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Executive Director, Chief of Engineering, NHK

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Cover: ABU Technical Committee Meeting 2019 which will be held in Tokyo, Japan on 18-19 November 2019.

The main focus in this edition is our upcoming annual Technical Committee meeting (TC) in Tokyo. As is customary we have included introductions to all our members in Japan. The TC meeting will take place on 18 and 19 November at the Hyatt Regency Tokyo as part of the ABU's 56th General Assembly and Associated meetings which will run from 17 to 22 November. The meetings are hosted by our member NHK-Japan.

The highlights in this issue include an interview with Mr Akihiko Chigono, NHK's Chief of Engineering and Executive Director. He shares his vision and wisdom in this challenging time for broadcasters. One of the key points he makes is the need for public service broadcasters to transform themselves from traditional broadcast organisations to more media centric organisations providing content on all platforms. It is important to keep up with the changes, evolve and be relevant to fulfil their key role as a 'core component of the social infrastructure'.

The featured article in this issue, "A Novel Approach for Upgrading TV Studios to HDR Technology", has been contributed by colleagues from our member IRIB-Iran. With the industry quickly moving towards implementing 4K with increased pixels or picture elements providing improved image quality, it also incorporates technologies such as HDR, WCG and High Frame Rate to further enhance the quality of the TV picture. This specific paper focuses on High Dynamic Range (HDR) which researchers have identified to play a huge role in improving the quality of television images. The article discusses how to effectively upgrade TV Studios to incorporate HDR technology.

As usual this issue includes reports and updates from our recent activities and other key industry events relevant to our members. The issue concludes with our regular industry news highlights, digital updates and the latest in equipment trends. With this edition we have now completed the redesign of the Technical Review layout which we started early in the year. We hope our readers are enjoying the new layout as much as we do. We would like to hear your comments and feedback as always.

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The Asia-Pacific Broadcasting Union (ABU) is a professional union of broadcasting organisations in the Asia-Pacific area which aims to co-ordinate and promote the development of radio, television and allied services in the region. It is non-governmental, non-political and non-commercial.

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A Novel Approach for Upgrading TV Studios to HDR Technology

Abstract

Image quality enhancement does not only mean increasing the number of pixels. Images can be enhanced by expanding the colour space, increasing the frame rate and extending the dynamic range. According to researches, high dynamic range plays a huge role in improving the quality of television pictures; therefore, it seems necessary to upgrade TV studios with HDR (High Dynamic Range) technology. In this research, the concept of HDR images is first discussed, then HDR video and different standards are introduced. After that, an approach will be demonstrated for upgrading a TV studio with HDR technology, using equipment such as HDR cameras. SDR to HDR convertors and management of SDR and HDR signals in studio and control room are then discussed.

Key Words

Colour Gamut, High Frame Rate, High Dynamic Range, Image Quality Enhancement.

1. Introduction

According to video quality enhancement literature, important factors for providing high quality television pictures are:

- Spatial resolution
- Temporal resolution, or frame rate
- Bit depth
- Wide colour gamut
- Dynamic range

In this research, we focus on high dynamic range and wide colour gamut because HDR is a technology that, in contrast to conventional methods, allows for a greater dynamic range between dark and light areas. Coupled with wider colour range (wide colour gamut), HDR will allow for accurate reproduction of wider colour and dynamic range of scenes. This makes for a deeper, brighter picture and ultimately a more enjoyable experience for the viewer.

HDR studies, were first performed on single images or frames. For example, a scene was captured with different exposure times, and the HDR image was created by combining them [1]. In order to capture the details of a scene in areas with high intensity, we have to shoot with shorter exposure times. **Figure 1** shows an image with an exposure time of 0.012s; but when we want to capture the details of darker areas, we have to shoot with longer exposure times. **Figure 2** shows an image with an exposure time of 3.132s. **Figure 3** shows an HDR image that is obtained from the combination of **figures 1 and 2** [2]. It follows that, if the number of images with different exposure times is increased, it is possible to create a better HDR image.

In other words, the HDR technique shows the bright and dark areas of an image more clearly. Besides dynamic range improvement, HDR technology eliminates some of the image artifacts in improperly lit environments. For example, **figure 4** shows an image with low dynamic range and **figure 5** shows an image with high dynamic range. As you can see in **figure 5**, light distribution is controlled in the image. This makes it possible to display clearer details in parts of the image that were originally too light or too dark [3].

After multiple experiments on single frames or single images, the first HDR camera was built in 1990 [4]. Further research has accelerated the use of HDR in the video and broadcast industry. Today, modern camera sensors can capture scenes with high dynamic range. In recent years, the HDR video parameters have been addressed in ITU-2100 standard [5], and the OETF (Optical to Electrical Transfer Function) and EOTF (Electrical to Optical Transfer Function) functions for HDR video, as defined in ST-2084 standard [6]. There are currently two important HDR video standards, PQ and HLG. Research has shown that the HLG standard, proposed in ARIB-STD-B67 [7], is suitable for monitors that cover up to 1000nit of luminance, and the PQ standard, introduced in ST-2084 and using the Burton function, is suitable for monitors that cover up to 10000nit of luminance.



Figure 1: Bottles small with exposure time of 0.012s [2]



Figure 2: Bottles small with exposure time of 3.132s [2]



Figure 3: HDR Bottles small obtained from the combination of Figure 1 and 2 [2]

2. HDR Technology

Today, there are various standards for HDR video, such as PQ, HLG, HDR10, Dolby Vision, SL-HDR1 etc. PQ and HLG are the bases of all the HDR Standards. Production in PQ is similar to standard dynamic range production. During capture, the scene may be exposed to produce the desired appearance on a reference monitor, ideally operating in the reference environment. Exposure setting may be assisted for example by setting a grey or diffuse white card to the desired signal level. It is possible for the PQ system to capture and encode information that is beyond the capabilities of monitors that cannot reach the ideal peak luminance of 10000 cd/m² and the full extent of the BT.2100 wide colour gamut. Therefore, HLG was designed to enable a straightforward migration towards HDR television production, with few changes to SDR production working practices. The compatible nature of the HLG signal allows standard dynamic range monitors to be used in non-critical monitoring areas.

The use of the HDR technology has become so important to some

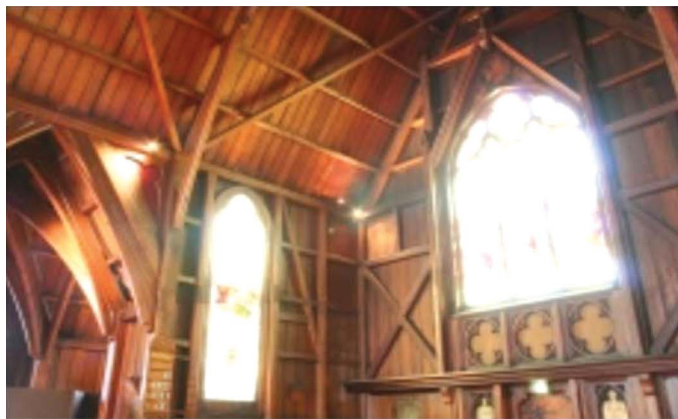


Figure 4: An image with low dynamic range [3]

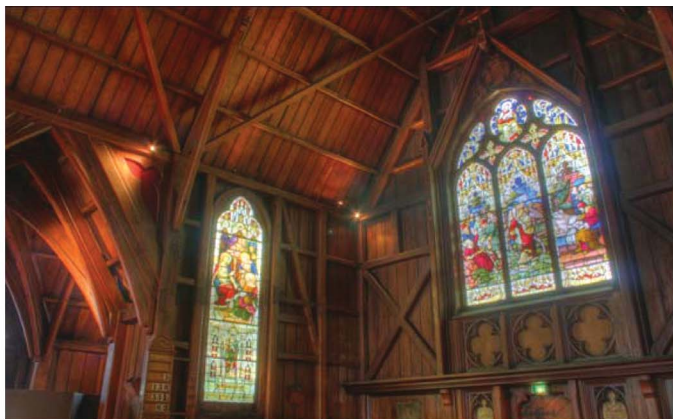


Figure 5: Image of figure 4 with high dynamic range (HDR image) [3]

broadcasters that they have equipped themselves with 4K HDR equipment. But other broadcasters, who are still broadcasting SD (Standard Definition) and HD (High Definition) signals, are making decisions based on their existing equipment.

Suppose that we want to equip a studio with HDR technology. The studio equipment, such as cameras, playouts, digital players, video mixers, audio mixers, interfaces and so on, need to be reviewed. The goal is to identify which items of studio equipment need to be replaced and which items do not need to be replaced in order to process HDR signals, together with other changes necessary to convert the SDR studio for HDR capability.

3. Studio Equipment and HDR Video Signal

3.1 Camera and Lens

SDR cameras are not able to capture video details in areas of excessively high or low nits of luminance. This means that captured video has low dynamic range. Therefore, to achieve high dynamic range, you need to use a purpose built HDR camera, or convert an SDR camera output signal to an HDR signal in the HDR standard of your choice. The camera is the main element in the production of HDR video signals and must necessarily support HDR technology. Sony's HDC-4300 camera supports HDR technology and is also able to capture 4K video. Ikegami has launched a product called HDK-97, which supports the HLG standard and has the ability to capture high dynamic range video with Full HD resolution. Ikegami has also launched the UHK-430 camera which can capture high dynamic range video at 4K resolution. The development of multiple cameras that support HDR technology, reflects the crucial role of HDR cameras in enhancing video quality. However there is the question that, if HDR output can be achieved simply by using SDR to HDR converters, why do we need to replace SDR cameras?

To answer this question, we first need to know the difference between video that is captured using HDR camera and the HDR video created by converting SDR to

HDR. Comparisons show that when SDR video is converted to HDR, it has lower quality than video which is originated as HDR. However, the difference in quality is actually negligible. In general, SDR and HDR cameras can be combined in live streaming. We only need to use SDR to HDR converters for SDR output signals. Usually, when video from both inside and outside the studio are live streamed, it is recommended to use SDR cameras in the controlled environment of the studio and HDR cameras for outside coverage, where sunlight presents a less controllable lighting environment.

Camera lenses also play a major role in improving the quality of HDR images. Due to the increased in brightness and colour of HDR images, it is necessary to use lenses that use a special coating to increase optical efficiency. Such a coating can play a key role in improving the quality of HDR and WCG (wide colour gamut) images. For this reason, the Fujinon and Canon companies have introduced lenses with enhanced performance for shooting in HDR and WCG.

3.2 SDR to HDR Converters

To convert SDR to HDR signal, converters such as HDRC-4000 [8] can be used. In general, there are many converters in the market which should be compared and the best one should be chosen. **Figure 6** shows a view of SDR to HDR converters.

For example, SAM is selling a product named UHD-1200. This converter can expand both dynamic range and colour gamut. It has the ability to output 4K videos with high dynamic range and suitable colour space. This converter could be used for SDR to HDR conversion. This product has four 3G-SDI inputs, so it can simultaneously convert four Full HD SDR signals to four Full HD HDR signals. The ability to send and receive signals through fibre is another feature of this product. It has SFP (small form-factor pluggable) input and output ports which are designed for this purpose [9].

For-A has proposed a product called FA-9600. Like other converters, this converter has the ability to convert the colour space from BT-709 to BT-2020 and also increase the dynamic range with standards such as PQ and HLG. This device can receive and convert two SD and HD signals or one 4K signal. But this product can be improved in some sections [10]. Grass Valley has launched AJA products for SDR to HDR conversions. AJA, which has been leading the industry since 1993 in the development of digital interfaces, converters, and so on, has launched the FS-HDR converter. It has four 3G-SDI inputs, which can convert four Full HD SDR signals into four Full HD HDR signals. It has the ability to send and receive four signals through fibre using SFP input and output ports [11].



Figure 6: A view of SDR to HDR converters

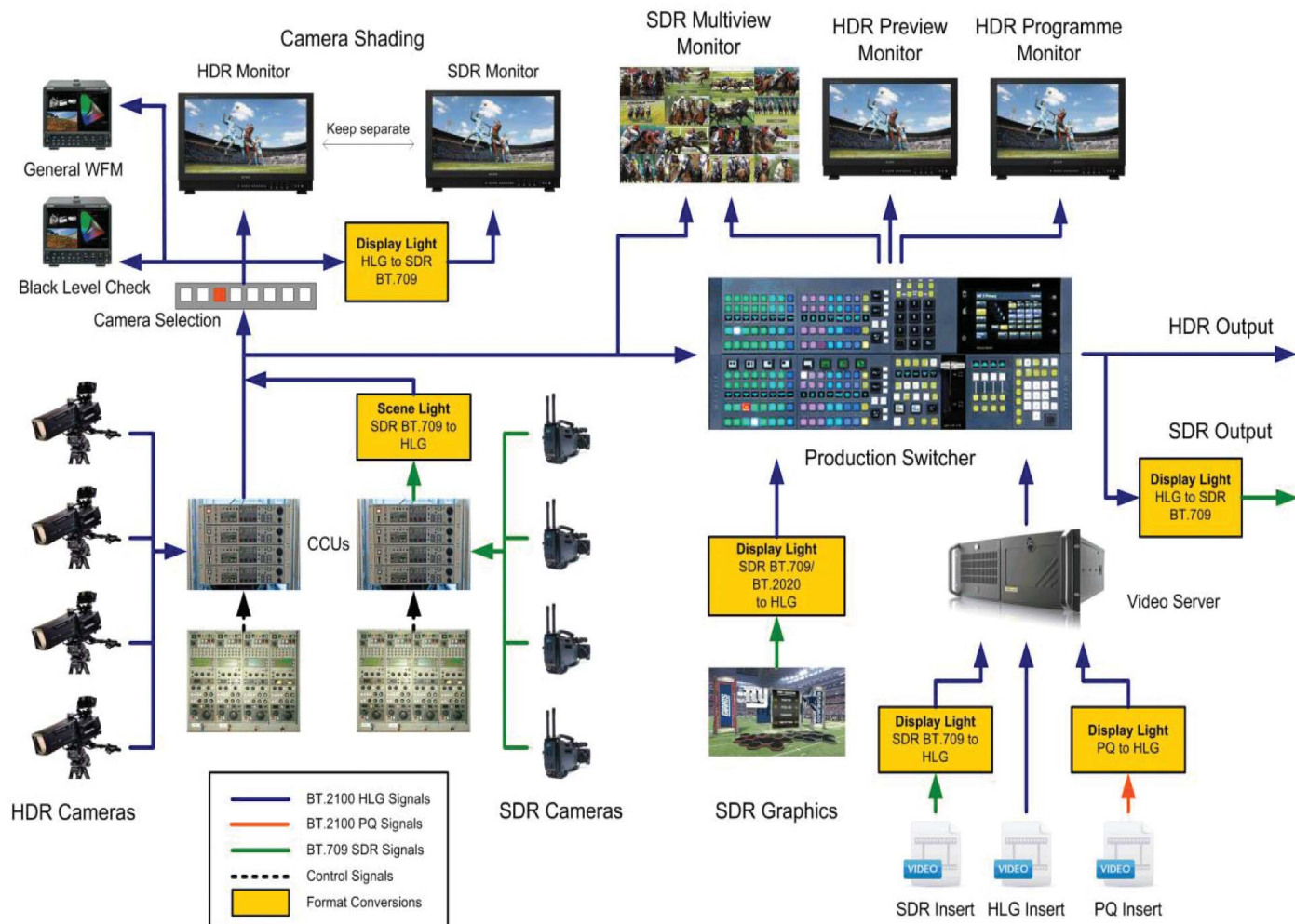


Figure 7: Sending HDR signal process according to ITU-R BT-2408-0 standard [12]

3.3 Video Mixer

A conventional Video mixer takes SDR input and after processing, outputs an SDR signal. The question is whether or not, if the input signals of an SDR video mixer are changed to HDR, the output is HDR?

