

# Accomplishments in FY 2014

## 8K Super Hi-Vision

NHK STRL is researching a wide range of technologies for 8K Super Hi-Vision (SHV) in preparation for the test broadcasting of 8K SHV in 2016 and the launch of broadcasting in 2018. We investigated a way of introducing the high dynamic range (HDR) video format for SHV and proposed it to the International Telecommunication Union, Radiocommunication Sector (ITU-R). We also contributed to standardization of the interface for ultra-high-definition television (UHDTV) production systems. We developed a full-specification SHV projector using laser diodes as light sources and advanced our development of elemental technologies such as long-life and highly efficient organic light-emitting diode devices and an oxide semiconductor transistor suitable for high-speed driving. We also developed an 8K high-efficiency video coding (HEVC) decoder compliant with the domestic standard that requires the video frame to be divided into four vertical slices for coding. In accordance with the roadmap released by the Ministry of Internal Affairs and Communications, we participated in domestic standardization activities for 4K/8K UHDTV broadcasting and worked on the establishment of standards and operation rules at the Association of Radio Industries and Businesses (ARIB).

→See p. 4 for details.



Optical cable for UHDTV production system interface (left)

## Three-dimensional imaging technology

We are investigating ways to obtain more natural and viewable three-dimensional television that does not require the wearing of special glasses. We made progress in our R&D on capture and display technologies using the integral method, display devices using electronic holography, and technologies for generating 3D images from multi-viewpoint images. We developed an algorithm for generating integral 3D images from images captured by a camera that can acquire color and infrared images simultaneously. We continued to participate in standardization activities for 3D image compression formats at the Moving Picture Experts Group (MPEG) and conducted coding experiments for integral 3D images.

→See p. 18 for details.



Integral 3D image reproduced using four liquid crystal panels

## Convergence of broadcasting and telecommunications

We continued with our R&D on technologies and services for the convergence of broadcasting and telecommunications. In our work on Hybridcast, we contributed to the establishment of technical specifications at the Internet Protocol Television (IPTV) Forum and to the standardization activities at ARIB. We also prototyped a sample 8K Hybridcast service that takes advantage of ultra-high-resolution large screens. We developed an encryption system that can search encrypted data without decryption and a watermarking algorithm for embedding the receiver's identity information.

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Example 8K Hybridcast service

## User-friendly information presentation

We are conducting research on using information technology to deliver the benefits of broadcasting to everyone in a form that is individually appropriate. In our work on automatically translating Japanese text into sign-language computer graphics (CGs), we improved the technology for adding diverse facial expressions. We reduced recognition errors in the speech recognition technology for closed-captioning and contributed to the development of a practical system. We also conducted experiments to measure cognitive characteristics and brain activities related to the sensation of depth caused by high-resolution video.

→See p. 27 for details.

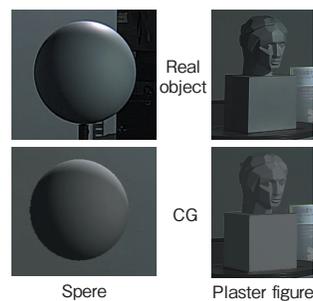


Example of expressive sign-language CGs

## Technologies for advanced content production

We are progressing with our R&D on program production technologies used to provide new content services and technologies used to transmit program contributions. We developed a technology for searching video using image similarity as well as a method for estimating the position and intensity of light in real time for natural synthesis of photographed images and CGs. We studied and evaluated a congestion control algorithm, automatic repeat requests, and high-speed adaptive modulation for bidirectional FQPs and conducted field transmission experiments. We downsized our millimeter-wave mobile camera for practical use and used the camera for shooting various programs such as golf tournaments and NHK's "Kouhaku" year-end music show.

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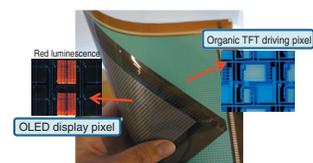


CG drawing using light estimation results

## Devices and materials for next-generation broadcasting

We are researching devices and materials for new broadcast services such as 8K SHV. In our research related to image capture devices, we made progress in developing sensors with ultra-high sensitivity, organic image sensors, and 3D-structured imaging devices. For imaging devices with a 3D structure, we built an array of pixels to enable capture of moving images and also studied ways to improve the sensitivity and reduce the dark current. In our research on recording devices, we continued with our development of magnetic and holographic recording devices. We developed dual page reproduction technology for hologram recording that can reproduce two data pages simultaneously by using two types of polarization and demonstrated its effectiveness. In our research on displays, we studied multiple division scanning drive displays and developed elemental technologies for future flexible displays.

→See p. 37 for details.



64×64 pixel flexible panel fabricated using developed printing technologies

## Research-related work

We promoted our research results on 8K Super Hi-Vision and Hybridcast in various ways, including through the NHK STRL Open House, various exhibitions, and reports. We also actively collaborated with other organizations and program producers. We supported international collaboration and standardization activities by contributing to domestic and international standardization activities at the International Telecommunication Union (ITU), Asia-Pacific Broadcasting Union (ABU), Information and Communications Council, Association of Radio Industries and Businesses (ARIB), and various organizations around the world. We also promoted the ISDB-T (Integrated Services Digital Broadcasting - Terrestrial) standard worldwide by giving lectures about it and attending conferences.

Public relations activities included the NHK STRL Open House, for which the theme was "Heart to Heart Technology." It featured exhibits on our latest research results such as 8K Super Hi-Vision, which is gaining momentum in anticipation of the 2020 Tokyo Olympics, Hybridcast, 3D television, user-friendly broadcasting, and advanced content production. The event was attended by around 20,000 visitors. We also held exhibitions in Japan and overseas to widely introduce our research results.

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STRL Open House 2014