



Asia-Pacific
Broadcasting
Union

Technical *Review*

No.275 July-September 2018

ABU Technical Committee Meetings in Ashgabat, Turkmenistan



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Asia-Pacific Broadcasting Union

TECHNICAL REVIEW

From the Editor's Desk

We are extremely excited that our member TVTM is hosting the annual Technical Committee meeting this year in Ashgabat, Turkmenistan. As part of the General Assembly and Associated meetings, the TC meeting will take place on 1-2 October. The TC meeting schedule along with a brief look at TVTM is included in this issue and we look forward to welcome colleagues who will be joining us in Ashgabat for the meetings.

This issue carries three interesting articles from members. The first one is a look at how technologies like Artificial Intelligence can be used in the broadcast and media environment to automate and increase the speed and efficiency of day-to-day operations. The article titled "AI-Driven Smart Production" contributed by our colleagues from NHK-Japan provides a good insight into one of their projects, how AI is used in image and bigdata analysis to extract useful information from content and how additional data about content can be automatically converted and integrated with media content. The second article with the title "Implementation of IMSC1 Standard for ATSC 3.0 Terrestrial UHD Closed Captioning System", contributed by KBS, presents a new standard for captioning and subtitling for videos based on the TTML (Timed Text Markup Language) standard. The third article contributed by DD-India with the title "Tower'ing Tasks: Criticality in Digitalisation of a Terrestrial Network", talks about the important role towers play in a terrestrial broadcasting network with a special focus on the different types of towers and loading capacity of towers. With digitalisation ongoing among our members and in the region, loading of additional antenna systems to existing towers is one way to move ahead. The article discusses how to calculate loading capacities and methods to strengthen existing towers, and shares similar experience from Doordarshan.

As usual reports on our recent activities and the regular news and digital updates from the industry complete this edition of the Technical Review. We hope our readers will benefit from the articles and information included in this issue.

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.

The ABU Technical Review is published in March, June, September and December of each year.

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Subscription rates (annual, 4 issues): Asia-Pacific US\$40.00; the rest of the world US\$45.00. Advertising and Editorial offices at Kuala Lumpur.

Published by
ABU Technology

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Design & Layout by: **SP-Muda Printing Services Sdn Bhd**
Printed by: **Percetakan Sri Raya Sdn. Bhd**

No 82 & 83, Jalan KIP 9, Taman Perindustrian KIP Kepong, 52200 Kuala Lumpur, Malaysia
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Cover:
*ABU Technical
Committee Meetings
in Ashgabat, Turkmenistan*

AI-Driven Smart Production

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Mr Takahiro Mochizuki, Mr Shoei Sato, Mr Atsushi Imai

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abstract

We have been developing a new broadcasting technology called “AI-Driven Smart Production,” which conveys information to viewers using artificial intelligence (AI) quickly, accurately, and automatically. AI-Driven Smart Production consists of two technical components. The first component uses program production assistance technologies to automatically extract useful information from big data and present it to the program producers. The technologies are social networking service (SNS) data analysis for prompt news gathering, speech recognition for generating closed caption, and image analysis for generating metadata of video footage. The other component uses a technology for automatically converting broadcast data into forms that can be easily understood by all viewers, i.e., sign language computer graphics (CG) animation for the hearing impaired and automatic audio description generation for the visually impaired. Some of these AI-Driven Smart Production technologies are in trials aimed at practical use at broadcasting sites. We expect these technologies to transform the working style of TV and Radio program production and to enhance the abilities of program producers in the broadcasting industry.

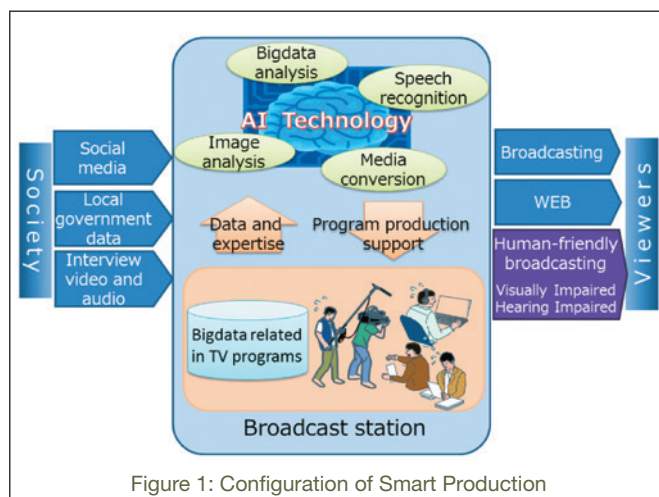
Introduction and Background

Program producers at broadcasting stations create content by filtering video, audio and text data from TV program archives and social media posts relating to their programs. The people involved in program production have had to spend large amount of time collecting, selecting, and editing that data. To create quality programing, the amount of data gathered from archives and social media may be huge, and the demand for higher quality has meant a growing burden on producers to use more data effectively.

To produce a program quickly and accurately, it is vital for there to be technologies to select and edit the needed information, present it according to the theme that the producers have in mind, and provide program production support. Here, technologies resulting from research and development on big data analysis are being put to use in program production.

In particular, NHK is advancing its own research in the use of AI technology to automatically extract useful information for producing programs rapidly and effectively. This technology is called Smart Production. Figure 1 shows an outline of the Smart Production system. The AI technology first analyzes diverse information (video, audio, and text data) obtained from society, then it accurately selects information that would be useful to the program being produced. The media conversion technology is used for human-friendly broadcasting to present the produced program content to visually or hearing impaired.

In this report, we describe big data analysis technology, image analysis technology, and speech recognition technology. In addition, we describe trials of audio description, sign-language CG, and content conversion technologies deployed at a broadcasting station that are intended to fulfill NHK's mission of delivering content to everyone.



Bigdata Analysis

Broadcasting stations create a great deal of content; news programs in particular must convey useful and accurate content to viewers quickly. Here, news program production can benefit from big data analysis technology that automatically sifts through massive amounts of diverse information, identifies the needed information, and presents it to producers. The information sources range from social media posts, reports issued by public organizations, to content archived at the broadcasting station. News programs often pick up social media posts from people who happen to be where an incident occurs and present them as part of breaking news. Producers have to search for and judge the authenticity of such posts, but this requires a lot of manpower.



Figure 2: Social Media Analysis System

We have developed a system that automatically extracts tweets that might be useful for news production from massive amounts of Twitter data¹⁾. The system vectorizes characters appearing in tweets by using a recurrent neural network (RNN) to determine if any useful information for news is included in them. It categorizes information into 23 types, such as “fire” or “accident” – the types of information types often featured in news programs – and then “learns” that categorized information.

Figure 2 shows the interface for the tweet presentation system. The producer checks the information in each tweet identified by the system as potentially useful. By incorporating feedback from the producer, the system can find new learning data and use it to maintain and improve its ability of extracting useful tweet information. In addition, images are often attached to tweets. We are currently researching how to improve the system's classification accuracy with image recognition and analysis so that it can identify relevant events and objects, such a fire or a fire engine, in images.

Image Analysis

Broadcasting stations have archives of past broadcasts containing video footage and other recorded materials. Program producers often search archived information and may reuse archived video footage during program production. It is important for them to have a way to search for video they desire efficiently from among the massive amounts available. The search would be made easier if the video footage included metadata indicating the content information. In this section, we introduce face recognition technology allows the user to identify a specific person who is significant in the video footage for metadata information, and a video summarization system as an application example of using these technologies.

I. Face recognition Technology

Facial images in television programs frequently vary in terms of their illumination conditions, facing direction, and expressions. This makes it difficult to accurately detect a person and recognize who he or she is. Our research has improved the detection sensitivity and reduced the processing cost of face detection by eliminating the

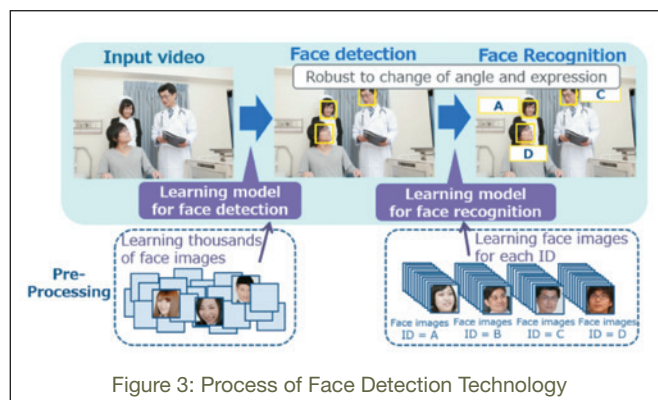


Figure 3: Process of Face Detection Technology

influences of changing face directions and expressions. This is accomplished by taking into consideration the general positional relationship of eyes and nose and by designing a detector that utilizes a decision-tree structure as shown in Figure 3. It can robustly distinguish individual differences by using integrated image features obtained from overlapping small blocks and works well even when the accurate positions of facial points cannot be obtained. This method was used to evaluate actors who frequently appear in NHK dramas. About 500 scenes were searched. The average match rate was 87.6%, about 35% higher than the conventional method. This system has enabled us to more easily identify those scenes where a specific person appears²⁾.