If all mixer inputs have the same SDR or HDR formats, the video mixer should not have the ability to convert SDR to HDR. In contrast, if a mixture of SDR and HDR formats are fed to the video mixer, dynamic range conversion is mandatory. So, companies like For-A and Grass Valley offer video mixers that are capable of accepting both SDR and HDR inputs and performing dynamic range conversion. Therefore, if we do not want to replace the video mixer, all the inputs should be in same HDR standard, such as HLG. Figure 7 shows the necessary changes in the studio and control room in accordance with ITU-R BT-2408-0 [12]. In figure 7, all mixer inputs are HDR, and SDR cameras are used with dynamic range converters.

3.4 Technical Monitor

In the control room, video quality control and both SDR and HDR signal monitoring should be properly done. The receivers may be HDR or SDR, but only HDR capable systems can display HDR signals with optimal quality. So SDR and HDR signals should be monitored. Sony offers the BVM-X300 to monitor the quality of HDR video. In figure 7, in accordance to

ITU-R BT-2408-0, quality control of both SDR and HDR signals are monitored.

3.5 Video Equipment Measurement

In the control room, the quality of both HDR and SDR signals are monitored using a Waveform Monitor. The black level control of both SDR and HDR signals is one of the most important tasks. Figure 7 shows the process of controlling the quality of the SDR and HDR signals, using a waveform monitor, according to ITU-R BT.2408-0. Taking into account the need of adding special capabilities for measurement of HDR signal parameters, it is necessary to choose appropriate measurement devices for HDR studios. For example, the Tektronix 8000 series is suitable.

3.6 Digital Recorders and Players

There is no metadata in SDI signals for HDR formats and devices are transparent to HDR or SDR when SDI is used as input and output. In contrast, if a signal is fed to a recorder as a file with HDR metadata, an HDR support recorder can understand HDR format. Typically, if an SDR video signal is recorded on Sony Professional Disk (PD), SDI output on this player is an SDR signal and if an HDR signal is recorded on PD, then the SDI output is HDR too. So, recorder and player replacement are not necessary if we pay attention to the signal formats and do conversion at appropriate points. If video files are not provided in the same

standard, there should be converters in the output path of such players. If we want to purchase a new file player or recorder, it is recommended that it supports HDR, as AJA products.

3.7 Playouts

Both SDR and HDR files can be imported inside playouts but an SDR to HDR conversion should be done when SDR files are played. Now there are only a few playouts that have the capability to do conversion internally. Therefore, it is better that SDR video files are converted to HDR before importing to playouts during production, using specific standards (such as HLG). Another solution is using separate playouts for SDR and HDR files and placing a converter in the output of SDR playouts. Converting and aligning recorded files can be done with software such as EDIUS Pro 9, a product from Grass Valley. This software supports PQ and HLG standard [13].

3.8 Digital Video Distributors and Glues

If the inputs of a distributor are SDR, output signals are SDR too, and if the inputs are HDR, the output signals are HDR. In general, it is better SDR to HDR conversion is done before any distribution. If the converters are placed after the distributors, the number of signals that need to be converted to HDR signal will be greater and therefore require more converters.

3.9 Scan Converter

This device converts computer graphics output into a SDI video signal. Replacing this device is not mandatory and its output can be converted to HDR by external converters.

3.10 Character Generator

The role of a CG is to produce static or animated texts, logos etc., for real-time keying or overlaying. We can convert the dynamic range of content generated in CG by inserting an SDR to HDR converter. In some documents, it is recommended that the KEY and FILL outputs of these equipment support HDR and WCG standards.

3.11 Frame Synchroniser

The role of this device is to synchronise the digital input frame with a reference signal. It should be noted that most SDR to HDR signal converters, such as FS-HDR, perform this task.

3.12 Audio Embedder and De-Embedder

These devices are used for embedding and de-embedding digital audio signals into/from SDI signals. The audio embedding and de-embedding operation does not affect the HDR signal.

3.13 Audio Equipment

In general, audio equipment like audio mixers, audio players, etc. does not have any effect on the HDR signal. In fact, the audio and the video paths are separate. For example, when a video file is played in a playout, playout SDI output is connected to the input of a de-embedder and the audio is removed from the video. After separating the audio and video from each other, the audio is connected to the input of the audio mixer and the video signal is connected to the video mixer. After processing the audio and video signals with audio and video mixers, these outputs are combined in the embedder and sent in form of SDI signal.

4. Management of SDR and HDR Signals in Studio and Control Room

According to above discussion, the SDR and HDR signals should be managed in the control room, in order for the HDR signal transmission process to be properly performed. **Figure 8** shows a structure in which the SDR and HDR signals are located on specific routes and separate paths are designated for HDR and SDR signals before converters. As shown in the figure, the SDR signals are converted to HDR signals before entering the video signal distributors. In this figure, all inputs to the production switcher are HDR. This removes the need to process separate HDR and SDR feeds throughout the production chain. The primary output from the production switcher is HDR.

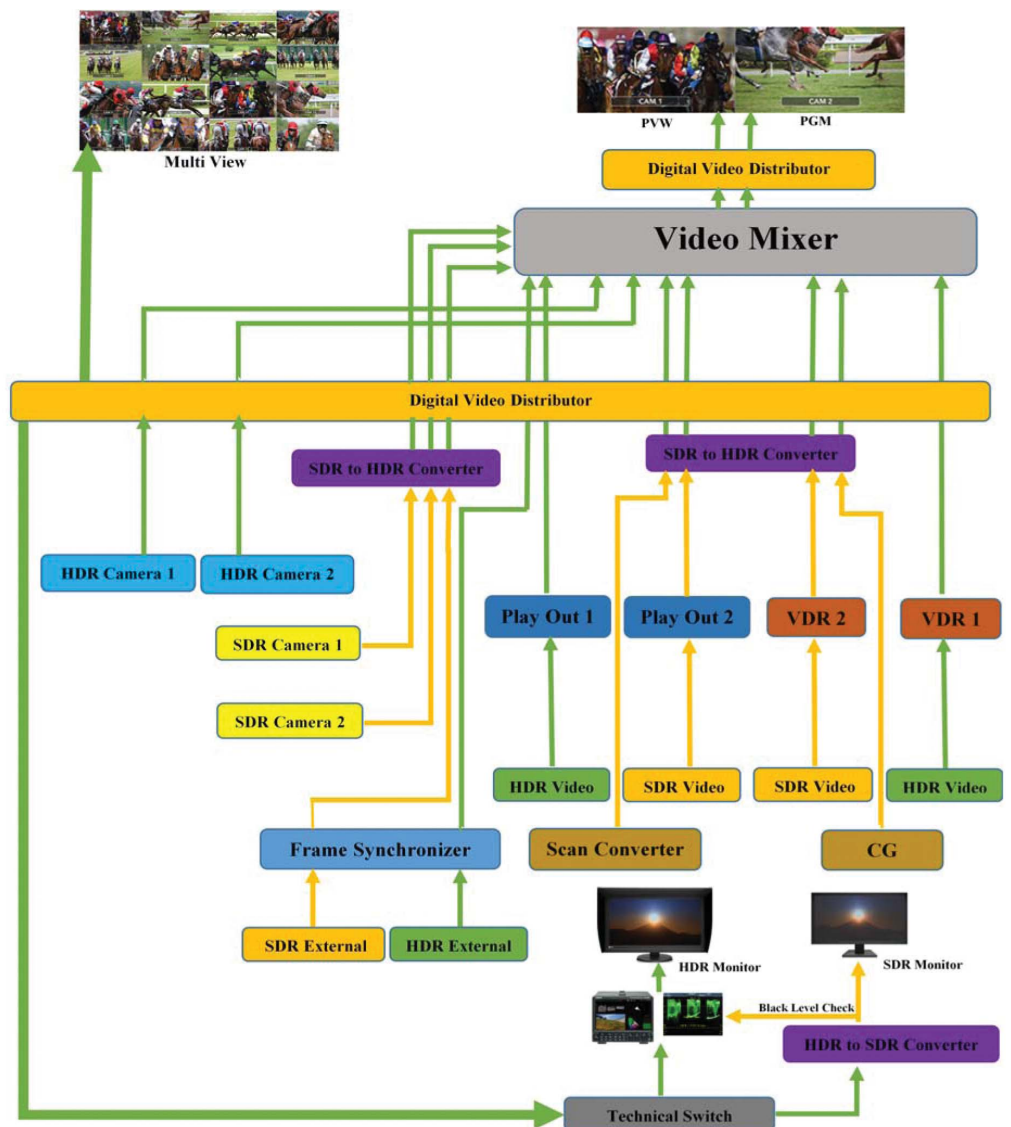


Figure 8: The changes in the studio and the control room with SDR output, in order to produce HDR output.

and the SDR BT.709 output is derived by a down-conversion of the HDR BT.2100 signal. Both SDR and HDR files can be imported inside one playout but an SDR to HDR conversion should be done when SDR files are played. Currently, there are a few playouts that have the capability to perform conversion themselves. Therefore, it is better that SDR video files are converted to HDR before importing to playouts during production with a specific standard (such as HLG). Another solution is using separated playouts for SDR and HDR files and place a convertor in the output of SDR playout.

Differences in black level may be more visible in the down-converted SDR signal than in the HDR signal, as bright highlights in the HDR image can mask detail in the shadows. To help ensure a consistent black level in the HDR and down-converted SDR signals, a dedicated waveform monitor displaying the lower portion of the signal range is recommended. In HDR focused production, for optimum quality of HDR pictures, both HDR and SDR cameras should be displayed using an HDR monitor. For SDR focused production, if the SDR production must not be compromised, both HDR and SDR

cameras should be displayed using an SDR monitor fed via a down-converter. Note, however, that the eye may adapt to the brighter HDR screen, affecting the appearance of signals on the dimmer SDR screen. So, the HDR and SDR screens should be separated for critical assessment of the down-converted SDR signal.

CONCLUSION

To convert an SDR studio to an HDR studio, there is no need to replace all studio equipment. An SDR studio can be converted to an HDR studio, just by adding a number of HDR cameras, a number of SDR to HDR converters, HDR signal measurement equipment, and a number of HDR displays. But there are some other points that should be considered. - It is best to separate SDR and HDR video files in two playouts to prevent additional processing in SDR to HDR converters. Also, after each item of equipment with SDR output, an SDR to HDR converter should be placed and only HDR signal distributed. Also, the quality of both SDR and HDR images should be controlled by the technicians in the control room.

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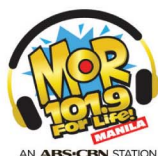
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‘The Broadcasting Industry is on the cusp of a new Era’

Interview with NHK’s Chief of Engineering & Executive Director, Akihiko Chigono

As Japan’s public broadcaster, NHK, prepares to host the 2019 ABU General Assembly, its Chief of Engineering and Executive Director, Akihiko Chigono, speaks to the Technical Review about the key challenges facing broadcasters, and how NHK is tackling them.



NHK will be hosting the next ABU General Assembly. Could you share with us as the host what to look forward to?

It is such an honor to host the 56th ABU General Assembly and Associated Meetings. We would like to welcome all members of the ABU to Tokyo. During the two days of Technical Committee Meetings on November 18 and 19, we would like to share constructive discussions and exchange opinions on issues concerning the current broadcasting industry. We are also planning to have a ‘NHK Technical Showcase’ exhibition located at the conference venue. Through various presentations at the Technical Committee and NHK Showcase, we hope to introduce our latest technologies and solutions.

How do you see the current situation of the broadcasting industry?

The broadcasting industry today is on the cusp of a new era, affected by the rapid development of IT technology. Terrestrial digital TV broadcasting started in Japan 16 years ago in 2003. Since then the environment of content distribution services has changed enormously by the spread of smartphones and the rapid development of audio and video services via the internet. Consequently, especially among the younger generation, the habit of viewing video on demand using personal devices is increasing extremely fast. In the field of production, equipment sharing and remote production using IP technology are already in practical use. Now Smart Production is drawing attention, automatic editing using AI and content delivery using cloud services will have a big impact on the work flow of content production.

How will NHK deal with this situation?

In our Three-Year Corporate Plan, one of the goals that we announced was ‘Progressing Toward Being a Public Media’. Besides television broadcasting, NHK will deliver internet simulcast and continue to fulfill its role as a ‘core component of social infrastructure’ delivering accurate information inside Japan and to the world from diversified angles. As a first step of utilizing IP services, we launched NHK Hybridcast, a television service that integrates broadcast and broadband in 2013. We are currently preparing to launch internet simulcast, a live-streaming service that delivers two terrestrial TV channels via the internet. IP conversion of broadcast equipment is also an essential theme. We are considering not only the equipment installation, but also the workflow change, expert training, and cyber security measures.

Could you tell us the current status of 4K / 8K satellite broadcasting?

NHK has launched two new satellite TV channels, BS4K and BS8K on December 1, 2018. The number of compatible receivers (including TV and STB) has exceeded 1 million (as of end of May 2019), and viewers are able to enjoy 4K/8K video featuring HDR and WCG, as well as advanced audio to create an unprecedented sense of engagement at home. Development of 4K/8K equipment is also progressing rapidly, leading to an increase of programming. NHK will air several big sports events in Japan such as the Rugby World Cup this September and the 2020 Tokyo Olympic and Paralympic Games. By broadcasting these high-profile events in 4K and 8K, we are intending to deliver the excitement of the game throughout the whole world. At the ABU Tokyo General Assembly, we would like you to experience various 4K/8K contents.

