Research and Development Toward 2020 and Beyond

1 **AI-Driven Smart Production**
Research on technology that uses artificial intelligence (AI) to rapidly and accurately obtain and analyze a broad range of information from society for use in program production, and on user-friendly broadcasting technology that can present information in forms that can be easily understood by all viewers was exhibited.

2 **Enriching Daily Activity by TV Content Connected with IoT**
Examples of services linked with broadcasting content using IoT devices were presented and research on a platform that enables the viewing of program delivered by broadcasting and the internet without awareness of the transmission path was displayed.

3 **Media-Unifying Platform**
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4 **New Live Sports Graphics System Powered by Realtime Object Tracker**
New image presentation technology for live sports events that involves the synthesis of real-time photography of a ball trajectory and computer graphics and internet distribution technology that enables the interactive viewing of video shot with a multi-viewpoint camera and 360° camera were exhibited.

5 **Internet Service Technologies for Realizing Interactive Content Viewing**
Audio description technology that automatically generates Japanese text explaining the progress of a sports game from data in real time and presents it aurally by speech synthesis was exhibited.

6 **Audio Description Services for Sports Programs**
Audio description technology that automatically generates Japanese text explaining the progress of a sports game from data in real time and presents it aurally by speech synthesis was exhibited.

7 **Sheet-Type Display with High Frame Rate**
A thin sheet-type OLED display that features high resolution and a high frame rate, and a full-featured 8K content production system for evolution into full-featured 8K Super Hi-Vision were exhibited.

8 **Full-Featured 8K Program Production System**
Visitors watched 8K video content shot with a full-featured 8K camera presented on a 450-inch screen by a high-luminance, full-featured 8K laser projector.

9 **8K Laser Projector**
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**Smart Production**

10 **Speech Recognition for Smart Production**
Technology for real-time voice recognition to render unclear pronunciation in information programs comprehensible and technology for efficient transcription of video interviews were exhibited.

11 **Face Recognition Technology for TV Program Video**
Technology that uses automatic appending of various types of information (metadata) on TV video for the automatic recognition of persons that appear in the video was exhibited.

12 **Automatic Generation of Sign Language CG Animation for Sports Programs**
An application for the automatic generation of sign language CG to help viewers with impaired hearing better understand and enjoy sports program was exhibited.

13 **Automatic Audio Description from Sports-Related Data for Live Broadcasting**
Requirements for Intelligible Audio Description
An “Audio Description” function that automatically generates commentary text from data related to live sports coverage and presents the commentary through automatic speech synthesis was described and an evaluation of the function was presented.

**Internet Technology for Broadcast Services**

14 **Services and Technologies to Bridge Content and Daily Activity**
Various examples of services produced in collaboration with private broadcasting companies and other organizations for implementing technology that links program viewing to user activities in all aspects of daily life were described.

15 **TV-Watching Robot**
A robot that watches TV together with people, combining the detection of the TV and people with the generation of comments related to the program, was exhibited.

16 **Privacy-Preserving System for Secure Integrated Broadcast-Broadband Services**
Technology that enables broadcasters to provide the services that viewers want with a high degree of security was described, including encryption technology for safe and secure broadcasting services that involve personal communication.
17 Advancing 8K Shooting and Recording Technology

Technology for diversified 8K program production, including a slow-motion system that can shoot and record at four times the normal speed, an 8K camcorder that can record 8K video on memory card media, and technology for supporting 4K and 8K shooting, were described.

18 Acoustic Devices for 22.2ch Sound

Devices for 22.2 multichannel sound that combine high performance and high convenience, including a one-point microphone that has high spatial resolution and a thin speaker that uses an elastic piezoelectric composite film, were described.

19 UHDTV Camera for HDR/SDR Simultaneous Production and Improvement of Color Reproduction

An integrated video production camera that can simultaneously output a high dynamic range (HDR) signal and a standard dynamic range (SDR) signal was demonstrated.

20 Program Production System Running on IP Network

For a program production system that uses an IP network, conversion equipment to enable the transmission of 8K signals over an IP network and technology for sharing of remote studio facilities, were described.

21 Smart FPU Broadening Possibilities of Outside Broadcasts

Technology for converting the FPU used for the radio transmission of live program materials to the broadcast station from the usual one-way communication to bidirectional communication, and technology for remote operation and many other functions over an IP network in addition to the transmission of video files was described. Examples of application were also presented.

22 8K Super High-Vision FPU

Towards the development of an 8K live broadcasting radio transmission system, a system for real-time 8K transmission that uses a large-capacity millimeter-wave FPU and highly efficient video compression was exhibited.
Next Generation Terrestrial Broadcasting Systems
Audio Coding for Next Generation Terrestrial Broadcasting Systems
Technology for next-generation terrestrial broadcasting, including a hierarchical transmission system that simultaneously provides Super Hi-Vision for fixed receivers and HDTV for mobile devices, and elemental technology for mobile devices, including technology for interworking of broadcasting and telecommunications and highly efficient video and audio coding systems, were displayed.