II. Video Summarization Technology

Previews of programs or digest videos are especially important kinds of content, as they are brief introductions to programs. We have been developing a technology that supports the creation of previews and digests (Figure 4).

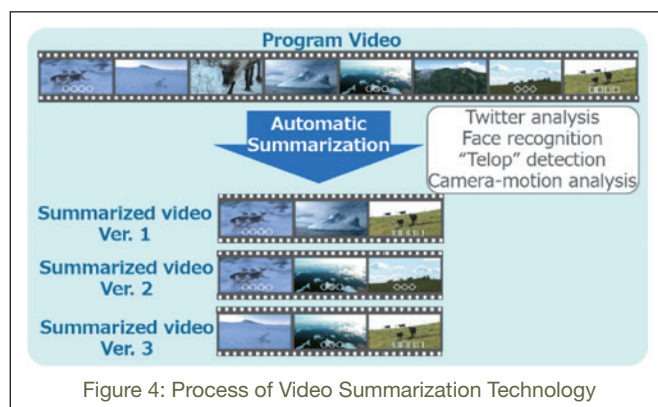


Figure 4: Process of Video Summarization Technology

The technology automatically creates summary videos by extracting important scenes from the program. It identifies characters and performers on the basis of image analysis, telop, and camerawork data. It also analyzes viewer comments on the program, performers, etc., on social media. Furthermore, by allowing program producers to freely weight the importance of the analyzed information, summary videos of various patterns can be automatically generated.

As an application of this technology, we have developed a system that automatically creates a summary images from video footage posted on AI social media. This system works

by applying face recognition technology and technology that identifies buildings or crowds of people. For example, in one broadcast, the system automatically selected images from about 1,400 images of persons, athletes, and media personalities captured on smartphones. It then composed summary images from the ones it selected. During the program, the system produced one “AI edited” image in 2 minutes and 30 seconds and another in 5 minutes.

Speech Recognition

Closed captioning of TV programs is especially useful for elderly and hearing impaired. Here, our research on speech recognition is aimed at means for efficiently producing closed captions for live programs.

We have been developing speech recognition technology that can quickly and accurately produce closed captions in a live broadcast. The accuracy of speech recognition in a TV program declines if there is background noise and inarticulate speech during a conversation. Conventional captioning systems use re-speakers to yield recognition results accurate enough for live captioning. A re-speaker works in a quiet room and rephrases the original noisy or inarticulate speech for the recognizer.

Many local broadcasters, however, cannot afford to employ a re-speaker. Thus, they need a way of automatically recognizing program audio without the need for rephrasing. For the direct recognition of such programs, we adopted deep neural networks (DNNs) to develop an acoustic model that estimates vowels and consonant of input speech in order to increase recognition accuracy.

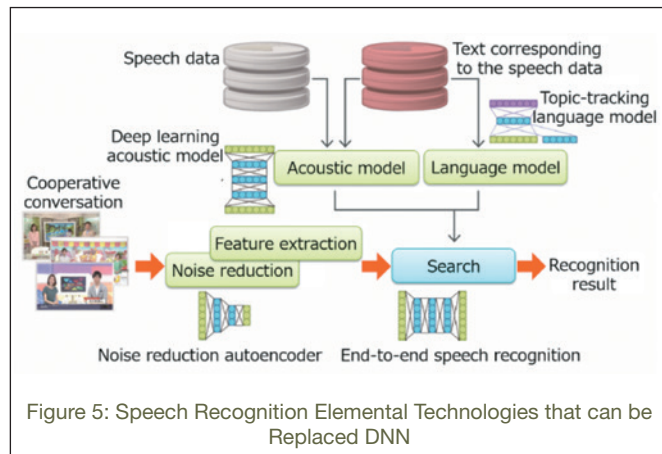


Figure 5: Speech Recognition Elemental Technologies that can be Replaced DNN

Furthermore, to recognize inarticulately or ambiguously pronounced words that cannot be accumulated manually into a pronunciation dictionary of phoneme sequences, we developed a speech recognition technique, called “end-to-end” speech recognition, that does not require a pronunciation dictionary. This technique trains a DNN that maps input speech signal to a symbol sequence (Figure 5).

An experiment conducted on a locally broadcast information program showed that it decreased the rate of miss-recognized words from 35% to 6%. This means we can caption programs by directly recognizing the speech in them³⁾.

Automated Commentaries and Audio Descriptions

Broadcasting stations provide a second sound channel in programs for commentary. For instance, by supplementing the images being shown with the commentary, visually impaired can better understand the program content. However, this second sound channel is currently used only on recorded programs in a limited number of genres such as dramas; it is not available for live broadcasts of sporting events, for instance. Here, as the Tokyo Olympics and Paralympics are fast approaching, we are researching a “barrier free service” that enables automated commentary for live programs to be produced using synthesized speech.

In live broadcasts of sports, player names, scores, elapsed times, rankings, and past scores are displayed along with the game image. However, all data on the screen is not necessarily spoken; that is, the sportscaster does not say or refer to everything appearing on the broadcast screen and often makes comments about things that do not appear on the screen.

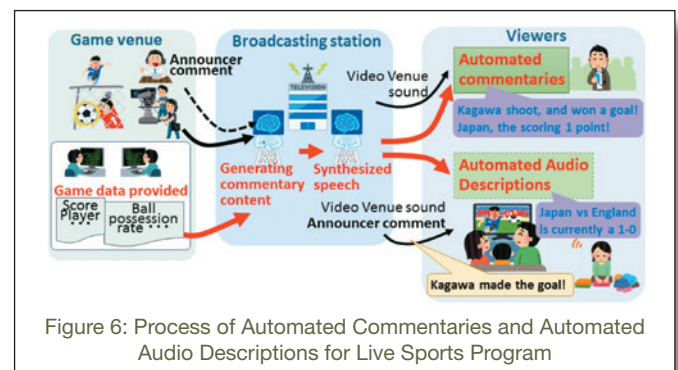


Figure 6: Process of Automated Commentaries and Automated Audio Descriptions for Live Sports Program

We are working on an automated service system called “Automated Commentaries⁴⁾” and “Automated Audio Description⁵⁾” (Figure 6). Automated Commentaries system converts data that is not provided in a broadcast into speech that overlaps with the sportscaster’s voice. Often during a sporting event, the organizers and managers provide game data – data such as “who”, “when” and “what”, including scores, goals, etc., and often in real time to the broadcaster. We use this data to generate a script describing game on-going by using a template that has been prepared in advance. Then we run the script through a voice synthesizer and broadcast the voiced script as an audio description. Although it is difficult to manually generate diverse descriptions, various automatic audio descriptions can be added as needed, even simultaneously, to multiple on-going games in this way.

When combining audio description with TV broadcast speech, it is very important to know how much overlap visually impaired can tolerate. We hence created content including various levels of overlapping audio descriptions and performed a subjective evaluation experiment with it on six visually impaired participants. All six subjects in the experiment said afterwards that despite the overlap, they wanted “Automated Audio Description”.

We will continue research and development of speech generation

technology with the goal of minimizing overlapping audio descriptions in a broadcast and synthesizing speech that can be easily heard even when it overlaps with other speech.

Both automatic audio description and automated commentary services resolve a number of issues such as with the quality of the synthesized speech content. They will be used in a wide range of services for the 2020 Tokyo Olympics.

CG-based Sign Language

People with hearing impairments want information presented in sign language instead of captioned subtitles. Broadcasting stations, however, have trouble finding and hiring sign language interpreters who have enough skill. It is not practical keep interpreters on standby at broadcasting stations all the time for unexpected situations.

To find a solution to this problem, we have been researching and developing sign language CG generation technology to produce weather reports in sign language. This technology is being used, for instance, to produce emergency reports when there is a severe weather event in the middle of the night.

Figure 7 shows the system configuration of the sign language CG system for weather forecasts. The motion data must be prepared in advance. Markers are attached to the arms, fingers and face of the signer and the signer signs words or phrases one by one while optical motion capture software records them and an infrared camera measures the 3D positions of those signs.

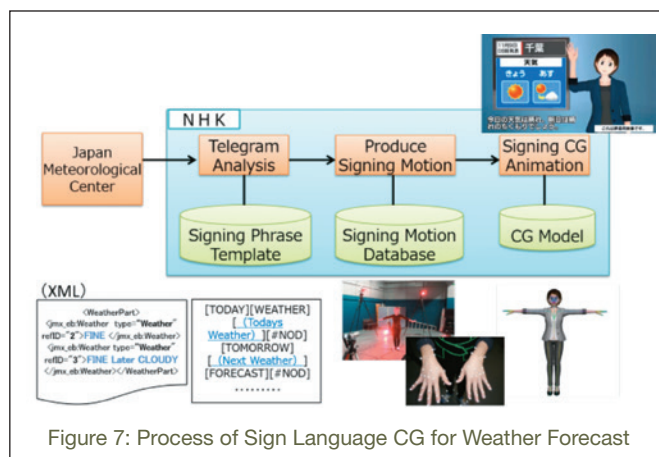


Figure 7: Process of Sign Language CG for Weather Forecast

By connecting the motion data of the signed words and phrases, a CG character animation can be generated for whole sentence of sign language. Sign language CG animation video is automatically generated with the weather forecasting template. In this template, words like “weather”, “temperature”, “precipitation percentage”, etc., XML data regularly sent to broadcaster by the Japan Meteorological Agency are replaced with the sign language⁶⁾⁷⁾.