To what extent does NHK plan to develop new technologies?

NHK is proceeding with the development of 'Diverse Vision', a next generation broadcasting service that is to come beyond 8K as future media technology. These technologies such as glasses-free 3D, VR and AR are not bound by the viewing habits of traditional television. Furthermore, we are looking into the possibility to implement UHD TV service to the terrestrial broadcasting and have been engaged with necessary research and development. Up to now, we have conducted field experiments in Tokyo and Nagoya, and have carried out technical research for video coding and wireless transmission methods. We are currently promoting various studies in cooperation with the state, commercial broadcasters, universities, and manufacturers.

How is preparation going for the Tokyo 2020 Games?

The Tokyo 2020 Olympic and Paralympic Games is a sport event that provides a great chance to revolutionize Japanese society. We see this as a good opportunity for NHK to innovate as an open media so to continuously provide services that meet the trust and expectations of viewers as a Public Service Media organization. NHK is preparing to deliver its largest scale of services with live BS4K and BS8K broadcasting, and internet simulcast by latest technologies. In addition, we would like to provide an occasion for our viewers to share the excitement of inspiring moments through public viewing.

From a technical perspective, what is the view of NHK to contribute to the ABU in the future?

Every year, NHK engineers attend the Digital Broadcasting Symposium and promote our latest technologies to ABU members. The contents range from technology developed at NHK Science & Technology Research Laboratories (STRL) to case studies from the field operation. Additionally, in order to provide those information to the absent members, we constantly contribute technical documents to 'ABU Technical Review'. Also, through the ABU program, "Broadcasting Technology Research Scheme", we welcome young ABU engineers to NHK STRL and provide technical environment to support their research opportunity. By these positive approaches, NHK will continuously contribute to ABU's technical activities.

Finally, please send a message to the technical members of ABU.

The broadcasting industry is changing vastly and rapidly. In order to face these challenges, we believe it is vital to share our experiences and methods, both successful and failure cases with our fellow ABU members. Therefore, we would like all ABU members to join the ABU General Assembly in Japan. We hope to discuss the future on broadcasting industry during the ABU Technical Committee and lead the ABU General Assembly 2019 to success. We are looking forward to your participation and look forward to seeing you soon in Tokyo. ■

Akihiko Chigono

Executive Director, Chief of Engineering
NHK (Japan Broadcasting Corporation)





Japan Broadcasting Corporation

NHK Headquarters



Corporate Overview

NHK (Japan Broadcasting Corporation), Japan's sole public broadcaster, started its radio service in 1925 and television service in 1953. NHK is funded by license fee from each household that owns a television set. This funding system enables NHK to maintain independence from the government and private institutions to ensure audience interests to always be the top priority.

Domestic Channels

NHK offers four HDTV channels that are broadcast nationwide: two over digital terrestrial and two over satellite. Analogue terrestrial broadcast was switched off in FY2011. NHK also offers three radio channels: two AM channels and one FM channel.

On December 1st, 2018, NHK launched two new satellite broadcasting channels, BS4K and BS8K. NHK started to develop ultra-high definition 8K systems in 1995 and launched the world's first 8K channel last year. Both content and facility will be further enhanced to achieve the full-scale dissemination in time for the Tokyo Olympic and Paralympic Games in 2020.

Compared to the conventional HDTV, 4K consists of four times more pixels, and 8K, 16 times, creating the spectacular ultra-high definition image. In addition to the visual quality, the three-dimensional sound with 22.2 surround audio will provide a totally new experience to the audience.

Digital Services and Digital Production

NHK offers digital services to promote deeper understanding to the broadcast program by providing supplemental information. NHK also utilizes digital technologies to enhance the efficiency of the production workflow.

1. Integrated Broadcast Broadband Service (NHK Hybridcast)

"NHK Hybridcast" was launched in 2013, which is a service that integrates broadcast and telecommunication to provide additional information to the viewers. Examples include the "NEWS WEB" which provides latest news and the "360-degree Gallery", which provides drama-related information.

2. Internet Radio

NHK launched "Radiru ★ Radiru" in 2011, which offers its three radio channels on the internet to supplement the poor radio reception areas. In November 2016, programs produced by NHK's local stations were added to its service. NHK also has been conducting an experimental distribution through "radiko", since October 2017, an internet radio platform for the commercial radio stations. The service was expanded nationwide in April 2018.

3. Usage of AI

An AI-driven announcer has appeared in one of NHK's news programs since April 2018. In the show, a CG-generated announcer reads out topics that are trending in social media with its high-quality synthesised voice generated through machine learning algorithms.

NHK has also developed a voice generation system to automatically produce weather information programs that sounds like an actual living announcer. Test runs begun in March 2019 and weather information such as daily and weekly forecasts, temperatures, and precipitation probabilities are being read out by this system.

Emergency Notification for Digital Services

NHK immediately provides safety information to the viewers through its digital services in times of emergency.

1. Simultaneous Internet Distribution Service in times of Disaster

The Japanese Broadcast Act was revised on April 1st, 2015, to enable NHK to provide safety information through the internet simultaneously with broadcasting, in times of emergencies, accidents, and other major incidents. Live feed from NHK's weather cameras capturing damages caused by natural disaster can also be seen on-line.

2. News and Disaster Prevention Application

In June 2016, the "NHK News and Disaster Prevention" app was launched. News, weather information, disaster-related breaking news, and live streaming of affected areas can be seen simultaneously with the live broadcast. ■



Master Control Room

TBS

TBS Holdings Inc



As one of Japan's premier media companies, the TBS Group has embraced the exciting changes taking place in the broadcasting industry, since founded in 1951. The company has developed a diverse array of businesses, including TV programs and content, cultural events, real estate, product commercialization and shopping. The centerpiece of these operations is TBS Television, which has created countless hit drama, variety, and news programs, and played an important role as a torchbearer of Japan's broadcasting culture. TBS boasts a 28-station television network, the Japan News Network (JNN), which is the largest private network in Japan.

While technological innovations and changes in lifestyle are rapidly altering the environment surrounding our broadcasting operations, TBS considers this era of change to be a golden opportunity to demonstrate the strength of our content production, which has been crafted over many years. In April 2018, we launched the subscription and transactional video-on-demand service "Paravi" in cooperation with several of Japan's leading media groups, a new media platform on which viewers can watch content "anytime, anywhere, and on any device." The addition of "Paravi" to our existing terrestrial broadcasting, broadcast satellite, communication satellite, and radio channels will enable TBS to meet viewers' changing needs even better than before.

TBS is focusing on broadcasting facilities. Above all, we enhanced our core broadcasting system by updating the television master control equipment in 2017. This renewal of the TV station's

most important facility marks the start of a new era in which we will deliver comprehensive video services including next-generation broadcasting and streaming services. TBS also introduced a system that, in case of natural disaster, allows life-saving information to be sent out quickly and reliably through all JNN-affiliated TV stations.

To name a few:

4K Broadcasts

The ultra-high definition 4K broadcasts airing on TBS' satellite channel, BS-TBS from December 2018, presents images sharp and detailed that viewers feel like the programs are actually taking place in their living room. BS-TBS has started full 4K programs including its signature "NEWS1930" and factual shows, realizing highly visible and strong image of the content.

Ninja Warrior

Known globally as Ninja Warrior, the sports entertainment TV series and format SASUKE has become one of TBS's most successful global hits. The program and its localized versions have been watched by viewers in 165 nations and territories. Also, 21 nations have produced localized versions of SASUKE, which continues to go from strength to strength all over the globe.

IAAF World Championships

Since 1997, TBS has broadcast the biennial IAAF World Championships. Over the years, we have crafted strong relationships with athletes competing on the international stage and infuse our coverage with exclusive footage and interviews. TBS was host broadcaster at the 2007 World Championships in Osaka and presented this event to viewers around the world. Our superb video production technologies were honored with that year's IOC Grand Prize for the world's best sports images. ■





NHK WORLD
JAPAN

NHK WORLD



NHK
NEWSLINE

from **TOKYO**

NHK NEWSLINE
(News Program)

NHK WORLD, NHK's international television, radio, and internet service, reaches the entire world in multiple languages, providing accurate and impartial news, rich and quality contents. It will aim to be the most trusted choice, will broaden your perspective, and will reveal the real Japan and Asia.

NHK WORLD's services include: NHK WORLD-JAPAN (Television, Radio, and Internet), NHK WORLD PREMIUM, and NHK WORLD RADIO JAPAN.

NHK WORLD-JAPAN (Television)

The channel offers 24-hour English language free-to-air television service available to 350 million households in 160 countries and regions. Latest world news and various genre of programs are delivered through satellite, cable TV, IPTV, and terrestrial broadcasting.

NHK WORLD-JAPAN (Radio)

The channel offers international radio service to foreign listeners in 17 languages; English, Arabic, Bengali, Burmese, Chinese, French, Hindi, Indonesian, Korean, Persian, Portuguese, Russian, Spanish, Swahili, Thai, Urdu, and Vietnamese. Latest information and reports from Japan are delivered through shortwave, FM, medium wave, and satellite radio.

NHK WORLD-JAPAN (Internet service)

The service offers NHK WORLD-JAPAN's television and radio programs online by both linear and on-demand. Each service is provided in various languages; English, Arabic, Bengali, Burmese, Chinese, French, Hindi, Indonesian, Korean, Persian, Portuguese, Russian, Spanish, Swahili, Thai, Urdu, Vietnamese, and Turkish, depending on the content. Additionally, internet service offers "NHK HuayuShijie", which is a Chinese language live streaming service consisting of news and various programs. These services are provided through our official website and app.

NHK WORLD PREMIUM

The channel offers 24-hour Japanese language pay television service available to 20 million households in over 100 countries and regions mainly targeting Japanese expatriates. A variety of contents such as news, dramas, music, kids program, and sports selected from NHK's domestic television channels are delivered through satellite broadcasting or cable TV.

NHK WORLD RADIO JAPAN

The channel offers Japanese language radio service in a purpose to provide information and entertainment to the Japanese expatriates. Content such as news, current events, sports, music, and radio drama are delivered through shortwave and satellite radio. ■

Journeys in Japan (Travel Program)



Journeys in Japan

NHK Science & Technology Research Laboratories



NHK Science & Technology Research Laboratories (NHK STRL) is a research institute of NHK specializing in broadcasting technology. Its role is to develop advanced broadcasting technology to enrich audience experiences. The range of research is extremely broad, and technologies being developed are proactively standardized. Ever since its establishment in 1930, STRL has conducted research and development (R&D), such as HDTV, satellite broadcasting, flat-screen television, digital broadcasting, Hybridcast, and 8K UHDTV.

NHK STRL has set up three research areas, Reality Imaging, Connected Media, and Smart Production, to further advance the broadcasting technology and aim to play a leading role in the R&D of cutting-edge broadcast technologies and services for the sustainable development of broadcast beyond 2020.

Reality Imaging

STRL has been engaged in the development of UHDTV for more than 20 years and continues to research on “Reality Imaging” technologies to provide video and audio that convey more and more realistic sensations to the audience. This includes the development of sheet-type displays, full-featured 8K production systems, next-generation terrestrial broadcasting system, AR, VR, and 3D television.

Connected Media

Utilizing internet technologies will enable to enhance the usability of broadcasting and its related services. STRL is developing technologies related to “Connected Media”, connecting broadcasting programs to IoT devices, such as

electric appliances and smartphones, so to offer more useful information and more convenient experiences to the audience. It is also developing technologies for a chain of production system using IP network with high flexibility and high efficiency.

Smart Production

STRL is conducting R&D on “Smart Production” utilizing AI, which is becoming an important technology for broadcasting. Applying AI technologies to video, audio, and text analyses, intelligent and efficient program production systems are being developed. STRL is also enhancing universal services to provide information in easy-to-understand manners for the viewers with disabilities and non-Japanese speakers. ■



NHK STRL Open House 2019

NHK Global Media Services



NHK Global Media Services, Inc. is a subsidiary of Japan's sole public broadcaster, NHK, that offers a whole range of media-related services.

Global Media Services was established on 1 April 2009 and now has about 400 employees. We have two main fields of business, NHK-related activities and independent operations.

Our NHK-related activities include assisting in the production of NHK news and programs for both domestic and international TV channels and online news. We play a key role in NHK's news and sports coverage of domestic and international events.

As part of our independent activities, NHK Global Media Services operates a comprehensive mobile website that offers news, weather, sports, emergency updates and other useful information for daily life. We also provide

NHK news and related contents for in-flight-videos, digital signage, large outdoor screens, and mobile devices in cars and trains.

Our independent operations also include making professional and amateur sports programs after acquiring broadcasting rights and supplying images of Japanese sports events to overseas broadcasters.

We are committed to translation services primarily for broadcasting by running a training institute for interpreters and translators. We create closed captions for TV and other platforms and produce 4K/8K content by making full use of the expertise of planning, shooting, and editing specialists who have access to the largest-scale visual archives in Japan. ■



NHK Technologies, Inc.



50-year History in the Broadcasting Engineering Industry

As one of NHK's (Japan's Broadcasting Corporation) affiliate organizations, NHK Technologies, Inc. (renamed through the merger of the two former NHK group companies, NHK Integrated Technology Inc. and NHK Media Technology, Inc. on 1 April 2019.) was established on 23 July 1969.

The Organization now employs approx. 2000 employees as of April 2019.

It serves clients in domestic and abroad, and plays a pivotal role in the international broadcast industry.

World Wide Engineering Services

Since 1975, NHK Technologies, Inc. has engaged in and has successfully completed over 116 ODA (Japanese Government's Official Development Assistance) broadcasting projects in 58 developing countries in Asia, Africa, Oceania and Latin America. These varied development projects under the Japanese government sponsorship range from the rehabilitation of radio/television studios to a large-scale construction of radio/television studio complex as well as establishment of radio/television broadcasting networks.

