

## Overview of NHK STRL

NHK Science & Technology Research Laboratories (STRL) is the sole research facility in Japan specializing in broadcasting technology. It has the role of leading Japan in developing new broadcasting technologies and contributing to a rich broadcasting culture as a part of NHK, the nation's public broadcaster, which is financed by receiving fees paid by each household and broadcasts two terrestrial television channels, three satellite broadcasting channels, and three radio channels. To fulfill its role, STRL conducts a wide range of research and development on next-generation broadcasting media, universal broadcasting services, advanced content production, devices and materials for broadcast. NHK proactively puts STRL's technology to practical use in its program productions and engages in standardization efforts for the new services enabled by its technologies.

## Research Activities

### Next Generation Broadcasting Media

#### Super Hi-Vision

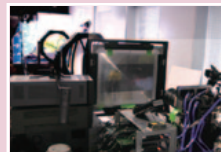
The Super Hi-Vision (SHV) system gives an extremely realistic presentation whereby viewers may feel as though they are actually at the site shown on the screen. SHV is composed of an ultrahigh-definition video system with 33 million pixels (7,680 x 4,320 pixels) and a 22.2 multichannel audio system. STRL is developing the broadcasting system and equipment, including cameras, displays, recorders, and production systems. It is also developing video and audio codecs and error correction and modulation technology to bring SHV into people's homes by terrestrial and satellite broadcasting.



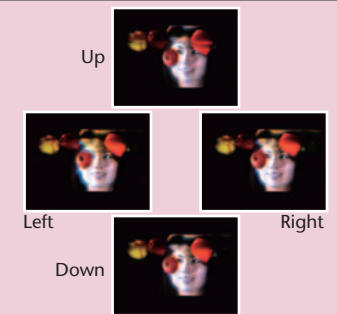
SHV encoder and decoder Full resolution SHV camera

#### Integral 3D Television

The goal of STRL's research on three-dimensional television is to convey the ultimate sensation of presence. Research is underway on an integral 3D television system that is capable of shooting images in real-time and displaying natural autostereoscopic images that can be viewed without special glasses. The images can be viewed comfortably even while the viewer is moving.



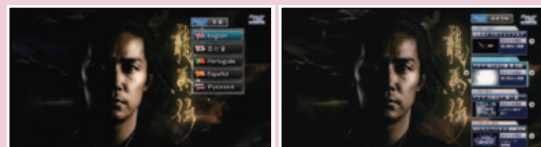
Shooting scene of integral 3D television



3D images observed from various angles

### Hybridcast® - A Fusion of Broadcasting and Communications Media

Hybridcast is a new system that will combine the advantages of reliable and high-quality broadcasting with bidirectional and personal communications. Viewers will be able to personalize broadcast content by adding content provided via a communications network. They will also be able to access a program recommendation service based on information retrieval technology and social networking services (SNS) and link together different devices such as TVs, PCs, and mobile terminals.



Multi-lingual closed-caption service Program recommendation service

Screen images of Hybridcast

### Universal Broadcasting Services

#### Human-Friendly Broadcasting

The goal of human-friendly broadcasting research is to make broadcasting more accessible and enjoyable for everyone, including children, elderly, and physically challenged persons.

#### Human Factors

It is important for broadcasters to learn more about human senses, especially audio-visual perception and psychological and physiological characteristics, since broadcasting is meant to appeal to the senses. Such knowledge will be especially useful to determine the SHV format and in human-friendly broadcasting. STRL researchers are conducting various studies on vision and audition to determine the best frame frequency and what constitutes high presence audio.



HRTF (head-related transfer function) being measured in an acoustic anechoic room

#### Real-time Subtitling System with Speech Recognition

The automatic speech recognition technology that STRL has developed makes it possible to create subtitles for the hearing impaired in real-time automatically.



Real-time subtitling system using speech recognition

#### Sign Language Broadcasting

STRL is studying how to transform Japanese into computer-animated Japanese Sign Language (JSL) automatically. It has developed a Japanese-JSL dictionary containing about 4,900 signs stored as digital 3D motion capture data. The data can be rendered in real-time using TVML technology.