We conducted an experiment to see if hearing impaired could understand the sign language expressions. The results showed that 96% of the sign language expressions were understood and the sign language information was effective. Currently, the NHK online site shows a page where people can evaluate the sign language CG for weather data. The site automatically updates weather data three times a day and provides weather data by sign language CG.

Conclusion and Future Works

We described “AI-driven smart production” technologies that are being researched and developed and showed how producers are using them in their productions.

By applying big data analysis, image analysis and speech recognition, broadcasters can quickly and efficiently obtain the information they need to produce a program smoothly. We described audio description technology for the visually impaired and the sign language CG generation technology for the hearing impaired. Moreover, integrating these technologies will enable producers to accelerate their productions and make viewer-friendly TV programs more efficiently.

It is expected that not only the use of AI technology in support of program production but also its uses in TV and Radio programs, like AI broadcasters, will increase in the future. We are seeing AI being used in more and more innovative new methods for creating content.

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Broadcasting Technology Research Scheme for ABU 2019

As part of our ABU activities in 2019, NHK is providing the following program for young generation from ABU member broadcasters and organizations to conduct a research at NHK STRL (Science and Technology Research Laboratories; <http://www.nhk.or.jp/strl/index-e.html>) during a period of three (3) to twelve (12) months.

We have the pleasure to announce its application details in the following web site.

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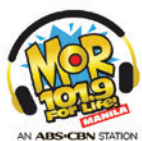
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Implementation of IMSC1 Standard for ATSC 3.0 Terrestrial UHD Closed Captioning System



Mr Yunhyoung Kim
KBS (Korean Broadcasting System), Korea

abstract

IMSC1 (TTML profiles for Internet Media Subtitles and Captions) is a new standard for captioning and subtitling for videos based on TTML (Timed Text Markup Language) standard. The IMSC1 is attractive to the video industry due to its simplicity and functional robustness. It is highly probable that the standard will substitute existing captioning standards such as CEA-708, DVB-TT, or SAMI.

Terrestrial UHD broadcasting in South Korea based on the ATSC3.0 has been airing since May 2017, and the ATSC3.0 standard refers the IMSC1 as a standard for captioning service. We developed the captioning system for terrestrial broadcasting based on IMSC1 standard for the first time in the world.

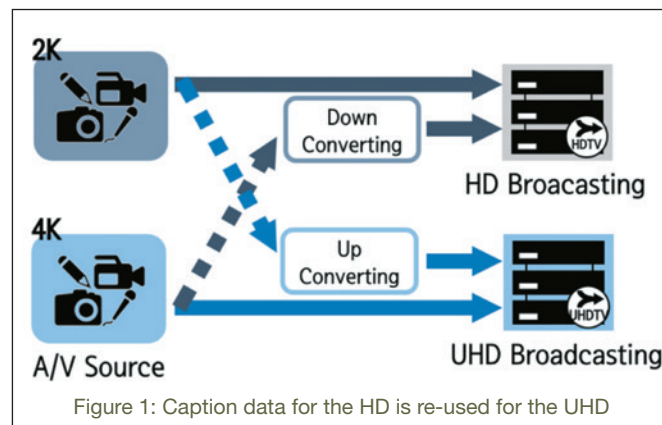
1. Introduction

The IMSC standard[2] is a new standard based on the TTML standard. There are several profiles of the TTML that extend the TTML standard. The SMPTE-TT, which was initially published in 2010, adds more functions such as image support or delivery of additional data. The CFF-TT, developed by Ultraviolet ecosystem, revises the SMPTE-TT to be practically used for the industry. The contributions from those standards are succeeded by the IMSC, which reduces fragmentation by bringing together multiple profiles of the TTML. It is created with worldwide collaborations of the W3C Timed Text Working Group, and targets applications for Internet subtitles and captions. The IMSC1 recommendation is published April 2016, and the IMSC1.1 recommendation is supposed to be published October 2018.

The IMSC standard is becoming popular among video industries. Apple supports IMSC1 standard in HLS, and 21st Century Fox uses it for managing and distributing its video assets. Also, ATSC3.0 standard, which is adopted in South Korea as a standard for the UHD broadcasting, refers IMSC1 as a standard for the closed captioning service[1]. As the usage of IMSC1 increases, it is expected that it would be a next major standard for captioning and subtitling.

In South Korea, UHD TV programs have been on-air since the end of May 2017. The UHD TV standard in Korea is based on ATSC3.0, and South Korea is the first country which developed a full-line ATSC3.0-based broadcasting system, including closed captioning for UHD. Revisions to the laws regarding handicapped services required terrestrial broadcasters to provide closed captions for every TV programs[5], so now all terrestrial TV programs contain

closed captions. Since this regulation also applies to UHD programs, we needed to prepare for UHD closed captions. Since terrestrial UHD programs are exactly the same as terrestrial HD except for their AV qualities, the caption data for the HD programs is also used as a text source for the UHD captions as depicted in Figure 1.



However, the closed caption format between them is different. There remains the need to convert the captioning format. Thus, to implement a closed captioning system for UHD, we developed two new systems, a caption format converter and a caption generator. Details on these developments are described in Section 2. Due to the lack of references on implementation, there are several technical difficulties encountered in implementing IMSC1 closed captioning system. An explanation of the problems and suggested solutions are given in Section 3. Implementation results on commercial TV receivers are given in Section 4. A summary of the results and conclusion is given in Section 5.

2. Development of a UHD Closed Captioning System

Our IMSC1 closed captioning system for the UHD broadcasting is divided into two parts: caption format conversion and caption generation. The closed caption data from the HD broadcasting is converted into captions formatted in IMSC1, and is encapsulated in ATSC3.0 broadcasting packets. Figure 2 shows an overall system.

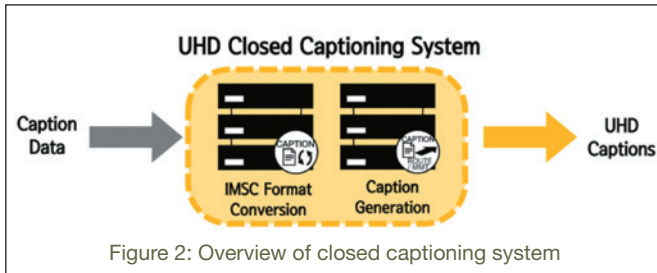


Figure 2: Overview of closed captioning system

2.1 Closed Caption Conversion

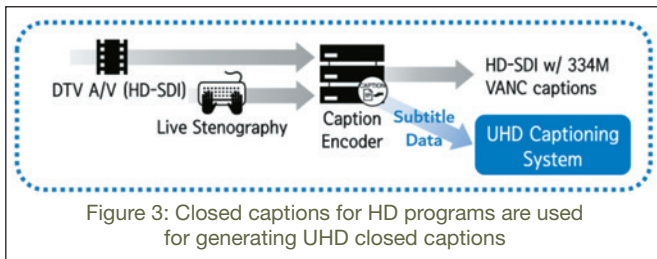


Figure 3: Closed captions for HD programs are used for generating UHD closed captions

Closed captions for the HD programs are generated by live stenography and formatted according to CEA-708[3]. This HD caption data is delivered to the UHD closed captioning system via a SMPTE-333M server to encoder interface (Figure 3). In the closed caption conversion, the caption data from the HD is turned into IMSC1 documents containing the XML-based UHD closed captions. Also, visual attributes for the captions such as regions and style attributes (sizes, colors, alignment and etc.) as well as timing information for captions display are defined. Our system includes editing functions to modify those attributes and specify durations for the captions rendered on the receivers.

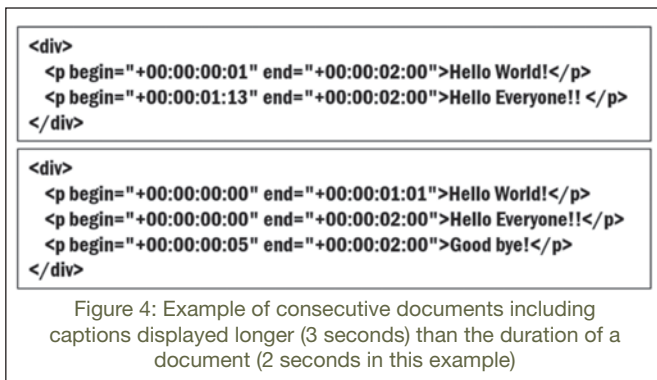


Figure 4: Example of consecutive documents including captions displayed longer (3 seconds) than the duration of a document (2 seconds in this example)

To minimize the response time for a caption to be shown, the document is repeatedly created every fixed period, for example, 2 seconds. Each document should contain exact timing information for captions to be displayed, but in this step, the information is just the duration of a caption to be shown in its period. We designed the exact time for the caption's display to be substituted in next step because the information should be synchronized with the PTP(Precision

Time Protocol) clock time in the UHD broadcasting system, which is not provided in this step.