Comprehensive Activities in the field of Broadcasting Engineering

NHK Technologies, Inc. offers the comprehensive Engineering Services in the entire process of formulation of Broadcasting System and Building Construction through the Survey, Design and Project Implementation. ■

Recent Projects



VTV (Vietnam) 1999 - 2017



MRTV (Myanmar) 2015 - 2019



Training session of the Bangladesh Human Development TV project

- (7) Handling correspondence and monitoring reports for NHK World TV and Radio Japan
- (8) Guiding visitors around NHK facilities
- (9) Translation

In recent years, NHK International has also been entrusted by the Japan International Cooperation Agency (JICA) with the implementation of several Technical Cooperation Projects for helping foreign broadcasters. The most recent are:

- (1) The project to support the public service broadcaster of South Sudan
- (2) The Bangladesh Human Development TV project
- (3) The project for capacity development for the public service broadcaster of Kosovo
- (4) The project for capacity development for the public service broadcaster of Ukraine
- (5) Training on weather forecasting and disaster prevention for Vietnam Television (VTV)

NHK International is committed to creating a brighter and more prosperous future for people everywhere through international cooperation in the broadcasting field. ■

NHK International, Inc. was established in 1980 as an affiliate organization of NHK, the Japan Broadcasting Corporation. It has the special mission to improve people's lives everywhere through the sharing of NHK's diverse knowhow, engaging in a wide range of international cultural exchange activities from support for manpower development to the provision of TV programmes to broadcasters of developing countries. NHK International's main activities are:

- (1) Providing programs for foreign audiences and the sale of visual materials
- (2) Producing foreign-language versions of Japanese programs
- (3) Purchasing and providing overseas content
- (4) Supporting the production activities of overseas broadcasters
- (5) Training and assistance projects for overseas broadcasters
- (6) Running the Japan Prize International Competition of Educational Content



Seminar on public service broadcasting for UA:PBC

NHK Enterprises, Inc. (NEP) was established in 1985 and is an affiliate of NHK (Japan Broadcasting Corporation). Currently, it has approximately 560 employees.

NEP has three overseas affiliates: NHK Cosmomedia America, Inc. in New York, NHK Cosmomedia Europe, Ltd. in London and Nippon Production Service Co., Ltd. in Bangkok.

As a member of the NHK Group, NEP produces over 13,000 NHK television and radio programs annually in genres including documentary, drama, animation, and entertainment in its commitment to enhancing the broadcast culture. NEP is also involved in the planning and production of large-scale display images through high-definition 4K and 8K videos and projection mapping, as well as the production of theatre videos.

Its line of business covers not only program production but also distribution of DVDs and Blu-ray discs, digital exploitation of visual contents, developing and planning of events and symposiums, sales and purchases, both domestic and international, of contents, as well as exploitation of character licenses.

NEP aims to be constantly ready and available as a partner close at hand to all sectors both at home and abroad. ■



Fukushima Projection Mapping – HARUKA 2019
– The Boshin Wind and the Flower Cloud
©fukushima sakura project/NHK Enterprises



Filming with special equipment that can be freely manipulated in all directions

NES *NHK Engineering System, Inc.*

NHK Engineering System, Inc. (NES, formerly NHK Engineering Services, Inc.) was established in December 1981 as one of NHK's (Japan Broadcasting Corporation) affiliate organizations and became a general foundation in 2013.

NES is focusing on transferring technologies developed by NHK and returning them to the public and widespread use of its patents. Moreover, our interests go beyond broadcasting to serve other industries including cinema, medicine, machinery, photograph and printing.

Recently, we are working on the following businesses:

- 4K/8K UHDTV
- Hybrid broadband / broadcast
- Accessibility technologies
- AR / VR technologies
- Shooting technology in special environments such as space
- Investigation of radio wave reception environment

The organization employs 93 employees (as of March 2019).

<http://www.nes.or.jp/en/company.html> ■



Small 8K camera



What is **JAMCO**

Japan Media Communication Center (JAMCO) is a non-profit organization established in 1991 for the purpose of promoting international mutual understanding and contributing to the development of broadcast in the world.

Originally created with funds from NHK and commercial TV broadcasters throughout Japan, its main activity is to expand and maintain the library of the Japanese TV programs that can be provided free of charge to TV stations in developing countries.

Programs are acquired from NHK and commercial broadcasters, to be reproduced in English, Spanish, French and Arabic versions as well as Music and Effects version available for language localization.

Over 28 years, JAMCO has accumulated 1,744 superb Japanese programs in international versions, including documentary, educational programs, children's programs, and drama. A total of 13,049 programs have so far been provided to TV stations in Asia, Oceania, Latin, America, East Europe, Middle East and Africa. (The data was provided in 31 March 2019) ■



BSAT

Broadcasting Satellite System Corporation (B-SAT)

The world's first direct broadcasting satellite (BS) service in the 12 GHz band was started in May, 1984 by NHK (Japan Broadcasting Corporation). This BS service to households was made reality after eighteen years of research and with the cooperation of many organizations and awarded as an IEEE milestone.



B-SAT was established in April 1993 to provide a successor to the BS-3 services and to procure new satellites. After operating the BSAT-1 and BSAT-2 series satellites, B-SAT currently operates BSAT-3a, 3b, 3c (launched in 2007, 2010 and 2011 respectively) and 4a (launched in 2017) at around 110 deg. East geostationary orbit.

B-SAT contributed to the initiation of digital BS in 2000 and the termination of analogue BS in 2011. 4KTV and 8KTV programs have been transmitted since 1 December 2018.

RHCP	1ch (11.72748GHz)			3ch (11.76584GHz)			5ch (11.80420GHz)			7ch (11.84256GHz)		
	 BS朝日	 BS-TBS	 BSテレ東	 W.O.W.O.W プライム	 NHK BSプレミアム	 Disney	 W.O.W.O.W ライブ	 W.O.W.O.W シネマ	 BS朝日 4K	 BSテレ東 4K	 BS07L 4K	
	BS Asahi	BS-TBS	BS TV TOKYO	WOWOW [PAY]	NHK	Disney [PAY]	WOWOW [PAY]	WOWOW [PAY]	BS Asahi	BS TV TOKYO	BS Nippon	
	(slots) (16)	(16)	(16)	(24)	(18)	(6)	(24)	(24)	(40)	(40)	(40)	
	9ch (11.88092GHz)			11ch (11.91928GHz)			13ch (11.95764GHz)			15ch (11.99600GHz)		
 BS11	 STAR1	 BS12 TwellV	 FOX SPORTS ENTERTAINMENT	 BS スカパー!	 放送大学	 BS07L	 BSフジ	 ANIMAX BSアニメマックス	 NHK BS1	 A-PAB	 STAR2	 STAR3
BS 11	Star Channel [PAY]	TwellV	Fox [PAY]	Sky Perfect [PAY]	OUJ	BS Nippon	BS Fuji	Animax [PAY]	NHK	A-PAB	Star Channel [PAY]	Star Channel [PAY]
(slots) (18)	(15)	(15)	(16)	(16)	(16)	(16)	(16)	(16)	(20)	(2)	(13)	(13)
17ch (12.03436GHz)			19ch (12.07272GHz)			21ch (12.11108GHz)			23ch (12.14944GHz)			
 BS4K	 BS-TBS 4K	 BSフジ 4K	 GREEN CHANNEL	 J-SPORTS 1	 J-SPORTS 2	 シネファイル W.O.W.O.W	 J-SPORTS 3	 J-SPORTS 4	 BS釣りビジョン	 BS 日本映画 毎ワキチャンネル	 BS dlife	
NHK SHV 4K	BS-TBS	BS Fuji	GREEN [PAY]	J-SPORTS [PAY]	J-SPORTS [PAY]	WOWOWプラス [PAY]	J-SPORTS [PAY]	J-SPORTS [PAY]	Fishing Vision [PAY]	Nippon Eiga [PAY]	Dlife	
(slots) (40)	(40)	(40)	(16)	(16)	(16)	(16)	(16)	(16)	(16)	(16)	(16)	
LHCP	8ch (11.86174GHz)			12ch (11.93846GHz)			14ch (11.97682GHz)					
	 SCN	 4K QVC	 トホクシンシャ 映画株式会社	 W.O.W.O.W			 BS8K					
	SCN	QVC	Tohokushin sha Film Corporation	WOWOW			NHK SHV 8K					
(slots) (40)	(40)	(40)	(40)			(120)						

B-SAT makes every effort to maintain reliable BS services, with measures including: (1) Four satellites for 24 channels, in addition BSAT-4b (back-up) will be launched before the 2020 Olympic games in Tokyo, (2) Two satellite control centers at Kawaguchi and Kimitsu, (3) Three uplink stations at Shibuya, Shobu and Kimitsu, (4) Transportable back-up uplink station on vehicle, and (5) Receivers for monitoring the BS waves at 9 locations in Japan.

B-SAT also makes effort to develop new BS services. For example, BSAT-4a is equipped with the 21-GHz band wide-band transponders for the broadcasting satellite services. ■

About Japan International Broadcasting Inc. (JIB)



Japan International Broadcasting Inc. (JIB) was established in 2008 under the Broadcast Act of Japan as a subsidiary of NHK (Japan Broadcasting Corporation) in order to enhance the international services of NHK.

At present, JIB's principal activities include:

- Production of TV programs for NHK WORLD-JAPAN (English, HD, 24/7), which reaches over 350 million households in 160 countries and regions.
- Distribution and promotion of NHK WORLD-JAPAN, cooperating with more than 300 satellite, cable, IPTV and terrestrial platforms around the world.
- Operation of NHK WORLD PREMIUM (Japanese, HD, 24/7), which serves mainly for Japanese living abroad.
- Research and development of digital services such as live streaming and video on demand in multiple languages.

Shareholders include NHK group companies as well as private companies, such as commercial TV stations, trade firms, financial institutions and telecommunication company. JIB can produce original programs with private or public sponsorship. Furthermore, JIB has recently expanded its scope of activities in Asian countries which include projects assisting broadcasters in Vietnam and Myanmar to produce localized educational TV shows.

For further information on JIB's activities, please visit the official website below.

<https://www.jibtv.com/> ■



Outside of the Building where JIB is located



Promotion of NHK WORLD-JAPAN in Washington DC, USA



Promotion of Localized NHK Educational Show in Vietnam

TI Com Net

International visual works

Who We Are:

TI ComNet, established in 2001, is an independent distribution and post production company specializing in translation, voiceover, subtitling services, content acquisition and sales, as well as international TV and film co-production coordination.

What We Do:

- TV program acquisition and sales through our website as well as exhibiting at many international content markets around the world each year
- Translation and localization of TV programs for broadcast and sales in various languages
- Co-production and filming coordination and liaison between Japanese and International broadcasters
- Marketing and promotion of our online catalogue website www.japantvmarket.com through sponsorship with our local partners
- International film festival management and support for local and regional broadcasters in Japan

Where We Operate:

Headquartered in Sapporo, Japan with branch offices in Tokyo, Singapore, and New York, TI ComNet has built strong relationships with diverse groups of professionals from the broadcast and film industries in the US, Canada, Europe, and Asia regions.

We introduce, translate and edit Japanese TV programs and movies for your country.



Introducing a brand-new online catalogue

JAPAN TV MARKET
www.japantvmarket.com

- | | | |
|-----------------|----------|----------|
| ✓ Entertainment | ✓ Travel | ✓ Anime |
| ✓ Documentaries | ✓ Drama | ✓ Movies |



For over 17-years, TI ComNet has accumulated an impressive catalogue of programmes, with many award-winning documentaries, animations, dramas and series available in multiple languages. The dedicated team at TI ComNet is also committed to providing the highest-quality service for all production requirements and continues evolving in an increasingly global and technological media environment.

Many small regional and local TV networks in Japan struggle to promote and expose their unique contents to the international market. Over the last decade, TI ComNet has diligently concentrated on building strong networks and partnerships with these smaller networks as well as independent broadcasters all across Japan in order to bridge the gap between them and the world by facilitating co-productions, providing international market exposures, localization of local and foreign programs for exchange and also the acquisition and sales of TV programs with many international broadcasters who have had trouble entering the Japanese market. Through these relationships, TI ComNet is dedicated in bringing many award-winning titles and hundreds of hours of unique Japanese contents to the world. ■



The Japan Commercial Broadcasters Association

The Japan Commercial Broadcasters Association (JBA) is an incorporated organization whose membership consists of 207 commercial broadcasters in Japan. JBA was established in 1951 by 16 commercial radio companies that were granted provisional licenses as the first commercial broadcasters.

JBA aims to improve broadcasting ethical standards, promote the public welfare through broadcasting services, anticipate its progress and development, and settle common issues among the commercial broadcasters, while facilitating mutual friendship and understanding. In order to attain these purposes, following activities are undertaken:

1. To establish and enhance broadcasting ethics
2. To share information relating to the members and solve the common issues
3. To conduct research and study of broadcasting programs, technologies and management
4. To report various issues relating to the industry to the Diet, the Government bureaus and the other agencies
5. To maintain the operations of TV Network Management
6. To maintain Official Archives in accordance with the copyright law
7. To familiarize the commercial broadcasting industry to the public
8. To publish newspapers, magazines and the other materials
9. To provide the necessary services to enhance welfare, mutual friendship and harmony among the commercial broadcasters
10. To undertake other projects deemed necessary to achieve JBA's objectives ■

Ikegami

Ikegami Tsushinki Co. Ltd.



Ikegami Tsushinki Co., Ltd. was established in 1946, Tokyo, Japan as a small component manufacture. Ikegami is a global integrated business enterprise that develops and operates businesses together with its offices and subsidiaries in Japan, China, Singapore, Germany, and U.S.A. worldwide. Ikegami's technologies are classified into the five business units: Broadcast Systems, Public Solutions, Security Solutions, Medical Solutions and Inspection Solutions. In order to provide the best solution to our clients for their business requirements, we aim to combine our Image, Process and Transmission technologies throughout the whole Ikegami group - regardless of which of the business units are involved. You can count on Ikegami as image-technology professionals to propose the optimum solutions with timely actions to your business' issues.

Ikegami is a leading supplier of high quality professional broadcast equipment. World-class video imagery, 4K and 8K technology, multi-format flexibility and unparalleled customer support define the Ikegami experience for users in broadcast, sports venues, mobile production, houses of worship, education, corporate and many more applications.

Recent increases in emergency and disaster recovery planning are being supported by Ikegami's expertise in system integration for traffic, rail, seaport, and airport (helicopter) surveillance - rapidly providing accurate information.

Ikegami is the market leader in Japan for medical use cameras. We are also working to develop 4K/8K technology for medical applications and successfully to increase our market penetration in Asia, Europe and North America.

<https://www.ikegami.co.jp/en/> ■

Broadmedia & Entertainment

Inter BEE 2019

November 13-15 | Makuhari Messe, Tokyo

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WHAT WILL YOU DO NEXT? Conveying the possibilities of new media to the world.



Inter BEE will evolve into a comprehensive media event covering everything:
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INTER BEE **SPORT**

SPORT×TECHNOLOGY×ENTERTAINMENT
Expanding the scope of sports contents
It provides opportunities for creating new business.