Generated sign language video

#### Speech-rate Conversion

Elderly persons sometimes complain that speech in programs is too fast to understand. STRL has developed adaptive speech rate conversion technology that slows down speech in a broadcast while retaining its clearness and overall duration.

**ORGANIZATION**

**NHK Science & Technology Research Laboratories**

**Planning & Coordination Division**

Planning and management of research, public relations, international/domestic liaison, etc.

**Patents Division**

Patent rights management, technology transfers, etc.

**Advanced Broadcasting Platforms Research Division**

Broadcast and communication hybrid systems, IP network, security, digital rights management, social network service, etc.

**Broadcasting Networks Research Division**

Next-generation digital broadcasting, satellite broadcasting, cable broadcasting, contribution system, optical link, etc.

**Advanced Television Systems Research Division**

Super Hi-Vision, three-dimensional television, high-presence audio systems, video and audio coding, audiovisual perception, etc.

**Human & Information Science Research Division**

Image recognition and representation, speech recognition and synthesis, natural language processing, information retrieval, cognitive science, information-barrier-free technologies, etc.

**Imaging & Storage Devices Research Division**

High-sensitivity imaging, high-speed imaging, organic imaging, high-density magnetic recording, high-speed optical recording, etc.

**Display & Functional Devices Research Division**

Flexible displays, plasma displays, organic devices, holographic recording, spin electronics, etc.

**General Affairs Division**

Staff administration, accounting, facilities management, etc.

**Advanced Contents Production**

**Mobile Program Production System**

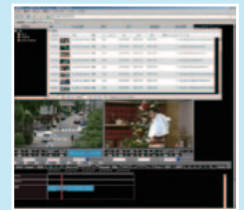
To avoid troublesome cables and eliminate restrictions on the movements of camera operators in studios, STRL has developed a wireless Hi-Vision camera that uses millimeter-waves instead of cables to transmit signals. STRL researchers have developed an experimental system using the MIMOOFDM transmission technique, which is capable of wirelessly transmitting high-quality, low-delay HDTV video.



Millimeter wave mobile camera

**Networked Production System**

STRL is developing a distributed production system that will allow program creators to use production resources such as equipment and video materials at different broadcasting stations anytime they desire. For this purpose, STRL is developing a widely distributed server system for transferring huge quantities of video material at very high-speed, distributed editing software, and a Web-based interface for editing programs.



Browser-based editor inter face

**Free-viewpoint System**

The goal of this research is to create smooth virtual 3D video images that can be viewed continuously while the viewer freely moves his or her viewpoint. A 3D model is composed from shots taken by several video cameras. The model can then be shown on an integral 3D television.



3D model (wire frame) created from free-viewpoint system

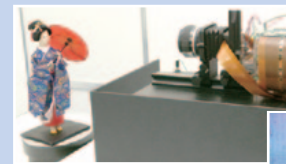


Digital 'extras' created with 3D models

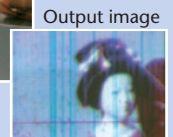
**Devices and Materials for Broadcast**

**Next-Generation Imaging Device Technologies**

STRL researchers are pursuing a new imaging concept to make cameras extremely compact. By using an imager that contains three layers of organic film, each with sensitivity to one of the three primary optical colors (red, green, and blue), and transparent circuits that read out signals from the respective films, a camera no longer has a need for a color-separating prism.



Experimental image pickup device



Output image

**High-capacity, High-speed Recording System**

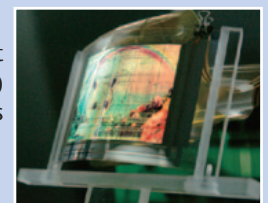
The Super Hi-Vision programs that will be made in the future will require a huge data storage system. Holography is a high-density recording technique that stores digital data three-dimensionally within a medium. STRL is studying a holographic multiplexed recording system using a wave-front control device for improving the recording/reproduction signal quality and a spatial optical modulation device.



Holographic recording optics

**Flexible Displays**

The goal of this R&D is to create ultra-thin and flexible displays that can be rolled up for easy transport and viewed anywhere. STRL researchers are developing flexible organic electro-luminescent (EL) displays and flexible liquid crystal displays (LCD). They are also developing flexible organic TFT circuits to drive these displays.



Flexible color organic EL display driven by organic TFT