For a caption to be seen for a longer period exceeding the interval, it must be described again in each consecutive document. The example is shown in Figure 4.

2.2 Caption Generation

In this step, the output from the caption format conversion is transformed into UHD caption service, based on ATSC3.0 transport protocols ROUTE or MMT. Given IMSC1 documents samples at a given interval (e.g. 2 seconds), the packetized caption service stream is generated. Figure 5 shows a process done in the caption generation step.

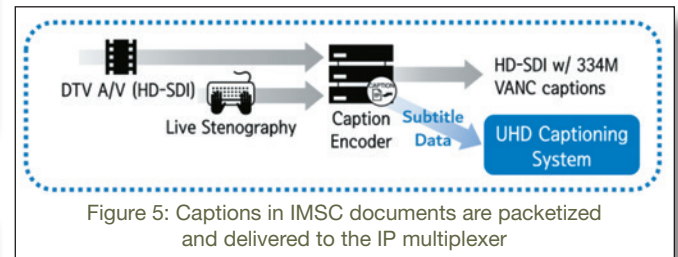


Figure 5: Captions in IMSC documents are packetized and delivered to the IP multiplexer

Exact timing information for the UHD captions displayed on receivers is handled in this step. The display time of the captions in the IMSC1 is calculated based on UTC clock time (Figure 6). As will be explained in detail in Section 3, the transport delay for the captions is reflected in the time information. UHD receivers display captions according to UTC time without any consideration on synchronizing it with other timing information, therefore, it's important to include an optimal transport delay in the system.

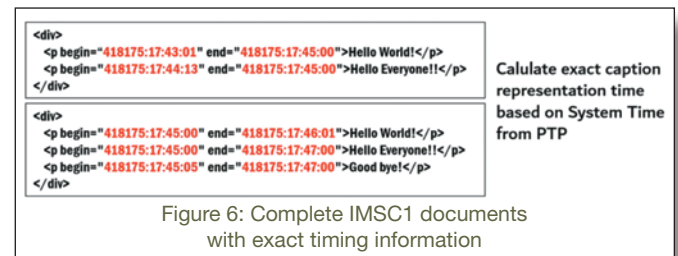


Figure 6: Complete IMSC1 documents with exact timing information

Also, the timing information from the UHD A/V encoder is used to packetize an IMSC1 document. Each transport-layer packet has a media time in its header, and the time value is synchronized with the current time of the encoder. Although this value is not used to render captions in the receiver, it is used to discard caption data packets which are not aligned with the current A/V media.

Figure 7 shows the caption generator in operation.

3. Dealing with Technical Ambiguities

Because there are few references on implementing the IMSC1 captioning system for terrestrial broadcasting, several technical uncertainties needed to be confirmed by broadcasters and commercial television manufacturers in Korea. We describe the ambiguities we found in the standard, and our answers to them.

3.1 Captioning based on Caption Files

In the IMSC1 standard, it is possible to use various time-

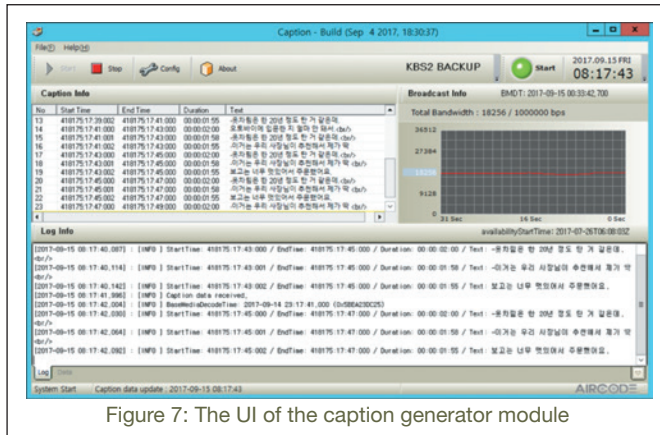


Figure 7: The UI of the caption generator module

bases. However, if the time-base is “media”, the timing information for the captions should be represented relative to the start time of a current media, that is, the start time of a currently on-air TV program. The problem is that it is not easy for UHD receivers to calculate the exact start time. The information may be extracted from the ESG(Electronic Service Guide), but the time described in the ESG would not be accurate. In order to use “media” base time, we need to add the start time of a current program somewhere in UHD broadcasting stream.

Instead of inserting additional information about the start time, we force the time base to be “clock” which is another possible option described in the standard. With the “clock” time base, a clock mode needs to be specified: ‘local’, ‘gps’, or ‘utc’. We chose ‘UTC’ clock mode and set the time value as current UTC time. However, this increases complexity in our system because the exact UTC time should be calculated with consideration of a transport delay.

3.2 Caption Readjustment on Rerun Programs

With the UTC clock mode, the expected presentation time of the captions on the receiver should be used, taking into account the transport delay in the UHD terrestrial network. When an ATSC3.0 broadcasting stream is delivered and decoded, the transport delay should be described and its value should be chosen with care because the receiver presents the media exactly at a time specified in the media stream considering that transport delay. It will not display correctly if the delay is not properly configured.

Therefore, the timing information of the UHD closed captions should also reflect this delay. Different from the A/V stream, the caption stream does not have a separate way to denote the delay, so the delay should be included in the time specified. Since it is hard to calculate the exact time of the delay, it must be determined by trial and error.

3.3 Considerations on Reliability

It is not clear that the time values of “begin” and “end” should contain the whole UTC time, which is defined as a time difference from January 1st 1972 to the current time. This requires using six characters for an hour to indicate the UTC time. In the appendix of the TTML standard[4] “N. Time Expression Semantics(Non-normative)”, there is an alternative permitting UTC time representation with

respect to the most immediately prior midnight, but we cannot do this because it would cause a discontinuity in displaying captions of a UHD program spanned over a midnight. Thus, we specify the whole UTC time to insure UHD receivers will work properly.

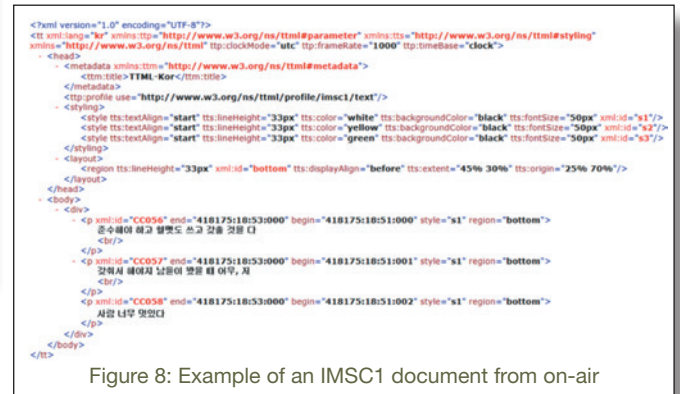


Figure 8: Example of an IMSC1 document from on-air

Figure 8 shows an example IMSC1 document. The time base is “clock”, and the clock mode “utc”. The UHD captions data in <body> consist of three caption lines denoted with <p> element. Timing information is expressed based on the UTC time.

The solution we used is applicable for live stenography, and it would be inappropriate for pre-generated closed captions with relative timing information from the start of a program. The timing information of pre-generated captions needs to be changed with consideration of current UTC time. It would be best in this case if the “media” time base were used. Therefore, a proper entry for “ttp:clockmode:” would be “media” to let receivers know the start time of a program with pre-generated captions.

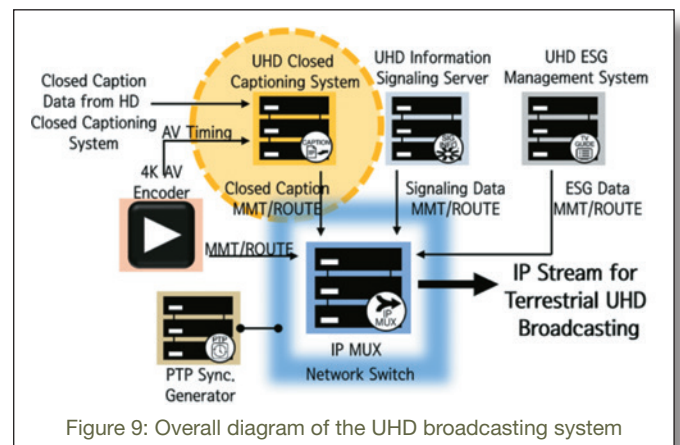


Figure 9: Overall diagram of the UHD broadcasting system

4. Implementation Results

We integrated our caption system into the UHD broadcasting system of KBS. To receive caption data from the legacy caption system in the existing HD broadcasting system, we updated it to transmit the data to the UHD caption system. The UHD caption system is installed inside the dedicated UHD broadcasting system network consisting of A/V encoders, signaling systems, and an IP Multiplexer. The captioning system is synchronized with PTP clock time.

To send the UHD caption data stream, we need to declare it as a service in the SLS (Service Layer Signaling). Figure 10 shows a declaration of the caption service in the ROUTE protocol. The stream is delivered to the IP mux and is integrated into the UHD broadcast stream. Figure 11 shows the profile configuration in the IP Mux. with the caption service stream. The bandwidth of the caption data is approximately 7K~19K bps.