NEW

INTER BEE **(5G)**

"High-speed large-capacity" "ultra-low delay"
"simultaneous multiple connection"
High presence and immersion created by 5G.
Triggering development of new content business!

INTER BEE **CREATIVE**

From leading-edge video production sites
Connecting with video creators
Methods and techniques of expression to stir up creativity will stimulate your creative brain!

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E-mail:contact2019@inter-bee.com

For Further Information
www.inter-bee.com



NHK Showcase – Get to Know all About NHK

A special event at this year's ABU meetings will be the NHK Showcase, which will run alongside the meetings for five days.

The event will introduce NHK content and technology to ABU members, focusing on 2020 and beyond.



Showcase 1 will look at Programmes and Contents. It will take place in the Crystal Room, Hyatt Regency Hotel.

This is a place to get to know more about NHK's programmes and meet producers and directors. Delegates are welcome to drop in for screenings, presentations, workshops and networking events.

Showcase 2 will focus on Technology. The venue is Tenpyo Room, Hyatt Regency Hotel.

It will introduce the latest technology developed by NHK. The "8K Living Room" will allow delegates to experience 8K ultra-high definition video and 22.2 advanced audio, as well as presentations of many other cutting-edge technologies such as AI, AR, and VR. Visitors are welcome to come to the showcase and talk with NHK engineers to find out more.



The Showcase will also feature a series of presentations that are likely to be of interest to most ABU members.

One is on 'New visual and auditory experiences and the creation of an inclusive society beginning with the Tokyo Olympic and Paralympic Games'.

Two other presentations will focus on 'Developing unique digital public media services' and 'Connecting with the next generation; Behind-the-scenes look at original and daring programmes'.

Another presentation will look at 'Journalism in the Internet era - How to win back trust'. It will look at the best approaches to entering the digital world, with a full report on strategies and prospects.

Also of interest for many ABU members will be a mini workshop on NHK Archives.

It will include a demonstration of the 4K-scanning of historical footage and colourisation of black-and-white films by NHK Archives using AI. There will also be a presentation of programmes restored and converted from 16mm film to 4K-HDR including 'The Silk Road' and a free-of-charge display of

a touch-panel monitor used to search archive contents.

Consultations on the preservation and restoration of archives will also be available.

NHK Showcase will run from Sunday 17 to Friday 22 November. It will be closed on Wednesday 20 November.

For more please see <https://abu2019tokyo.jp/events.html#NHKShowcase> ■

The logo for

ABU Tokyo 2019

The distinctive logo designed by NHK for this year's ABU General Assembly depicts a pine tree – a symbol in Japan of supremacy, long life, good health, prosperity and good luck.

Inspired by this beloved tree, the logo consists of three circles joined together.



These circles can be seen to represent several important concepts:

- TV, Radio and the Internet
- Past, Present and Future
- News, Entertainment and Education
- Content, Technology and Communication

This simple logo symbolises not only the diversity of the ABU but also its aspiration to provide the best possible experiences to everyone it serves.

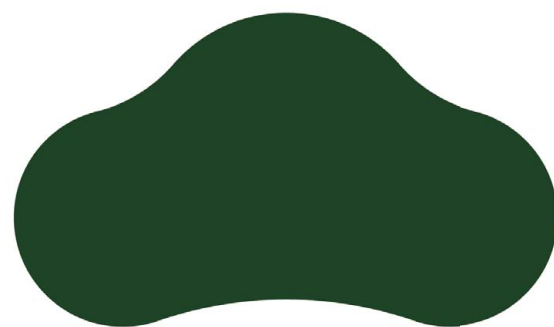
The theme for **ABU Tokyo 2019** is Building Trust:
Enriching Audience Experience.

With the media landscape drastically changing, audiences are seeking more diverse and higher quality experiences through multiple platforms.

ABU broadcasters can meet their needs by providing services that are:

- Ubiquitous – Online distribution, VOD
- Shared – Social Media, Public Screenings
- Advanced – 4K/8K UHD, VR
- Reliable – Trustworthy information, Emergency news
- Inclusive – Content for everyone

Meeting audiences where they are is one of the most significant missions for broadcasters and an indispensable ingredient in building trust.



ABU Tokyo 2019

56th ABU General Assembly & Associated Meetings



TECHNICAL COMMITTEE MEETING



ABU Tokyo 2019
56th ABU General Assembly & Associated Meetings

18-19 NOVEMBER

PROGRAMME OVERVIEW

VENUE: CENTURY B, HYATT REGENCY TOKYO HOTEL

MONDAY, 18 NOVEMBER 2019 (DAY 1)

OPENING SESSION

09:00 - 09:30 **Welcome address**

Opening Address

KEYNOTE PRESENTATION

11:45 - 12:30 **Special Keynote Presentation by NHK**

12:30 - 14:00 **Networking lunch**

ABU ENGINEERING AWARDS 2019

09:30 - 10:30 **Technical Review Prizes | Commended & Best Articles**

ABU Green Broadcast Engineering Award

ABU Developing Broadcasters' Excellence Award

ABU Engineering Industry Excellence Award

ABU Broadcast Engineering Excellence Award

ABU Distinguished Service Award 2019

10:30 - 11:00 **Tea, coffee & networking**

FUTURE STRATEGIES

14:00 - 15:30 **Session Chair:** Dr Kong Bin, Vice Chairman, ABU Technical Committee

WRC-23 – what's at stake for broadcasters?

SDI to IP Migration – The ST-2110 Suite of Standards and Broadcast Applications

Visual Cloud and Expanding Cloud Applications within the Broadcasting Workflow

Lessons from the Digital Switch Over

Cybersecurity strategies for broadcasters

15:30 - 16:00 **Tea, coffee & networking**

TC PROCEEDINGS

11:00 - 11:45 **Session Chair:** Mr Hamid Dehghan Nayeri, Chairman, ABU Technical Committee

Confirm Agenda and TC-2018 Proceedings and appointment of Rapporteurs

ABU Technology Activity Report

Bureau Proposals (Introduction)

ADVANCED TECHNOLOGIES

16:00 - 17:30 **Session Chair:** Mr Masashi Kamei, Vice Chairman, ABU Technical Committee, Senior Research Engineer, Science and Technology Research Laboratories, NHK-Japan

Advanced Standards for Terrestrial Broadcast Delivery

Next Generation Audio and its Applications

How is Data, AI/ML revolutionising the Broadcast Environment

5G and Broadcast Delivery – What we need to know

Satellite Broadcasting and Future Technologies

End of TC Day 1



TECHNICAL COMMITTEE MEETING



ABU Tokyo 2019
56th ABU General Assembly & Associated Meetings

18-19 NOVEMBER

PROGRAMME OVERVIEW

VENUE: CENTURY B, HYATT REGENCY TOKYO HOTEL

TUESDAY, 19 NOVEMBER 2019 (DAY 2)

TOPIC AREA REPORTS

09:00 - 10:15

Session Chair:

Mr Sunil, Vice Chairman, ABU Technical Committee, Additional Director General (Engineering) & Head International Relations, Doordarshan

Production

Mr Kazim Pektaş, Chief Engineer, TRT-Turkey

Transmission

Mr Kenichi Murayama, Senior Manager, Planning & Management Division, Engineering Administration Department, NHK-Japan

Capacity Building

Mr Tharaka Mohotty, Director Engineering, MTV-Sri Lanka

Spectrum

Dr Li Leilei, Professor, Academy of Broadcasting Planning, RTPRC-China

10:15 - 10:30

Bureau Proposals (Final Reading)

10:30 - 11:00

Tea, coffee & networking

TECHNOLOGY PANEL

11:00 - 12:30

Theme: The Future of Linear Broadcasting

The distinguished panel of broadcasters and industry experts will share their vision on the future of broadcasting, providing insight and sharing experiences on how some broadcast organisations are facing the challenges and charting its way forward.

12:30 - 14:00

Networking lunch

THE HOST PRESENTS | NHK-JAPAN

14:00 - 15:15

Session Chair:

Mr Masashi Kamei, Vice Chairman, ABU Technical Committee

As host of this year's TC meeting, NHK will make presentations on some selected topics discussing how they have implemented some of the advanced technologies within their operations. The presentations will also include some of the advanced broadcast research projects currently being developed within their R&D labs.

MEMBER UPDATES

15:15 - 16:30

Session Chair:

Mr Hamid Dehghan Nayeri, Chairman, ABU Technical Committee

Information Exchange and Status Reports

Members' Updates

New members and Updates from Sister Unions & Intl Organisations

CLOSING

Future Meetings

ABU DBS 2020, Kuala Lumpur, 2-5 March 2020

ABU Media Summit on Climate Change and DRR 2020

NHK Broadcasting Technology Research for ABU 2020

Appointment of Honorary Vice-Chairman from the host of the 2020 ABU General Assembly

Welcome to ABU TC & GA 2020 Hanoi

Closing Remarks by Chairman

End

ABU members attend BIRTV2019 in Beijing



Broadcast engineers from members of the ABU Technical Committee were among those who took part in a media cooperation project in Beijing in August.

The Media Cooperation Exchange Project for Broadcasting Industry Personnel was held on 20-25 August as part of the Beijing International Radio, TV & Film Exhibition (BIRTV).

In addition to attending BIRTV, ABU members at the exchange project attended technical seminars and visited China Media Group and other companies involved in television production.

The organisers of BIRTV helped make it possible for ABU members to attend by providing accommodation, meals and local transport, with members paying only for their flights.

BIRTV2019 took place at the China Intervention Convention Centre in the Chinese capital on 20-24 August. A showcase of the latest products and services, it included a five-day conference and a four-day exhibition. ■







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Spectrum planning meeting looks to the future

Planning for future spectrum for broadcasters and mobile operators continued with a regional meeting in Tokyo in July-August.



The 5th Meeting of the APT Conference Preparatory Group for WRC-19 (APG19-5) took place from 31 July to 6 August.

Among the participants was a Vice-Chairman of the ABU Technical Bureau, Mr Masashi Kamei of NHK Japan, who represented the ABU.

The meeting was organised by the Asia-Pacific Telecommunity (APT) and hosted by Japan's Ministry of Internal Affairs and Communications.

World Radiocommunications Conferences (WRC) take place every three to four years. The next, WRC-19, will be held in Egypt from 28 October to 22 November.

The WRC reviews and if necessary revises the Radio Regulations, the international treaty governing the use of radio-frequency spectrum. It also coordinates satellite orbits.

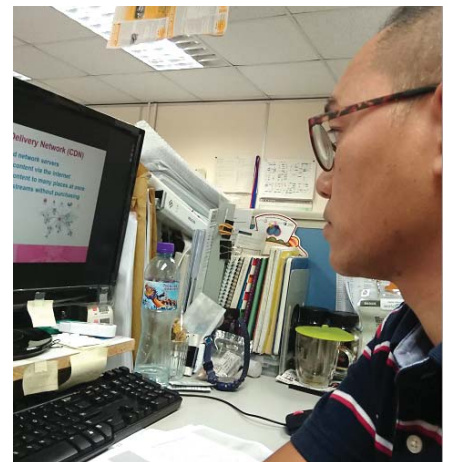
Put simply, it decides who will be allowed to use what frequencies. Its upcoming tasks include making decisions on the identification of future spectrum for mobile networks, including new 5G networks. ■



TECHWEBINAR SERIES 2019



Amir, Sara and Badrul coordinating the webinar



Henry Chan, Radio Television Hong Kong

The annual **ABU Technology Webinar Series** this year took place from **26 August** to **23 September**.

This is a series of online webinars offered free of cost to those interested in broadcast technology organised by the ABU Technology every year since 2011.

The month-long series included presentations on different aspects of broadcast and media technology presented by experts from around the globe. Some of these topics were taken from workshops and seminars organised earlier in the year, allowing participants who were not able to attend these activities to also benefit from the presentations.

The webinar sessions were grouped under five main themes, with a total of 36 sessions presented. The main themes covered during the series included:

- Digitising of Audio/Visual Archives
- Digital Radio Implementation & Case Studies
- DTV Migration, ASO Experiences & UHD TV
- OTT & IBB Technologies and Services
- SDI to IP Migration and Cybersecurity

The sessions were run in an interactive format with each presentation followed by a live question and answer session. The sessions lasted about 45-60 minutes with each topic being repeated later the same day to allow participants from multiple time zones to join.

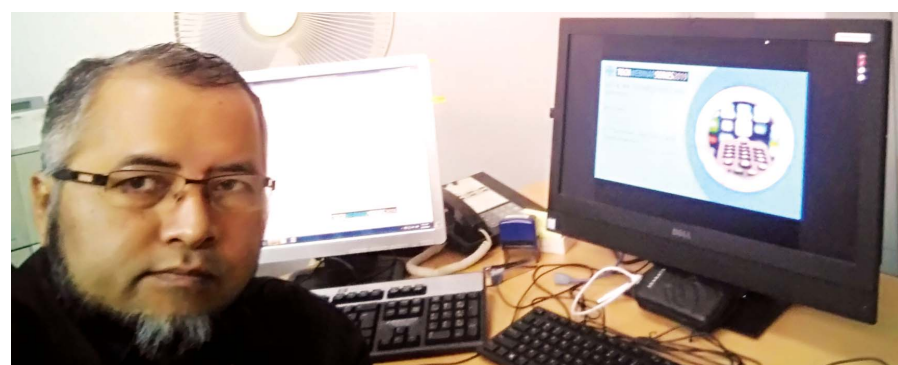
The ABU Webinar series received 222 registrations from 56 countries representing 189 organisations. ■



Amani Ali, PBC



Marc M. Batschkus, MD PhD,
Archiware GmbH, Germany



Zainal bin Zakaria, Radio Television Malaysia



Udaya Krishna Shrestha, Radio Nepal

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DAB+ WORKSHOP

looks at new trends

A five-day workshop on DAB+ Digital Radio Broadcasting took place in Kuala Lumpur on 8-12 July. It brought together about 20 representatives of broadcasters and regulators in the Asia-Pacific region and the Middle East.



The ABU staged the workshop together with the Arab States Broadcasting Union (ASBU) and the global industry forum WorldDAB.

It took place at the Malaysian Ministry of Information's training institute, IPPTAR.

Speakers from WorldDAB shared their expertise on the DAB+ Digital Radio Ecosystem.

Representatives of Paneda-Thailand, GatesAir-Singapore, Aqipa-Australia and Keystone spoke on headend system design, transmission systems and environment friendly infrastructure, and different brands of receivers.

An expert from ATDI-Australia, **Yahya Khaled**, demonstrated the latest network planning software in the workshop on RF planning and interference, giving real world examples from a number of countries.