Movie Contents Preferred to Be Viewed in a Wide Visual Field
As a step towards optimizing 8K video production, the relationship between the preferred viewing angle and viewing distance, obtained from evaluation experiments in which various 8K video scenes were viewed on screens of various sizes, was explained.

3D Television

Parallel-Type Integral 3D Display
Technology for implementing 3D images with greater number of pixels to improve the video quality of integral 3D television by synthesizing a video of multiple direct-view display panels was exhibited.

Fundamental Technologies for Integral 3D Television
Elemental technology for integral 3D television, including imaging technology that does not require a lens array, depth compression representation for high-quality depth display, and display technology for improving the quality of 3D images, was exhibited.

Spatial Light Modulator with Narrow Pixel Pitches
As a display device for electronic holography, a spin-injection spatial light modulator that has a pixel pitch of 2µm and a sensing element with a new structure for reducing driving current were exhibited.

Optical Phased Array
An experiment in which an optical phased array was operated using a polymer material for which the direction of a light beam can be controlled freely was described. This technique can be applied for an integral 3D TV display that does not require a lens array.
Next-Generation Device

26 Organic Light-Emitting Diode with High Color Purity
A green-light-emitting OLED device that has very high color purity compared with previous devices was exhibited. The device can be used for implementing an OLED display that has the wide color gamut necessary for Super Hi-Vision broadcasting.

27 Three-Dimensional Integrated Imaging Device
An imaging device that has a 3D structure and smaller pixels achieved by improving the signal processing circuit was exhibited. The device is intended for 3D video shooting in the future.

28 Magnetic Nanowire Memory Aiming at High-Speed Recording Device
Research toward implementing future high-speed recording devices is moving forward. In this exhibit, magnetic nanowire memory was explained and driving of recorded data was demonstrated.

29 Eco-Friendly Quantum Dot Light-Emitting Diodes
A light-emitting device using a quantum dot material that can be applied by coating and is expected to emit light of high color purity was described. The device is intended for use in implementing ultrahigh-definition displays with a wide color gamut.

30 High-Performance Thin-Film Transistors for Sheet-Type Displays
A high-performance thin-film transistor that is expected to be driven at high speed for the implementation of a sheet-type display that features high image quality and low power consumption was described.
**29 Solid-State Image Sensor Overlaid with Photoelectric Conversion Layer**

A charge-multiplying photoelectric conversion layer and the characteristics of a reading circuit for it were described. This device is intended for use in implementing an 8K Super Hi-Vision camera that features high sensitivity.

**30 Elemental Technologies for High-Resolution Organic Image Sensors**

The fabrication and characteristics of an organic imaging device that consists of three organic films that are each sensitive to light of a specific primary color were described.

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**20 Metadata Acquisition Technology of Graphics System for Live Sports Programs**

Technology for acquiring subject information, such as a ball trajectory or the orientation of an athlete’s face, with high accuracy for use in new forms of video presentation that will make sports program even more enjoyable was demonstrated.

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**30 Ultra-Directional Microphone**

A shotgun microphone that has sharper directivity for use in acquiring the sounds of sports competitions clearly, even in the midst of a cheering crowd, was described.

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**NHK Engineering System**

**31 Utilization of NHK’s Technologies**

From among the patents and other results of NHK R&D and the applied research broadcasting technology aimed at the benefit of society, video search, sign language CG, and 8K technology for PC and medical applications were exhibited.

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NHK Museum of Broadcasting

Progress of VTR’s for Broadcasting Program Production

The video tape recorder greatly changed broadcast program production, which had previously been only live program, and VTR technology has been well researched at NHK STRL. The evolution of the VTR was described and actual equipments were exhibited.

NHK Engineering Administration Department

Reception System of Super Hi-Vision Satellite Broadcasting

The receiver equipment that is required for home viewing of the Super Hi-Vision (4K/8K) satellite broadcasting that is planned for introduction as a service in 2018 and broadcasting technology that was developed for cable delivery were described.

Interactive Exhibits

1. Pop-Up Book Based on Integral 3D
   A “pop-up book” that uses integral 3D imaging and allows the user to freely change the degree to which content seems to stand out by manipulating the book was exhibited.

2. Let’s Try Virtual Reality
   By using 8K display virtual reality technology that allows users to experience a scene as though they were really there was displayed.

3. Three-Dimensional Sound Reproduction With Line Array Loudspeakers
   Visitors were invited to experience 3D sound presented with binaural technology that enables 22.2 multichannel audio to be reproduced easily in the home.

4. New Experience of Synchronous Multiple Viewing by MMT
   Visitors were invited to enjoy a new, highly entertaining experience in which MMT distribution technology is used to switch among images from multiple viewpoint.