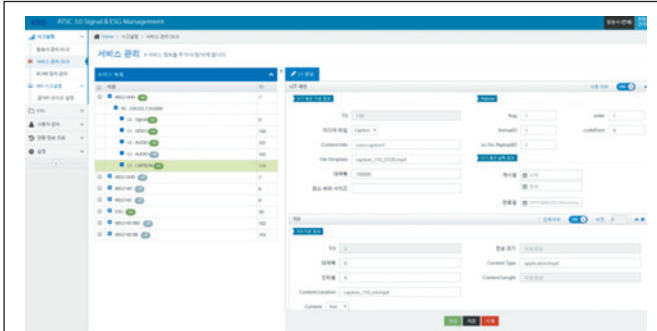


Figure 10: Configuration of the UHD caption service in the UHD broadcasting signal management system

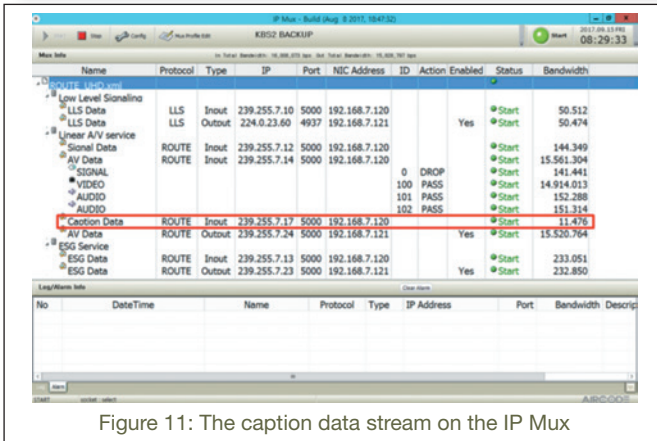


Figure 11: The caption data stream on the IP Mux

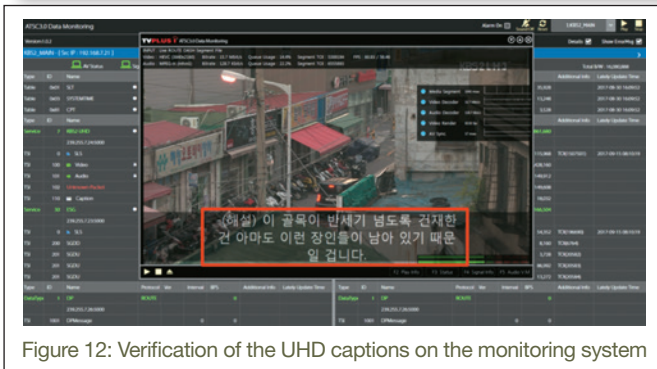


Figure 12: Verification of the UHD captions on the monitoring system

Figure 12 shows the UHD captions decoded and presented on our monitoring system to verify the output stream before broadcasting. The captions in Korean are properly presented inside the red rectangle.

The UHD captions presented on commercial UHD receivers are shown in Figure 13. We check the captions using UHD receivers from two major commercial UHDTV manufacturers in Korea.



Figure 13: UHD captions presented on the commercial UHD receivers

5. Summary and Future Work

We developed a UHD caption system based on the IMSC1 standard, which had been mainly used for the Internet caption services. It is different from the HD caption standard in that it is based on an XML document which enables various visual effects for the captions, and that timing information for each caption is controlled.

Our system consists of two parts: caption conversion and caption generation. The caption data from the HD caption system is transformed into IMSC1 documents, and is packetized into ATSC3.0 service stream. With several conformance tests using commercial UHD receivers, we verified the UHD caption streams from our broadcasting system. The captioning system is currently in operation for UHD broadcasting.

To prepare for a launch of the world-first commercial UHD broadcasting, we had to implement the UHD captioning system as quickly as possible because it is a mandatory television service in Korea. Even though there are many possible service scenarios with the IMSC1 caption standard, such as sending texts with images, animating texts, and decorating texts, we do not fully utilize those features. We plan to provide enhanced caption services with the newly introduced standard.

6. References

- [1] ATSC Standard: Captions and Subtitles (A/343), Advanced Television Systems Committee, December 2016
- [2] "TTML Profiles for Internet Media Subtitles and Captions 1.0 (IMSC1)," W3C, April 2018, <https://www.w3.org/TR/ttml-imsc1.0.1/>
- [3] CEA-708-D: Digital Television(DTV) Closed Captioning, Electronic Industries Alliance, August 2008
- [4] "Timed Text Markup Language 1 (TTML1) (Second Edition)," W3C, September 2013, <https://www.w3.org/TR/ttml1/>
- [5] Disability Discrimination Act Revision 3, Korea Ministry of Government Legislation, <http://www.law.go.kr/IsInfoP.do?IsiSeq=105109&ancYd=20100511&ancNo=10280&efYd=20100511&nwJoYnInfo=N&efGubun=Y&chrClScD=010202#0000>

author

Yunhyoung Kim

KBS (Korean Broadcasting System), Korea

Yunhyoung Kim received his Bachelor of Science in Electrical and Computer Engineering from Sungkyunkwan University in 2004, and Master of Science in computer science from Korea Advanced Institute of Science and Technology (KAIST) in 2007. He is a research engineer in Technical Research Institute at Korean Broadcasting System (KBS) since 2007. He participated in standardizing several DTV standards such as Open Hybrid TV (OHTV; hybrid broadcast broadband TV standard in Korea) and Assistive Services for the Vision and Hearing Impaired. His research interests are an efficient metadata management and a content delivery via both the terrestrial broadcasting network and the Internet. He is also interested in economic analysis of content business as a Ph.D student in Information and Industrial Engineering at Yonsei University since 2014.



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KBS Certification

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- » Conducting various Field Test for manufacturers
- » Free usage of measuring device for development
- » Issuing credible certificates and test reports

The representative of public broadcasting services in Korea.
KBS Broadcasting Equipment Certification Center

Main business of KBS Broadcasting Equipment Certification Center

Broadcasting Equipment Certification, Tests



- Improve performance by testing equipment at the actual broadcasting site of KBS
- Securing reliability of equipment quality through KBS certification
- Issue test certificates required for the broadcasting equipment manufacturer's R&D business.

Free technical support for equipment manufacturers



- Give an idea about developing equipment suitable for broadcasting sites
- Technical consulting support including KBS expert's know-how of developing equipment
- Free use of measuring equipment and facilities

Free Promotions for equipment certified by KBS

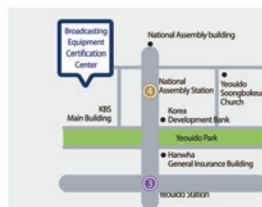


- Promotion at domestic and overseas exhibitions and conferences such as KOBA Show and NAB Show
- Place advertisements on websites and magazines

Provide broadcasting field experience for the industry people



- Give an opportunity to visit the actual broadcast site, experience production and transmission process
- To encourage quality improvement, provide operational highlights and key specifications for each equipment



KBS Broadcasting Equipment Certification Center

4, Gukhoe-daero 62-gil, Yeongdeungpo-gu,
 Seoul, Republic of Korea
 TEL : +82 2 781 5381~7
 Website : <http://office.kbs.co.kr/certi/>

DAB+ provides the backbone for radio's digital future

Broadcasters around the world are launching services on DAB+, attracting new audiences and growing revenues as a result of moving to digital. With over 100 members from 29 countries representing the full digital radio ecosystem, WorldDAB is well placed to help and support broadcasters and regulators in Asia Pacific at every step of the way.

Radio is alive and well, continuing to grow and innovate in the face of dynamic and ever-evolving challenges and competition from the likes of Google, Amazon, Sonos and Apple Music. It remains free and easily accessible across platforms, thanks to its low-cost receivers, robust transmission and high quality, relevant content.

There are now over 2,270 full-time DAB services on-air across 41 countries, with over 470 million people able to receive DAB services. Many of these are targeting niche formats, cultures and languages – allowing broadcasters to attract new advertising partners and expand their audiences.

With increased competition from online services and limited spectrum available on FM, DAB+ in clear Band III spectrum gives broadcasters a cost-effective way to simulcast existing services and offer new digital only stations to attract new listeners, grow revenue and target new markets.

The success of DAB+ was the focus of a packed conference session at Broadcast Asia in June this year – 'Radio's new wave' saw broadcasters discuss how innovation in content & digital platforms is the key to the future of radio. In the face of global competition, local DAB+ broadcasts offer more reliable and more relevant digital content to local audiences in the Asia Pacific.

WorldDAB is the global industry forum for DAB+ digital radio and has been working closely with broadcasters in Thailand, Indonesia and Malaysia to support all aspects of the rollout of DAB+ digital radio. We are available to run workshops, share best practice and work closely with established and emerging markets to help support the development of digital radio regulation and services.

With unique cross industry representation, WorldDAB members include experts from public and commercial broadcasters, regulators and network providers, through to manufacturers of receivers, chips, professional equipment and automobiles.

Our not-for-profit remit allows us to give unbiased advice and WorldDAB works to define and promote DAB by offering support on all aspects of the switch from analogue to digital radio. This includes regulation, licensing, technology trials, network planning and build out, marketing and production of digital radio content.