Yahya Khaled, ATDI



Dr Les Sabel, WorldDAB

Dr Les Sabel from WorldDAB was the principal speaker. He covered diverse topics such as DAB+ technologies, case studies of its implementation around the world, policy and regulations on the digital switchover, and hybrid radio.

Day one covered digital change in the radio industry, broadcasting and IP, and a view on digital radio future current trends and pressures including emergencies.

Dr Sabel also focused on DAB+ broadcast features and functionality, a global status update and current industry activities including WorldDAB profile and what it provides to the broadcasters' community. DAB+ digital radio's multi-platform strategy makes use of hybrid radio for advertising, broadcast categorised slideshows, brand building and smartphone app use cases.

On day two, the workshop covered the DAB+ system structure, head-end systems with details on ensemble structure, and service structure and its advanced features. **Sohan Karunaratne** from Aqipa GmbH Australia gave details of Pure brand digital radio receivers, their



Sohan Karunaratne, Aqipa

distribution and coverage profile around the world, and their capabilities.

Different types of digital radio receivers such as portable, bedside, personal, wireless smart speakers, and in-car radios including internet radios are manufactured under the Pure brand.

Anupon Tajawanno from Paneda-Thailand, a DAB technology provider company, highlighted headend system design case studies with references to a Thailand field trial and Thailand DAB+ roll out. For DAB+ digital radio service coverage, the country is divided into regions for programme multiplexes so that only a few frequencies are needed with the re-use of the frequencies and with provisions for future upgrade into more regions.



Anupon Tajawanno, Paneda

It was followed by the session on transmission systems and support systems in which ETI/EDI, Modulation and coding, Signal flow in transmission chain with Redundant equipment and antenna systems were discussed.

Overview of support systems and equipment for content delivery, control and monitoring, ancillary equipment, power systems, and network management were discussed as well.

Jason Mak from GatesAir gave details on current DAB transmitter technology and architecture, cooling systems, output structures and redundancy options and about transmitter control and monitoring.

GatesAir has Intraplex, Maxiva and Flexiva transmitters for different platforms



such as Terrestrial TV, Radio and Mobile TV with Powersmart features for cost, energy, and space efficiency. What makes DAB+ environmentally friendly was another topic he dealt with, referring to cost factors of radio operation in equipment, energy, cooling, floor space, service and maintenance.

Dr Sabel covered DAB+ network planning topics with details about system requirements, network types, equipment location options, connectivity options and link capacity, cost benefit analysis, network codes etc.

For broadcasters, the requirements could be studio and transmitter locations, roll-out schedule, service quality, cost analysis, content, control & monitoring issues. He went on to discuss the receiver architecture for home, car, personal and smartphone receivers.

Across the globe, over 600 models of 68 million receivers have been sold so far, from US\$15 units to very expensive high-end brands. Modules and chips for the receiver units are available from a number of vendors. On this, **Michael Chen** from Keystone Semiconductors spoke about their IC/modules used in different receivers and had a range of those modules for demonstration.

On the 4th day, RF coverage planning was discussed with coverage modelling methods and design examples. Dr Sabel briefed on regulatory considerations with operating parameters to be set for broadcasters.

Other requirements such as spectrum and regulation, coverage and capacity, planning of signal levels for different receiving environments were considered too in the session. For RF coverage, different modelling methods and standards set field strength values for SFN/MFN transmission network types. Transmission network design examples were considered too for covering specific licence areas with different terrains.

RF coverage and interference practice was demonstrated by Yahya Khaled from ATDI Australia. He gave specific examples of Asia-Pacific countries on RF



coverage calculations using digital maps and coverage network planning. Different propagation models and coverage prediction & analysis measurements were used as well as tools for the purpose. Impact of terrain and RX antenna height on coverage including coverage planning threshold were studied.

On the final day, Dr Sabel explained about regulation and policy issues from the regulators' perspective. He laid out different steps for ASO planning and moving ahead in transition.

A visit to Radio Television Malaysia (RTM) premises was organized. The participants toured FM radio broadcasting facilities and a stage studio for live and reality show productions.

On the sidelines of the workshop, display and demonstrations of different models of DAB+ receivers and modules were arranged to enrich participants' learning.

The workshop featured a hands-on group exercise in which participants were asked to plan the DAB+ rollout for a fictitious country/area of their making. Each group presented their solutions including aspects of transmission, networking, services, regulation and timelines.

The Head of the ASBU Technical Training Department, ASBU Academy, **Dr Adnan Salhab**, spoke about the importance and relevancy of the workshop. ■



News from The ABU Region

Japanese TV networks embracing synchronised streaming

Waking up to the need of an OTT offering, five Japanese networks – Nippon Television Network Corp, TV Asahi Corp, Tokyo Broadcasting System Television Inc, TV Tokyo Corp and Fuji Television Network Inc – are teaming up with TVer, a Japanese OTT provider, to simultaneously stream their evening news programmes for five weekdays in January 2020. This initial trial-over-the-air will cover Tokyo and six other locations in the Kanto region of Japan. The online broadcast is expected to eventually provide coverage to the whole country.

Japan Today newspaper has revealed that the Japanese broadcasters were reluctant to adopt online streaming due to concerns surrounding costs, copyrights and relationship with other stations; hence, the broadcasters are using new stories for the trial as there is less controversy over copyrights. Moreover, falling TV viewership among youngsters is prompting TV networks to review and re-strategise their traditional content distribution model.

In consideration of affecting private networks, NHK's simultaneous streaming was limited to disaster and live sports coverage in the past. After Japan revised this rule in May this year, NHK is now set to launch a regular simultaneous streaming service in March 2020, ahead of the Tokyo Olympic Games 2020. [APB News]

iflix Introduces Market First Contextual Segment Targeting

iflix Advertising, iflix's brand solutions business, has announced a suite of advanced targeting solutions to deliver more effective brand messages to highly-engaged audiences. iflix now offers brands the chance to employ the company's rich proprietary data to target viewers based on contextual insights, going beyond pure demographic and device ID targeting.

Contextual segment targeting allows brands to reach audiences that matter to them the most by combining iflix's first-party intelligence (including browsing and streaming data, as well as genre and programming preferences), with third-party verified demographic data, for a holistic insight into viewing preferences and behaviours. To empower brands further, iflix has also introduced pre-defined audience segments to be targeted via direct or programmatic-guaranteed deals.

Since launching in January 2019, iflix

Advertising has become Southeast Asia's leading premium digital video advertising solution. Brands have the means to align themselves with world-class content and entertainment on a global scale and access multiple advertising formats which include sponsorships of top titles, playlists and channels and premium video ads, as well as bespoke content solutions including brand integrations in iflix original productions. Regional and global brands are integrating iflix advertising into their campaigns to drive reach, improve efficiency, engage with the highly-coveted millennial demographic, and to create native brand experiences that leverage the power of premium on-demand content.

Iflix is Southeast Asia's leading entertainment service with the widest and most compelling selection of TV shows, movies, hyper local originals, premium live sports and up-to-the minute news from around the world, to stream or download, on any internet connected device wherever, whenever. [Iflix]

Google Ties Up With Prasar Bharati to Digitise AIR & Doordarshan Archives

World's largest search engine company Google has tied up with Prasar Bharati for live coverage on YouTube & Google Search for events of national importance such as the National Independence Day and Republic Day telecast. Google will work towards digitising a wealth of content from over two decades from All India Radio and Doordarshan on Google Arts & Culture and host digital archives of Prasar Bharati in over 12 Indian languages on YouTube.

Google India & South Asia Director of Public Policy Chetan Krishnaswamy said, "We are delighted to collaborate with Prasar Bharati in promoting their library of rich content, as well as promoting Indian events of national importance to the internet users across the world. With this collaboration, we are hoping to bring the best of Prasar Bharati's broadcast programming to digital users across age groups, in varied languages and topics that are integral to India's rich history and culture.

Prasar Bharati CEO Shashi Shekhar said, "The partnership between Prasar Bharati & Google has been instrumental in bringing the content of national interest on the digital platform to a range of audiences globally. Some of these events include Independence Day, Republic Day, General

Election etc. The partnership has also played a key role in creating mindshare for the Public Broadcaster among the young audience who are digitally savvy and are increasingly consuming media through smartphones and other mobile handsets." [SATiTV.COM]

Signal TV expands playout capabilities with Imagine

Signal TV has expanded its playout capacity using the fully integrated Versio modular playout solution from Imagine Communications. The satellite broadcaster airs premium content on both TV and radio to more than two million subscribers across the Philippines and says the new playout system gives it increased scalability and speed to market with a future-proofed, software-based solution.

Imagine worked with systems integrator Composite Technology on the geo-dispersed Versio solution, which expands the system to 4+1 channels, providing redundancy on every channel. The channels have the capability of live broadcasting, switching via Signal's existing Platinum VX router. The ADC automation system is designed to offer flexible and efficient operations across workflows.

Content is stored on an Imagine Versio IOX SAN online storage system, connected to the Versio array over 10 gigabit fibre ethernet. The Versio software also provides the broadcast graphics, and a Nexio Motion workflow engine provides content management. Imagine and Composite Technology delivered the project as a turnkey supply. [Rapid TV News]

Astro Partners With Broadpeak to Strengthen OTT Delivery

Broadpeak, a leading provider of content delivery network (CDN) and video streaming solutions, is working with Astro Malaysia Holdings ("Astro"), Malaysia's leading content and consumer company, to strengthen the latter's OTT video delivery service through its multicast ABR solution. Broadpeak's multicast ABR technology will provide Astro with a cost-effective solution for OTT delivery, enabling the operator to distribute live and catch-up TV to public venues, as well as consumers and businesses, guaranteeing an exceptional experience.

Astro is using Broadpeak's multicast ABR satellite solution to distribute 20 MPEG-DASH live channels for Android TVs, iOS and Android tablets and smartphones. The complete Broadpeak solution includes a BkE200 transcaster server, BkA100 analytics, BkS350 origin and packager servers, and nanoCDN™ technology. Broadpeak also played the role of system integrator in this project, coordinating with

third-party project stakeholders, including Viaccess-Orca, Neotion, and Datacom, to assure a seamless deployment.

With Broadpeak's nanoCDN technology Astro can deliver adaptive bitrate formats (i.e., HLS, DASH) to public places where broadband connectivity is limited using satellite, with the quality of DTH broadcast. Utilising Broadpeak's BkA100 analytics solution, Astro can visualise business, streaming, and QoE statistics to optimise the quality of its OTT service. [Multichannel News]

TVBS Puts Trust in Clear-Com for Secure, Flexible IP-Based Communications

TVBS, the Taiwanese commercial broadcaster, has installed a complete Clear-Com system for all of its wired and wireless communication requirements in its Taipei City headquarters and on location. The newly upgraded system enables the broadcaster to take advantage of the latest technologies including IP, and to easily integrate additional third party equipment. Having used Clear-Com Matrix Plus 3 system for over 10 years, TVBS' existing combined wired and wireless system had reached the end of its useful life, though it has been retained as a back-up system.

The new solution is based around a Clear-Com Eclipse HX digital matrix which integrates the wireless devices and wired settings simply and securely. V-Series Panels, integrated into the system through IP-enabled LQ Series devices, are multi-language and can display characters horizontally or vertically. TVBS' OB vehicle is equipped with a FreeSpeak II digital wireless intercom solution, directly connected to the Eclipse HX system via an LQ device that integrates the signal and sub-control connection into the same system. FreeSpeak II enables production teams to roam freely while on location and is resistant to 4G interference. The Agent-IC mobile app allows handheld devices to become part of the intercom through Wifi or 4G LTE signals on mobile phones, partially replacing the production teams' walkie-talkies and increasing flexibility of use. Agent-IC also provides administrator test signals, which is helpful for temporary scheduling. [live-production.tv]

Indonesian version of BBC's technology programme Click launches on Kompas TV

For the first time, the BBC's TV definitive global technology guide, Click, has been made available to Indonesian-speaking viewers. Every week, the Indonesian edition of Click will look at the digital developments that improve lives around the world, with special focus on Indonesian talent and innovation. Kompas TV is one of Indonesia's leading news TV channels.

Click also will be available on the BBC News Indonesia YouTube channel and will be streamed live on Indonesian over-the-top platforms such as Iflix and Hooq. In addition to its website, bbc.com/Indonesia, and YouTube channel, BBC News connects with its Indonesian-speaking audiences via Facebook, Instagram and Twitter. BBC News Indonesia radio programmes are available on FM in major cities across Indonesia. The BBC News Indonesia two-minute radio news bulletin for young audiences, Global Newsbeat, is rebroadcast by 64 radio stations.

BBC News Indonesia is part of BBC World Service which delivers news content around the world in English and 41 other language services, on radio, TV and digital. BBC World Service reaches a weekly audience of 319 million. As part of BBC World Service, BBC Learning English teaches English to global audiences. BBC News attracts a weekly global audience of 394m people to its international services including BBC World Service, BBC World News television channel and bbc.com/news. [BBC]

Indian government holds consultation on National Broadcast Policy regulation

India's Ministry of Information and Broadcasting (MIB) has opened talks with members of the India broadcasting and media industry about creating a National Broadcast Policy. The aim of the policy will be to address issues that are challenging the sector, with the aim of promoting more self-regulation, though no timeframe was given, according to Television Post. The deliberations were announced by information and broadcasting minister Prakash Javadekar in the Lok Sabha, the Indian parliament's lower house. The Indian Broadcasting Foundation, the News Broadcasters Association and the Association of Radio Operators for India have all held meetings with government officials according to reports.

MIB had previously announced that it plans to work alongside the Federation of Indian Chambers of Commerce and Industry (FICCI) to develop the National Broadcast Policy. According to a report in the Economic Times (ET), the industry has told MIB that the policy should look to safeguard media freedom while the sector should have a regulator of its own. In its submission, the Indian Broadcasting Foundation reportedly told the ministry that the threat of legal action with punitive damages would lead to a chilling effect on the publication of free and independent news and put undue pressure on journalists, with the industry body calling on the ministry to ensure a "safe environment" for journalists.

Other requests include allowing for a self-regulation code for content production and distribution for OTT video streaming services, the ET reports. It comes as the ministry is also looking at developing a policy or strategy paper for the film industry, which will prepare a broad outline for the industry until 2025. It will consider issues including government incentives, regulation and other issues that might impact the film industry. [IBC]

Media registration opens for the World Radiocommunication Conference 2019 (WRC-19)

The World Radiocommunication Conference 2019 (WRC-19) will take place in Sharm El-Sheikh, Egypt from 28 October to 22 November 2019. Preceding WRC-19, the Radiocommunication Assembly 2019 (RA-19) will be held in the same venue from 21 to 25 October 2019.

