in R&D aimed at sharing the benefits of broadcast technologies with the general public. This includes some of NHK’s patented and ongoing research that are open to wider application.
Museum of Broadcasting

90 Years of Radio Broadcasting - Looking back on the early days
The exhibit looked back at the early days of Japanese radio broadcasting and features photographs, historical materials, and equipment from the time.

Interactive Exhibit

Let's Make Faces!
We asked visitors to stand in front of our special screen and make happy or angry or astonished faces to trigger fun graphics that pop up on the screen.

Let's see if you can touch it!
We had a special box that can "recreate" the shape or firmness of the objects displayed inside. Visitors could put their hands in it, close their eyes, and see if they can feel it for themselves.

How are colors made in an LCD television?
We showed how colors are displayed in an LCD television, illustrating that Nobel Prize-winning blue LEDs are also at work here.

Let's Put on a Sound Helmet!
We presented special headgears each equipped with a pair of headphones and a smartphone to let visitors experience the immersive world of 22.2 multichannel sound.

Service for Viewers

The exhibit aimed to familiarize visitors with Hybridcast, NHK On-demand, and other hybrid services that integrate broadcasting and the Internet. We also opened to any questions you may have regarding digital broadcasting including receiver systems and other research that NHK is working on to further improve our broadcast services.

Poster Exhibit

- Updating of Scrambling Scheme
- Emotional Speech Conversion Technique for Neutral Recorded Speech
- Haptic Technology to Convey Shape and Hardness of 3D Objects
- Higher-resolution Image Enhances Viewer's Depth Sensation
- Operation Principle of New Magnetic Nanowire Memory
- Fabrication Technology for Flexible OLED Displays Using High-mobility Oxide Semiconductor ITZO
- Field Emitter Array Image Sensor with HARP Film
- Solid-state Image Sensor Overlaid with Photoelectric Conversion Layer
- Pixel-parallel Processing Three-dimensional Integrated Imaging Device