WorldDAB will be attending the ABU General Assembly later this year and in 2019 at ABU DBS. For more information on DAB+ or how WorldDAB can support your move to digital, please contact projectoffice@worldadab.org





State Committee of Turkmenistan for Television, Radio Broadcasting and Cinematography



The State Committee of Turkmenistan for Television, Radio Broadcasting and Cinematography was created on October 17, 2011, by a decree of the President of Turkmenistan. Previously all TV channels and radio stations came under the aegis of the Ministry of Culture and Broadcasting of Turkmenistan.

The State Committee oversees seven television channels and four radio stations. It covers all events taking place in Turkmenistan with a particular focus on social and economic changes as well as its success and achievements in various spheres of life, emphasizing the history of the Turkmen people. These productions reflect the unique features of the country's historical development and showcase Turkmenistan's national culture including historical monuments which have been entered into UNESCO's list of World Heritage Sites.

The seven specifically themed television channels are:

- Altyn Asyr – Turkmenistan TV – highlights events in the political arena
- Yashlyk – broadcasts programmes for young people
- Miras – produces programmes on historical and cultural themes
- The Turkmenistan TV Channel – broadcasts in seven languages and operates as a news channel
- Turkmen Ovazy – the musical channel
- Ashgabat TV – produces programmes about the capital city and is also a news channel
- Turkmenistan Sport





ABU TECHNICAL BUREAU 2016/2018



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ABU Technical Committee Meeting

1-2 October 2018

Ashgabat, Turkmenistan

PROGRAMME

VENUE: ROOM 3, BANQUET HALL
LEVEL 1, YYLDYZ HOTEL, ASHGABAT

DAY 1 MONDAY, 1 October 2018

09:00 – 10:30

1. Opening Session

Welcome Address

Mr Masakazu Iwaki

Chairman, ABU Technical Committee, Deputy Director, Science & Technology Research Laboratories (STRL), NHK-Japan

Welcome Address

TVTM-Turkmenistan

Opening Address

Dr Javad Mottaghi

Secretary-General, ABU

ABU ENGINEERING AWARDS 2018

Announcement and Presentation of 2018 ABU Engineering Awards and Technical Review Prizes

Technical Review Prizes – Commended & Best Articles

Presented by

Mr Hamid D Nayeri

Director, International Technical Affairs, IRIB-Iran, Panel Chairman, ABU Engineering Industry Excellence & Green Broadcast Engineering Award

ABU Green Broadcast Engineering Award

Presented by

Mr Aale Raza

Director, Whiteways Systems Pte Ltd

ABU Engineering Industry Excellence Award

Presented by

Mr Chuck W Kelly

Regional Sales Manager Asia/Pacific, Nautel

ABU Broadcast Engineering Excellence Award

Presented by

Mr Masakazu Iwaki

Chairman, ABU Technical Committee, Deputy Director, Science & Technology Research Laboratories (STRL), NHK-Japan

Panel Chairman, Broadcast Excellence & Developing Broadcasters' Awards

Industry Keynote:

Special Invitee from the Broadcast Industry

10:30 – 11:00

Tea, coffee & networking

11:00 – 12:30

Session Chair:**Mr Masakazu Iwaki**

Chairman, ABU Technical Committee

2. Confirm Agenda and TC-2017 Proceedings and appointment of Rapporteurs**3. ABU Technology Activity Report****4. Bureau Proposals (Introduction)****5. Industry Updates and Developments****Session Chair:****Mr Masakazu Iwaki**

Chairman, ABU Technical Committee

5.1 DVB Updates**Dr Peter Siebert**, Executive Director, DVB Project Office, DVB**5.2 Technical Issues for Expanding Terrestrial UHD Broadcasting****Mr Haeng Un Jung**, Head of Transmission Planning Department, Korean Broadcasting System**5.3 Digital Radio Update****Mr Lindsay Cornell**, Principal Systems Architect, BBC Digital

12:30 – 14:00

Networking lunch

14:00 – 15:30

6. Future Strategies**Session Chair:****Dr Kong Bin**

Vice Chairman, ABU Technical Committee, and Operation Director/Senior Engineer, Academy of Broadcasting Planning, SAPPRFT, PRC

6.1 The coming revolution in Virtual set/AR/VR production with the real-time 3D gaming engines**Mr Aale Raza**, Director, Whiteways Systems**6.2 WRC-19 Preparations****6.3 Topic****Mr Charles W Kelly Jr**, Regional Sales Manager Asia/Pacific, Nautel, Canada

15:30 – 16:00

Tea, coffee & networking

16:00 – 17:00

7. Members' Present – Digital Implementation and Migration**Session Chair:****Mr Tharaka Mohotty**

Vice-Chairman, ABU Technical Committee and MTV-Sri Lanka

7.1 Digital Switch Over in Thailand**Mr Kachan Kannika**, Director, Engineering Support and Development Bureau, National Broadcasting Services of Thailand (NBT-Thailand)**7.2 Digital Migration Roadmap****Mr Nguyen Duc Tue**, Deputy Director, Technical Centre, Vietnam Television (VTV-Vietnam)**7.3 Looking back at the Digital Transition and Looking Forward to the New Era, UHD****Ms HONG, Young-Kyung**, Senior Manager, Technology Management and ABU Technical Liaison Officer, Korean Broadcasting System**7.4 Digital Migration Status**

TVTM Turkmenistan

DAY 2 Tuesday, 2 October 2018

09:00 – 10:30

8. Summary from Topic Area Chairmen**Session Chair:****Dr Kong Bin,**

Vice Chairman, ABU Technical Committee, and Operation Director/Senior Engineer, Academy of Broadcasting Planning, SAPPRFT, PRC

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**Session Chair:****Mr Masakazu Iwaki,** Chairman, ABU Technical Committee**9. Bureau Proposals (Final Reading)**

10:30 – 11:00

Tea, coffee & networking

11:00 – 12:30

10. TC ELECTIONS

12:30 – 14:00

Networking lunch

14:00 – 15:00

11. Technology Panel**Theme:** Cyber Security and Big Data in Media**Panel Discussion**

15:00 – 16:00

12. Updates from Status Reports**13. Useful to know**

13.1 New members

13.2 Updates from Sister Unions & Intl Organisations

AIBD, ASBU, EBU, WorldDAB, DRM, DVB, IABM, NABA, ITU, etc.

14. Any other matters**14.1 Announcements of Upcoming ABU Events****ABU Digital Broadcasting Symposium, Kuala Lumpur, 4-7 March 2019**

ABU Technology

ABU Media Summit on Climate Change and DRR

25-26 April 2019, Kathmandu, Nepal

NTV-Nepal

NHK Broadcasting Technology Research for ABU 2019**Mr Akira Negishi,** Senior Manager, NHK World Department, NHK-Japan**14.2 Appointment of Honorary Vice-Chairman from the host of the 2019 ABU General Assembly.****14.3 Welcome to ABU TC & GA 2019 Tokyo****15. Closing**

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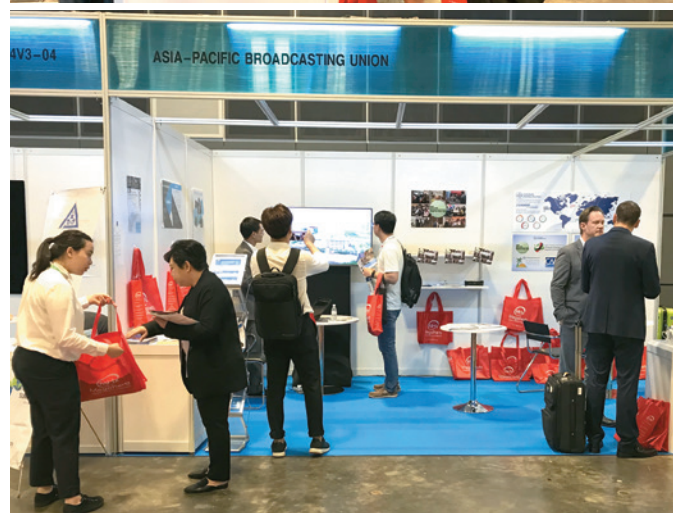


The BroadcastAsia 2018 exhibition and international conference, part of and under the new brand ConnectTechAsia event, was held on 26-28 June 2018. The ConnectTechAsia in addition to BroadcastAsia encompassed 2 other focused events CommunicAsia and NXTAsia. The event as a whole attracted over 40,000 attendees from 96 countries.

The biggest attraction of the event was the industry exhibition. Across two venues it included 1,800 exhibitors from 52 countries, including 40 international group pavilions and four technology-dedicated zones and other activities. The 3-day exhibition showcased state of the art technologies and developments across the communications, IT and broadcasting industries.

The other attraction at the Broadcast Asia show was the International Conference, which was the BroadcastMedia Track as part of the new ConnectTechAsia Summit. The conference topics covered the latest innovations in cloud technologies, AI, VR and AR applications, 5G, IP in broadcasting and OTT among others.