The outcomes of the international treaty-making conference (WRC-19) and the RA-19 will have a global impact in the field of communications. Wireless, and especially space-based, connectivity is helping make smart societies a reality across all 17 Sustainable Development Goals (including intelligent transport systems, e-government, tele-education, e-health, e-logistics, smart energy, smart agriculture), in both developed and developing countries, and particularly in rural and remote areas. WRC-19 will facilitate the management of scarce orbit/spectrum resources in the interest of end-users, with global implications for both policy-makers and the industry.

WRC-19 will focus on:

- Reviewing and revising the international regulatory framework for radiocommunications – the Radio Regulations – to reflect the increasing convergence in radio services arising from the rapid evolution of information and communication technologies (ICT).
- The management of scarce radio-frequency spectrum to provide new opportunities for radiocommunication services, including those for maritime and aeronautical transport, as well as for scientific purposes related to the environment, meteorology and climatology, disaster prediction, mitigation and relief.
- The management of satellite orbital slots and associated spectrum resources (Earth stations in motion – ESIM, Non-geostationary fixed-satellite service (FSS) systems and small satellites).
- IMT-2020 and beyond (in marketing terms called 5G - Fifth Generation of Mobile Technologies), High Altitude Platform Systems (HAPS), mobile broadband and other advanced technologies. [ITU News] ■

DIGITAL BROADCASTING Updates



Malaysia's transition to digital TV going forward in stages

Malaysia's transition from analogue to digital television broadcasting will be implemented in stages, the **Minister of Communications and Multimedia, Gobind Singh Deo**, said in August.

He was speaking after a successful pilot transition in Langkawi in July and early August. The island is the first location to fully receive the myFreeview digital TV broadcast, which replaces the analogue transmission.

"The two-week pilot test has run smoothly. The feedback (from viewers) is very useful for us to further improve the transition process," Mr Gobind said.

"So, after evaluating the results of the pilot project in Langkawi, the government is now keen on expanding the transition from analogue to digital TV broadcast to the whole country in stages."

myFreeview is the designated brand for Malaysia's free Digital Terrestrial Television Broadcasting (DTTB) services.

It currently offers 15 TV channels and six radio channels from Radio Television Malaysia, Media Prima, TV Alhijrah and Bernama News Channel, free of charge.

Mr Gobind said the quality of the TV channels offered by the broadcasters involved could also be improved with new content and interactive applications through the adoption of digital technology. (Malay Mail)

ONE Media and Saankhya to deliver ATSC 3.0 over 5G

ONE Media 3.0, a wholly-owned subsidiary of Sinclair Broadcast Group, has announced an agreement with Saankhya

Labs, a developer in wireless systems and cognitive Software Defined Radio (SDR) solutions, to accelerate the development of a Next-Generation Broadcast Offload Platform over 5G cellular network.

The platform, also known as the ATSC3.0, will sit at the heart of the 5G convergence as it enables 4G and 5G wireless operators to offload over-the-top (OTT) and live content dynamically onto "one-to-many" broadcast digital terrestrial transmission (DTT) networks. This will therefore create many "firsts" in DTT technology:

- "Cellularising" broadcast architecture to enable indoor reception of DTT with mobile and portable devices;
- Dramatically improving DTT spectrum utilisation, providing more bits/higher robustness through spectrum reuse;
- Introducing AI-based analytics engines to provision and directly offload traffic from congested 4G/5G networks;
- Providing content delivery networks (CDN) with significant improvement in the streaming experience by moving OTT traffic to the broadcast platform; and
- Enabling hyper-localisation of broadcast content (video/audio services, datacasting, advertising, and emergency alerts).

The 'Direct-to-Mobile' focus of this activity will leverage the one-to-many efficiencies of broadcast in a new topology that can provide high-reliability and large bandwidth solutions, and make them available to the competitive marketplace. Video delivery currently depends on 'best effort' unicast mobile networks, but the consistent quality is essential to building a strong broadcast video network. According to Saankhya Labs, OTT content players and mobile network operators will take full advantage of this unique video delivery solution. Earlier this year, demonstrations of the 5G-related components of the new co-operative network were shown at CES2019, Mobile World Congress Barcelona 2019 and NAB Show 2019. [APB News]

NTT, NTT DOCOMO, and SK TELECOM Join the HEVC Advance Patent Pool

HEVC Advance, an independent licensing administrator, announced that Nippon Telegraph and Telephone Corporation (NTT), NTT DOCOMO Inc. (DOCOMO), and SK TELECOM Co. Ltd. (SK Telecom) have become Licensors in the HEVC Advance HEVC/H.265 Patent Pool License Programme. With these additions, all of NTT's, DOCOMO's, and SK Telecom's HEVC/H.265 standard essential patents are included in the HEVC Advance license, which currently totals over 7000 world-wide patents and counting.

HEVC Advance further announces recent additions to its growing list of Licensees,

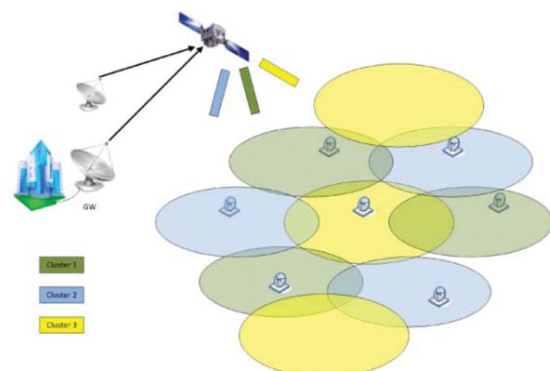
including BenQ Corp., Coship Electronics, Jiuzhou Electric, SDMC Technology, Changhong Network Technologies, Tatung Corp., Sonopress GmbH, Bosch GmbH, Schwaiger GmbH, Avtex Limited, SB Electronics B.V., Razer (Asia-Pacific) Pte., Axis Communications, Genetec Inc., Hitachi Industry & Control Solutions Ltd, DMM.com LLC, Maspro Denkoh Corp., Kumahira Co., Ltd., and Memory-Tech Holding Inc. With these further endorsements of licensing programme and rapidly expanding list of Licensees, HEVC Advance takes another positive step toward achieving its goal of enabling the benefits of HEVC technology to reach all consumers.

HEVC Advance is an independent licensing administrator company formed to lead the development, administration and management of an HEVC/H.265 patent pool for licensing essential patents. HEVC Advance provides a transparent and efficient licensing mechanism for HEVC patented technology. [HEVC Advance]

DVB-S2X extended with Beam Hopping support

The DVB Steering Board approved a revision of the DVB-S2X specification that adds support for Beam Hopping (BH). In multi-beam satellite systems, BH enables efficient and flexible use of satellite resources for applications such as VoIP, cellular backhaul, Internet of Things, maritime and in-flight connectivity and government.

BH works by grouping the cells covering a given territory in clusters; the cells of each cluster are visited by the satellite beam (which can be composed of a single carrier signal, or of multiple carrier signals, even with different symbol rates) in successive illumination periods. The illumination periods may be cyclic and pre-planned or random (i.e. immediately following the traffic demand). Thus, while the "normal" S2X receiver operation mode is continuous, a beam hopping receiver has to operate with "bursty" signals, and this requires the need for a long preamble preceding the useful data payload, to enable receiver (frequency, phase, timing) synchronisation. A post-amble is required as well, to allow the satellite beam to switch from one cell to the next. [DVB]



SMPTE's Latest IMF Plugfest Makes Significant Progress Toward Interoperability

The Society of Motion Picture and Television Engineers, or SMPTE, announced that the SMPTE Interoperable Master Format (IMF) plugfest marked another milestone in the development of the IMF family of international standards (SMPTE ST 2067).

IMF is the family of standards for the exchange of component-based audio-visual masters intended for worldwide distribution – from movies to TV shows to advertisements. The format is specifically designed to efficiently handle multiple-territory distribution and advanced content such as high dynamic range (HDR), wide color gamut (WCG), immersive sound (object-based audio), and access services (subtitles, captions). Organised by the SMPTE Technology Committee 35PM (Media Packaging and Interchange), IMF plugfests provide implementers with opportunities to interchange test content with the objective of improving interoperability and identifying areas of improvement in the standard.

The SMPTE IMF plugfest included the following areas of focus:

- Packaging of World Wide Web Consortium (W3C) Timed Text Markup Language (TTML) Profiles for Internet Media Subtitles and Captions 1.1 (IMSC1.1), which is the subtitle and caption format in IMF that enables worldwide and accessible experiences.
- SMPTE ST 2067-50:2018 (IMF Application #5 ACES), which is intended for long-term archive of uncompressed Academy Color Encoding System (ACES) image essence.
- SMPTE RDD 45:2017 (Registered Disclosure Document IMF Application ProRes), which adds support for ProRes image essence and is intended to test HDR ProRes IMF packages.

- SMPTE TSP 2121-1:2018 (IMF Application DPP), which creates a profile of IMF designed for broadcast and online content use cases, meeting requirements expressed by DPP member companies.

Implementers included Amazon, Dalet, Visible Light, Fraunhofer, Marquise, MTI, Ownzones, Rohde & Schwarz, and Venera Technologies. Test content was provided by Paramount, Universal, Turner, the BBC, and 20 Century Fox. [\[SMPTE\]](#)

ITU incorporates EBU ADM Renderer in NGA standards

The International Telecommunication Union has the EBU ADM Renderer (EAR) at the heart of its new ITU ADM Renderer specification for Next Generation Audio production. The EAR is an open-source production renderer for NGA content that is convertible to any of the established vendor-specific playout systems.

The EAR is a joint effort of multiple public service media R&D centres organised in the EBU Broadcast Technology Futures group and the b<>com institute. Published as Tech 3388 in March 2018, the EAR specification aims to reduce entry barriers for technology providers and content producers by creating a generic path to NGA that defers the choice of vendor-specific standard to the distribution stage.

The document was later submitted to the relevant ITU-R study group, where Dolby and Fraunhofer IIS agreed to work with the EAR team to create a wider common system. The original EAR was then extended with features from Dolby and Fraunhofer IIS with all three elements now forming part of the ITU specification.

Next Generation Audio can deliver fully immersive (360 degree) experiences for cinemas, home theatres and headphones,

with multilingual content and access services, all wrapped up in a single package that is adaptable to any playout scenario. The technology is a departure from channel-based surround sound systems in that it uses metadata to define the positioning of audio components in time and the soundscape. Better compression codecs and the intelligent use of audio material also allow the new technology to deliver a particular service with less bandwidth than older systems. The European Broadcasting Union (EBU) recommends the use of ADM (Audio Definition Model) metadata for Next Generation Audio, and the EBU ADM Renderer is able to natively interpret ADM metadata as specified in ITU-R BS.2076. [\[EBU TECH News\]](#)

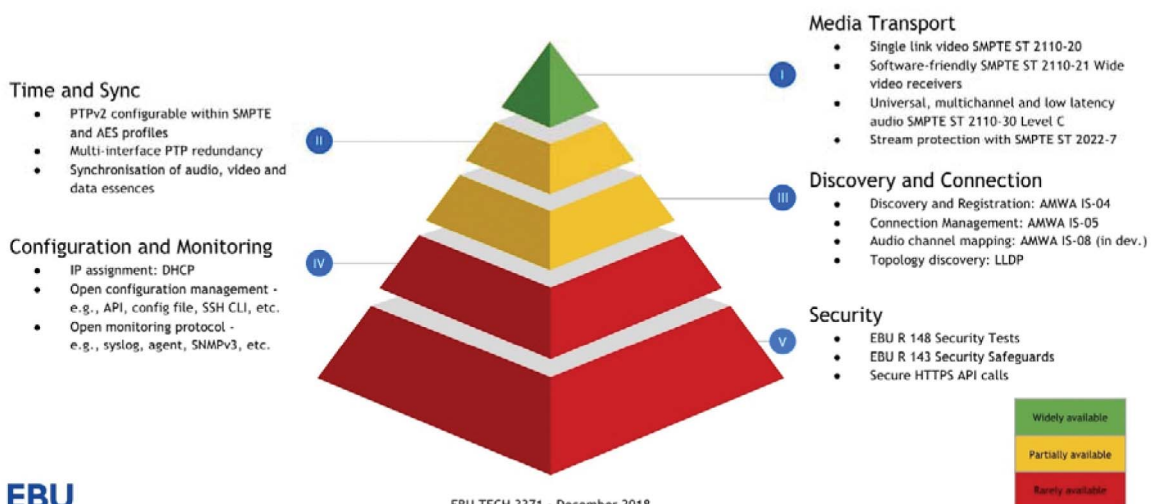
WBU Supports EBU's Technology Pyramid for Media Nodes

The World Broadcasting Unions' (WBU) Technical Committee has unanimously supported the completion of all standards associated with the European Broadcasting Union's (EBU) Technology Pyramid for Media Nodes. SMPTE's ST-2110 suite of standards provides an important first step in broadcasters' migration towards a fully Internet Protocol (IP)-based infrastructure. More work, however, needs to be done to complete and promulgate standards in configuration and monitoring, security, discovery and connection, as well as timing and synchronisation for IP production systems.

"Broadcasters planning the move to new IP production facilities for Television or Radio should engage manufacturers with the Technology Pyramid for Media Nodes and ascertain their degree of compliance," said **Michael McEwen**, Head, WBU Secretariat. "Further, the missing standards need to be completed as soon as possible so that broadcasters can make the important migration to IP with the required assurance." [\[WBU News\]](#) ■

The Technology Pyramid for Media Nodes

Minimum User Requirements to Build and Manage an IP-Based Media Facility.



Equipment Trends



Orban Introduces OPTIMOD 8700iLT FM Processor

Orban, the developer of audio processing solutions, has announced the release of the OPTIMOD 8700iLT FM processor. OPTIMOD 8700i LT is a light version of Orban's flagship audio processor OPTIMOD 8700i. It offers the same versatile five-band and two-band audio processing for both analogue FM transmission and digital media (DAB+/HD Radio/Streaming) as the 8700i.

The OPTIMOD 8700i LT Audio Processor has exclusive features such as the Multipath Mitigator phase corrector which reduces multipath distortion without compromising the stereo separation and the Sub-harmonic Synthesizer which allows to add modern-sounding bass punch to older recordings. It also includes Orban's MX limiter technology which lowers distortion, improves transient punch, and minimises pre-emphasis-induced high frequency loss. Further outstanding features are monitored and alarmed dual redundant power supplies as well as safety bypass relays for carefree 24/7 operation. Of course, a digital MPX output is also available as well as a 10 MHz clock input. [Orban]

New Remote UI for Wheatstone's LXE Audio Console

LXE, the IP audio console for Wheatstone's popular WheatNet-IP audio network, broke new ground as the industry's first re-programmable control surface, and now adds a multi-touch remote UI for multiple operators sharing board duties during fast-paced productions. Remote LXE mirrors the LXE hardware surface as a fully functional and studio-ready user interface, complete with like buttons and knobs as well as familiar navigation and menuing options for setting EQ curves, filtering and other custom settings.

Working in conjunction with the LXE hardware surface, Remote LXE provides complementary production functions for separate operators using an LXE board in the same location or in another location over an IP connection. Real-time fader tracking and live synchronisation of buttons and controls between the virtual surface and the physical LXE board offer an independent, yet shared user experience for multiple operators – or as a tool for engineers to remote in to correct operator setup issues.

The LXE console is known for its advanced flexibility as a reconfigurable,

compact board that is available in one frame or in a split-frame configuration. It can be configured for up to 32 physical motorised faders, with full DSP processing available on each. Physical controls such as buttons and knobs on the console can be user defined using a simple menu interface. LXE is the flagship IP audio console for the WheatNet-IP audio network, a complete IP audio ecosystem of consoles, talent stations, I/O units, accessories and SIP phone and codec distribution appliances.

Remote LXE is one of several new WheatNet-IP additions, adding to the hundreds of software and hardware elements that make up the WheatNet-IP Intelligent Audio Network, any of which can be connected together for any sized operation or purpose. WheatNet-IP is a complete AoIP infrastructure that includes AES67 compatibility. [Content+Technology]

Densitron introduces two new WUXGA HDMI monitors

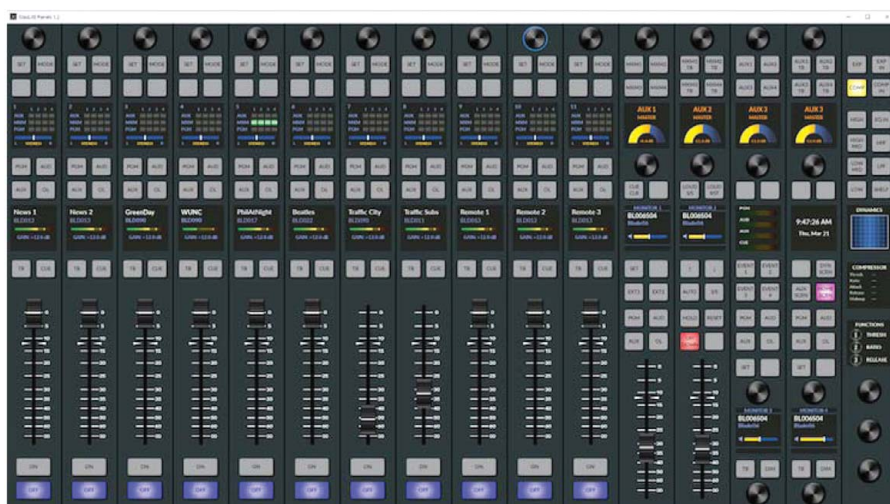
Densitron, the global leader in innovative Human Machine Interaction (HMI) and display technology, introduced 7" and 10.1" WUXGA display monitors for broadcast, control and monitoring, test and measurement, and industrial applications. Both of the monitors feature convenient HDMI connectivity, in-plane switching, high contrast, 1200x1920 resolution, improved colour saturation, a native four-lane MIPI interface, and single VDD power supply.

The 7" version provides peak luminance of 450cd/m2, adjustable brightness, and includes IPS technology that provides 80/80/80/80 symmetric viewing. Similarly, the 10.1" display provides peak luminance of 600cd/m2, adjustable brightness, as well as IPS technology that provides 85/85/85/85 symmetric viewing.

Both models also provide the twin benefits of optical bonding with Projected Capacitive Touch (PCT) as standard. Furthermore, both are designed to operate continuously in "24/7" mode, with a backlight half-life of 50,000 hours, which is approximately five years. [Densitron]

Sony Introduces Simple Live Streaming Camcorders with Free Firmware Upgrade

Sony announces that its palm-sized 4K HDR professional camcorders, HXR-NX80 and PXW-Z90, will receive additional workflow flexibility via a free firmware upgrade. Introducing a new proposition for users to streamline the process of acquiring live content, the camcorders will be enhanced with Simple Live Streaming, providing opportunities for content creators to shoot wherever and however they want.





The Simple Live Streaming ensures that ultimate mobility is achieved. As standalone operations, the easy-to-use camcorders require only Wi-Fi connection without additional gear. The Simple Live Streaming allows users to conduct live streaming and upload onto major video sharing sites and social media platforms in a straightforward manner anytime, anywhere.

Sony has been actively promoting "Simple Live solution" achieved by combining the MCX-500 Multi Camera Live Producer and the RM-30MP remote commander to provide multi-camera basis simple live production. When a user needs to expand the live streaming to multiple camcorder operation, HXR-NX80 and PXW-Z90 camcorders can be connected to MCX-500 via SDI or HDMI providing live stream onto social media platforms with rich live features such as tally, title and transition. The Simple Live Streaming supported by HXR-NX80 and PXW-Z90 offers even simpler operation achieved by single camera, further enhancing the remote delivery of content quickly without compromising on imaging quality.

Well-suited for a range of live applications including events, concerts, seminars, weddings and news reporting, the ultra-lightweight camcorders shoot in any situation with stunning image quality at all times, offering users complete creative control, all thanks to Sony's groundbreaking Fast Hybrid AF system featuring 1.0-type stacked Exmor RS CMOS image sensor. In addition, fixed 29mm wide-angle ZEISS Vario-Sonnar T lens are equipped with 12x optical zoom that can be increased maximum to 18x with Clear Image Zoom maintaining 4K resolution using Super Resolution Technology or 24x in HD. On the audio front, the XLR audio input terminal and microphone holder also add to its operability on top of sound quality and reliability in connection. The free firmware upgrade is planned to be available by the end of 2019. [Sony]

Blackmagic Design Announces DaVinci Resolve 16.1

Blackmagic Design has announced DaVinci Resolve 16.1, a new update to the company's popular edit, color, visual effects and audio post production software that includes major updates to the new cut page to help create the



world's fastest editor. DaVinci Resolve 16.1 public beta is available for download from the Blackmagic Design website.

As the large film studios that use DaVinci Resolve for most of the world's feature films need to get their systems updated before the next programming season starts, this new public beta lets Blackmagic Design continue to develop new ideas without causing delays for the large studios who need a finished and well tested release of DaVinci Resolve. The new features are focused mostly on the new cut page to allow customers to dramatically decrease the total turnaround time for complex work.

Changes in the bin allow customers to place media in various folders and isolate clips from being used when viewing clips in the source tape, sync bin or sync window. Clips will be seen in all folders below the current level and as customers navigate around the levels in the bin, the source tape will reconfigure in real time. There's even a menu for directly selecting folders in a customer's project. An exciting feature to be added in this public beta is the new Smart Indicator. The new cut page in DaVinci Resolve 16 introduced multiple new smart features, which work by estimating where the editor wants to add an edit or transition and then allowing it to be applied without the wasted time of placing in and out points on the exact locations of the clips. DaVinci Resolve 16.1 features are new update allowing editors to improve sorting of media, smart indicator adding UI feedback for intelligent edit features, new cut clip tool allowing instant cutting of clips in the timeline, new button changes on DaVinci Resolve editor keyboard, new sync bin organises and displays sync media for easy shot selection, close up edit mode now includes face recognition to better frame shots, new sync window allows manual syncing of clips, or audio based sync, and multiple other improvements in editing, color, Fusion and Fairlight audio pages. [Blackmagic Design]

GatesAir Integrates Video over IP Support into Intraplex® Ascent Transport Platform

GatesAir, a global leader in wireless, over-the-air content delivery solutions for radio and TV broadcasters, has added a new application to its Intraplex Ascent transport platform to support reliable and secure video over IP transport alongside audio. The new Ascent SRT Gateway will especially be useful for broadcasters managing contributed video and/or audio content for point-to-multipoint distribution.

The application's video support also brings Ascent into the television market, with an exceptional value proposition for national broadcasters feeding many destinations. Ascent will now provide transparent support of any real-time, IP-based broadcast video protocol, with applicability to ATSC 3.0 and DVB-T/T2.

GatesAir introduced Intraplex Ascent as a next-gen Audio over IP platform which represents an evolution in broadcast and IT convergence, and is GatesAir's first Intraplex system to live on a COTS x86 server. Ascent provides broadcasters with a highly scalable, redundant and cloud-based transport platform for multichannel contribution and distribution. Designed for centralised control and maximum interconnectivity, Ascent is compliant with the AES67 standard, today's leading AoIP networking solutions, and most Intraplex Audio over IP codecs.

Ascent offers two key differentiating factors for IP transport: an ability to manage many Secure Reliable Transport (SRT) streams on a centralised platform, and its integration of GatesAir's unique Dynamic Stream Splicing (DSS) software. The latter diversifies SRT data across redundant networks, and adds protection against packet losses and network failures.

The applications can scale to support more streams and more destinations as needed, with video bandwidth speeds



of up to 200 Mb/s at the base level. The core Intraplex Ascent platform is available in two form factors, each of which supports up to 32 audio channels (AES3, AES67, analogue). Ascent adds value to broadcasters by removing the need for many separate codecs and auxiliary hardware components at the originating studio or headend. This streamlined architecture frees multiple equipment racks in enterprise-level facilities, simplifying installation and systems management. [GatesAir]

Ross Video Releases XPression Graphics V9.0

Ross Video has announced the official release of version 9 of the XPression real-time motion graphics platform, which includes over 40 new features ranging from extended font management, enhancements to the data-driven

graphics content tool Datalinq™, and the acquisition of content beginning in traditional desktop design software to controlling playout of multiple XPression graphics engines. When it comes to creating highly efficient workflows for getting content from concept to viewer, XPression is part of the process every step of the process.

The ability to import Adobe Photoshop files and their associated layers helps to more directly realize the vision of an art director who starts the design process on the desktop. With version 9.0, these files can be directly imported into XPression and provide an accurate position on the screen and retain the layer order and grouping designed by the artist.

An all new edition of the XPression Remote Sequencer is also part of

this XPression 9.0 release. The new Remote Sequencer continues to offer a comprehensive linear playout of XPression to be executed using a highly efficient single keystroke workflow. For improved control, however, Remote Sequencer now provides an extended playout control of rundowns at the level of individual channels and Take IDs. The flexibility of direct access to individual Take IDs in the Remote Sequencer has been expanded to enable users to modify Take Items' content and channel assignment directly, before going to air. Seamless integration of the XPression Project Server and Scene Manager allow for new Take Items to be added to the playout sequence at the last second, helping contribute to the success of the production. [Ross Video] ■





- **ABU Broadcast Engineering Excellence Award**

For outstanding contributions in broadcasting engineering and related disciplines.

- **ABU Green Broadcast Engineering Award**

For outstanding contributions in developing, implementing and/or promoting green technology in the broadcasting industry.

- **ABU Engineering Industry Excellence Award**

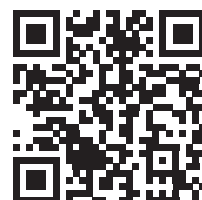
For outstanding engineering contributions made by an individual to the broadcasting industry.

- **ABU Developing Broadcasters' Excellence Award**

For contributions of an outstanding nature in broadcast engineering made by an individual in a developing broadcasting organisation.

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ABU Appoints Website Specialist



Saravana Kuma Ramalingam was appointed Project Manager – Media Streaming and Web Applications on 1 August 2019.

The post is newly created. His role includes developing the new ABU website as well as a new content sharing platform, Asia Pacific View.

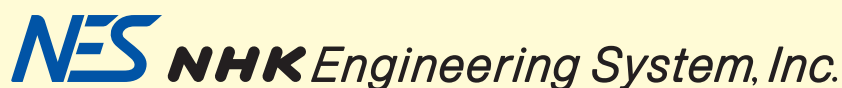
A Malaysian, Saravana has more than 10 years of experience in advertising, content development, media management, broadcasting and branding.

His fields of expertise include web & application development, content development & creative management, and media streaming software. ■



Communication University of China – CUC – Affiliate Member

Founded in 1954, Communication University of China is one of the key universities of the Project 211 under the administration of Ministry of Education. It is a top university in China featuring media education, also comprehensively covering inter-disciplinary courses including film and TV art, information engineering, journalism and communication, management, business, creative arts, information science, economics and law, animation and digital arts and liberal arts.



NHK Engineering Systems – NES, Japan – Affiliate Member

NHK-ES is a general incorporated foundation. Its purpose is to contribute to the development of society and technology by making the technological achievements based on research and development that NHK has made for the advancement of broadcasting available to the public, including industries other than broadcasting. ■

CALENDAR OF EVENTS

9-10 October	ABU-DRM Regional Workshop on Digital Radio 2019	Kuala Lumpur
22-24 October	Regional Workshop on OTT and IBB Technologies & Services	Kuala Lumpur
11-13 November	16th Iran Media Technology Conference	Tehran
13-15 November	Inter BEE 2019	Japan
17 November	ABU Technical Bureau Annual Meeting	Tokyo
18-19 November	ABU Technical Committee Meeting	Tokyo
21-22 November	ABU General Assembly	Tokyo
2-6 December	Training Course on Engineering Fundamentals for Broadcasters	Kuala Lumpur



Atsushi Haruguchi

Honoured with Distinguished Service Award



Mr Atsushi Haruguchi
Senior Executive Officer, NHK Technologies, Inc

The ABU is to confer a Distinguished Service Award on Mr Atsushi Haruguchi, former Deputy Chief of Engineering and Director of the Engineering Administration Department at NHK-Japan.

The award will be presented to him at the ABU Technical Committee Meeting in Tokyo on 18 November.

The award is being bestowed on Mr Haruguchi in recognition of his important contributions to the development of television broadcasting, including the launch of 8K television.

He contributed greatly to the development and installation of the play-out system for radio, terrestrial and satellite television broadcasting at NHK's Engineering Administration Department.

He oversaw the technical planning of the entire department and contributed to promotion activity for the digitalisation of terrestrial television broadcasting in developing countries.



Mr Haruguchi was the Director of the Engineering Administration Department from 2014 and the Deputy Chief of Engineering from 2016, contributing to the launch of the world's first 8K television from December 2018.

He joined NHK in 1981. He has been the Senior Executive Officer of NHK Technologies, Inc. since June 2019. ■





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or visit dbs.abu.org.my