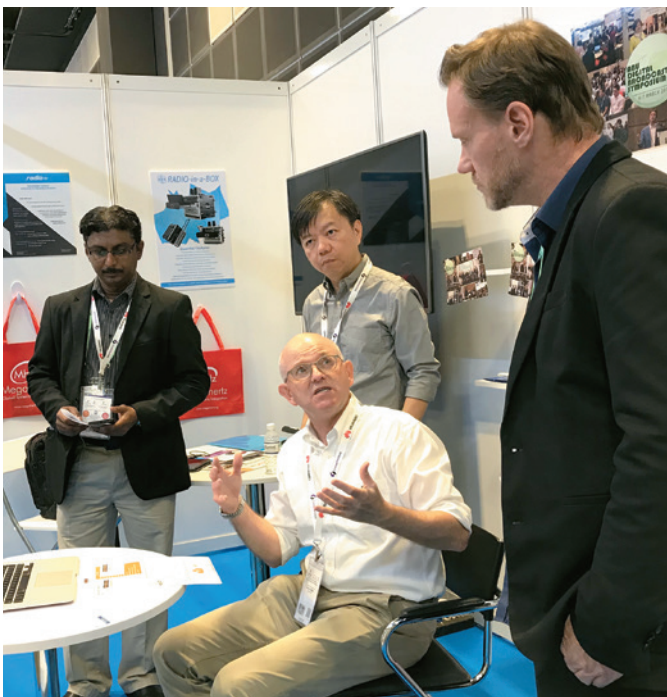
The conference was presented in two tracks, the BroadcastMedia Technology track and the BroadcastMedia Commercial track. The technology track focused on new and advanced technological solutions that the industry has to offer. These included topics such as the move to IP technology in production environment, enhancing user experience with the use of 4K UHD for higher resolution and quality in video and audio together with high dynamic range and higher frame rates for better and smoother pictures and next-gen technologies like the use of Artificial Intelligence (AI) in broadcasting applications.





The Commercial track focused more on the application of technologies like OTT and IBB and strategies for generating revenue. It included case studies on business strategies and opportunities advancing technologies can offer. The conference sessions were well attended by broadcasters, media players and technology enthusiasts.

The ABU was well represented through its stand at the show. The ABU booth showcased some of the projects and success stories by members through video clips and other promotional material on new programmes and projects currently in place within their organisations, including channel promos. As usual the stand provided information posters and flyers on upcoming activities and events. The booth was visited by many of the ABU members who joined the BroadcastAsia event this year.



ABU holds Innovation Metric-based Workshop

The ABU along with two Canadian consultants led by Dr. Sorin Cohn, Founder & CEO, c-IM&E Inc. & BD Consulting Inc., conducted an Innovation Metric-based workshop at the ABU headquarters in Kuala Lumpur from 16 to 18 July 2018.

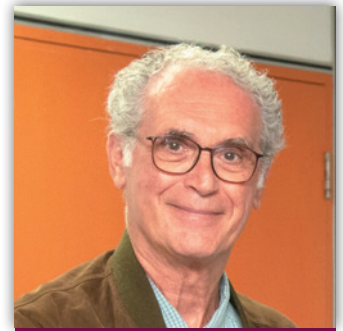
The workshop was a success, grouping participants from various countries in the region, notably from Malaysia, Vietnam, Bangladesh, Bhutan, Maldives and Afghanistan. Twenty-three participants from nine ABU member organisations in seven countries joined the workshop.

Many companies are wasting significant efforts, time and money because they do not nurture a corporate culture of innovation and do not manage their innovation activities comprehensively, competitively and methodically, taking into account market and management realities and using metrics appropriate for their life cycle stages of evolution. Most of the difficulties arise from inconsistent understanding of the innovation market, and lack of measurements to determine specific market realities, prioritising innovation needs and evaluation of the market.

Competitive Value Guide

The competitive value guides are innovation management diagnostics tools that provide a multi-perspective dashboard reflecting the competitive position of a company, a community or an industry sector/region as perceived by the appropriate executive managers. As well, these tools offer standard benchmark assessments of the innovation practices, cultural traits and management alignments that are instrumental for making wise investments and competitively pursuing corporate value growth.

Participants underwent a learning process on how to accelerate company growth, improve its competitiveness



Dr. Sorin Cohn
Founder & CEO, c-IM&E Inc.
& BD Consulting Inc.,

and avoid decline through effective business innovation management based on proven metrics, comprehensive methodologies and effective tools.

- Enhance your organisation's value and your personal reputation as contributor to your company's innovation success in its specific environment.
- Build successful organisations (companies) through





metrics-based engineering methodologies and competitive analyses to determine appropriate innovation strategies and develop winning business models.

- Accelerate a company's growth, avoid decline and enhance its competitiveness through in-depth knowledge and practical applications of advanced innovation management methodologies and tools.
- Nurture methodically a culture of innovation and support effective executive teams that align energising strategies with astute business models and methodical processes to develop, produce and commercialise for success in the market.
- Integrate risk management and HR management policies within the innovation management process for higher return on investments and enhance the effectiveness of an organisation's structure and processes to achieve a higher return on investments in business innovation.
- Contribute to the development of smart communities that are well prepared via business and social innovation programs to attract successful businesses and professionals for better competing in the global world of tomorrow.

Initiate, develop, implement, deploy and evaluate government programs aimed at enhancing industry performance and employment through astute policies and metrics-managed programs supporting business and social innovation.

Innovation Management Training

Can one *innovate* innovation? While innovation in firms/organisations has been the key contributor to enhanced



competitiveness and economic growth, it has become lately a buzzword. Its indiscriminate use has created a fog that hides confusion and inaction behind all the talk about innovation. Too many people still think of innovation narrowly in terms of R&D and/or have not grasped yet the fact that services constitute the larger part of what's going on in industry, including within manufacturing companies.

Our answer to the question above is an unqualified "yes". Companies of all sizes and in all sectors can use the knowledge of firm-level innovation management. Firms can benefit from the most up to date techniques and tools to direct and drive their innovation activities to where and how the greatest value can be reaped in support of their own business goals and innovation strategies.

Innovation should not be considered and treated as a goal in itself, but as the means to the goal; i.e. the relevance, competitiveness and success of the organisation.

Companies of all sizes and in all sectors can profit by learning and applying effective methodologies for metrics-based firm-level innovation management using up to date techniques and tools to direct and drive their innovation activities to where and how the greatest value can be reaped in support of their own business goals and innovation strategies.

Decision-making is critical because resources are limited and opportunities for innovation may be numerous. First, it is necessary to decide **where** to innovate and then to select what to innovate. Then one needs to plan on **who** and **how** to pursue the innovation. The latter involve the necessity for evaluating the progress of innovation, which implies the what and how to measure it. There are also decisions on **who** and **how** to reward, as well as **where** and **when** to go next.

Traditional emphasis on R&D and technology has not allowed sufficient attention to other critical areas of competitiveness in the market – business models and competitive strategies, financial capabilities, commercial processes, as well as entrepreneurial, cultural and organisational aspects of leadership.

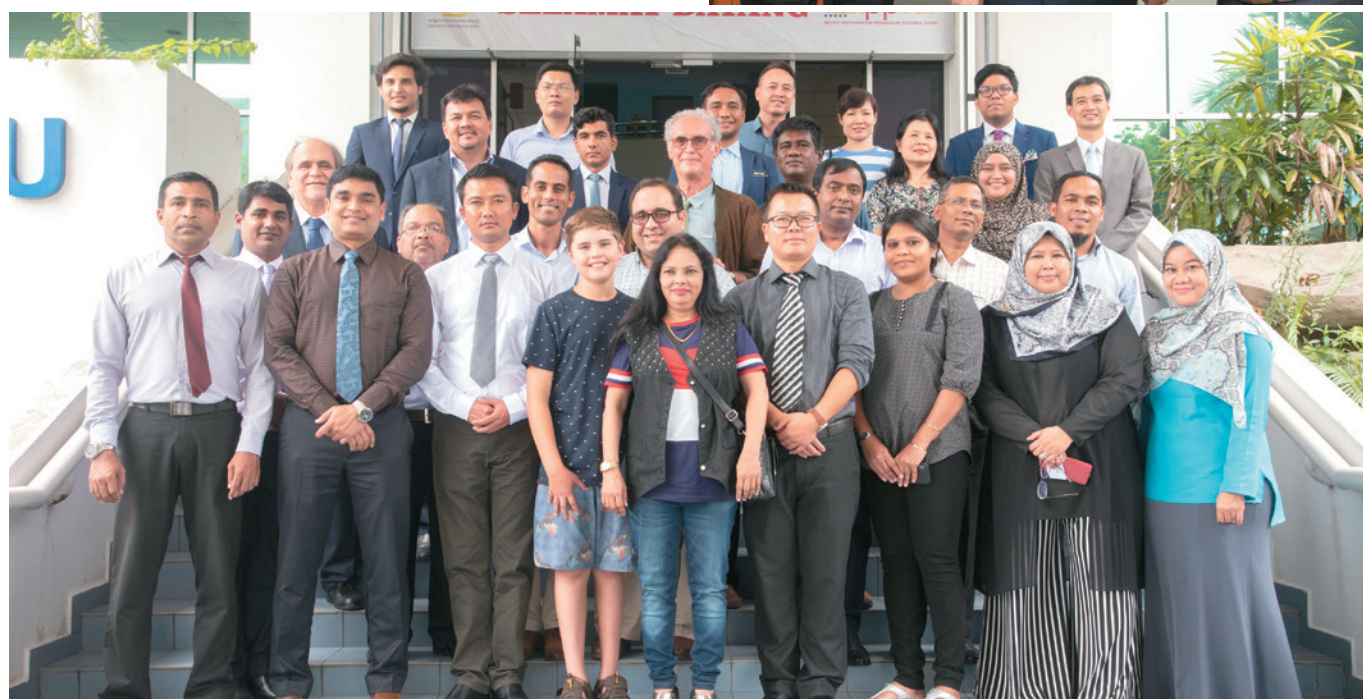
The training addresses the key steps necessary to achieve effective firm-level management of innovation. This is done methodically by:

- Understanding what business innovation is all about.
- Showing leadership by enunciating a clear and energising vision, by determining and pursuing manageable business goals; and by instilling a competitive will to win throughout the company.
- Having an in-depth and up to date knowledge of the market, of the firm and of the competition.
- Ensuring a corporate-wide consistent adoption of a comprehensive framework for innovation management and an appropriate mix of business models for attractive market position.
- Directing innovation to focus on reality-anchored competitive imperatives; and by selecting innovation strategies and priority innovation targets that can lead to tangible market performance.
- Securing the necessary funding for innovation, with proper understanding of the language of investors and the key areas of importance when requesting new funding.
- Acquiring the resources necessary and sufficient for success: the people with necessary expertise and innovation skills, the organisational structures, the infrastructure and technical resources, plus the funding to cover them.
- Balancing innovation reward and risk: learning how to value innovation projects and associating them with appropriate risk management attention to reassure investors – internal or external.
- Understanding the need and how to select and manage effective collaborations and partnerships, because few companies can afford to own all necessary resources and that is why they need to collaborate to conquer.
- Applying a metrics-based management of innovation in a

structured manner using a well-chosen balanced portfolio of metrics.

- Timely evaluating, reviewing and adjusting innovation activities as sine-qua-non steps in the process... and communicating what is being learned through both success and failure.
- Nourishing a corporate culture of innovation/ entrepreneurship aligned with business goals and strategies, including the adjustment of the organisation to best enable effective innovation.
- Finally, companies should take full advantage of their innovation ecosystem in which they participate together with regional and national governments, industry associations, universities and colleges, as well as the variety of private for profit or not-for-profit organisations capable of supporting innovation and interested to serve companies in need of their services.

The training does highlight the use and benefits of advanced management tools and methodologies. It proves and quantifies the benefits of the basic principles for firm-level innovation management by pointing to the key findings of recent comprehensive studies of Canadian industries. Participants also presented their case studies which were analysed and commented on by the lecturers and other participants.





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Multicultural DAB+ Workshop

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Mr Anupon Tajawanno
Paneda



Mr Nils Ahrens
Rohde & Schwarz



Mr Yahya Khaled
ATDI



Mr Aaron Alphonso
Macquarie Media



Mr Alex Ng
Gates-Air



Dr Les Sabel
WorldDAB Technical
Committee



The DAB+ workshop held in Kuala Lumpur, Malaysia from 23-27 July 2018 saw a diverse mix of countries working together to take the next steps in establishing DAB+ digital radio.

The event was jointly organised by the Asia-Pacific Broadcasting Union (ABU), the Asia-Pacific Institute for Broadcast Development (AIBD), the Arab States Broadcasting Union

(ASBU) and the WorldDAB, the global industry body for DAB+ digital radio.

The intensive five-day technical workshop was attended by 35 representatives from 13 countries across Africa, the Middle East, South East Asia and the Pacific and was led by Dr Les Sabel of the WorldDAB Technical Committee.

The workshop covered a wide range of topics over the five days. Day one focused on the DAB+ business case and provided a review of radio's evolution, outlining the many reasons to move forward with DAB+ digital radio. The wide range of features available when using DAB+ were described and demonstrated using local demonstrator equipment and current receivers. The day concluded with a look at the future, and how hybrid digital radio can keep radio relevant and provide both commercial and public service broadcasters with exciting new features.

Day two started with a deep-dive into the structure of the DAB standard and how multiplexing systems are used to ensure high spectral efficiency and cost-effective transmission. This was augmented with presentations from Mr Anupon Tajawanno of Paneda on their head-end solutions. The presentations on the transmission side of DAB were assisted by a detailed presentation on high-efficiency transmitters by Mr Nils Ahrens of Rohde & Schwarz. The delivery of Programme Associated Data such as text and images as well as Service Information was assisted by a presentation provided by All In Media.



Day three saw the focus shift to receivers with emphasis on the broad range available – over 600 models and over 68 million sold to date worldwide. A number of receivers were provided by VQ, Pure and Richter and those were demonstrated along with presentations describing their wide ranges of affordable products. Mr Alex Ng of Gates-Air provided a detailed analysis of why DAB+ is the most cost-effective digital radio standard, as well as highlighting their world leading high efficiency transmission products. After a review of regulation topics, the group then focused on the technical details and theory of RF planning. The final session on day three was the start of the hands-on design exercise where four groups were formed to undertake the task as teams. Their mission was to select a design scenario, which could be based on a specific country or a hypothetical one, and develop a high level rollout plan.



Day four started with a practical RF planning session led by Mr Yahya Khaled of ATDI. He presented some design examples of how to determine RF coverage and how to analyse RF interference situations. This was followed by a session on network architecture and design, providing a wide-ranging overview of the options available and the pros and cons of different architectures with respect to cost, reliability and flexibility. The technical details of DAB+ systems having been supplied the work groups then continued in the afternoon defining their hands-on exercise and moving on





to the development of rollout plans. Day four concluded with a tour of the Radio Television Malaysia studios, showing that broadcasting in Malaysia is moving forward and continues to evolve with new facilities being constructed and state-of-the-art infrastructure planned.



On day five the group was addressed by Mr Aaron Alphonso, the CTO of Macquarie Media in Australia. He shared his experience of rolling out DAB+ in Australia from the technology and transmission perspective, but importantly also how the internal studio operations of radio stations needs to evolve to be able to provide multi-faceted multimedia content to ever more demanding audiences. This provided the delegates with an additional perspective to complete their design exercises.

The design teams were very multi-cultural and worked well together, nominating a leader and a presenter. The four teams presented wide ranging problems and solutions. Team 1 focused on a specific geographically transmission problem but also looked at how their deployment plan needed to consider service improvements and time to revenue issues. Team 2 looked into the specific issue of planning DAB+ for the populous city of Bandung in Indonesia and included consideration of the existing and likely new services. Team 3 studied the west coast of Malaysia, proposing a SFN transmission architecture to suit both the local programming demands and the geography while Team 4 expanded their problem space to cover the whole of the Malaysian peninsula and issues such as ATV switch-off and operations requirements. All teams presented well and demonstrated their newly found knowledge and design skills in a very professional manner.



The workshop concluded with a session on how to move forward, essentially encapsulating many of the issues that need to be covered across the radio ecosystem when deploying a new technology. Knowledge of the technology is essential, but a successful deployment involves many stakeholders including the government and regulator, all broadcasters including commercial, public service and community, receiver manufacturers and retailers and the automotive industry.



The final session also saw a receiver prize give away and addresses and words of encouragement from Mr. Utpal Mandal, Programme Manager at the AIBD, Dr Adnan Salhab, Head of the Technical Department of the ASBU, Dr Les Sabel from the WorldDAB Technical Committee and Mr Chang Jin, Director of the AIBD Pacific Broadcasting Union.



The success of the workshop is great credit to all the team members at WorldDAB, ABU, ASBU and AIBD. The delegates have now returned to their own countries to take the next steps in establishing DAB+ digital radio and enthusiastically taking radio into the 21st century.

WorldDAB is the global industry forum for DAB+ digital radio and is available to help and support all those involved in the rollout of DAB+ digital radio. WorldDAB runs workshops, shares best practice and works closely with established and emerging markets to help support the development of digital radio regulation and services.



Tower'ing Tasks: Criticality in Digitalisation of a Terrestrial Network



Mr M S Duhan
DDG (E), DD India

abstract

Towers are critical constituents in the terrestrial transmission chain of Radio and TV system. Towers have multifarious user and loads should generally be considered at design stage. Load of additional antenna and wind loads on tower and appurtenances are to be analyzed for resultant forces and tower member's capacity. To make any alterations or haul up new DTT Antenna, tower's structural capacity should be determined. The computer software's have provided realistic methods for tower strengthening. This paper provides useful experiences for the organizations that are planning to put additional antenna on their existing towers for digitalization of their network.

TV towers are most vital organ of terrestrial television. Besides their core use of raising transmitting antennas to a high elevation, TV towers can also contribute to the unique identity and cultural heritage of a city. Some TV towers, such as the one at Pitampura Delhi, have the provisions of a restaurant and high viewing gallery. With their colourful lighting, these towers can be given unique appearances to mark special occasions. The towers provide tourists with an opportunity to enjoy views of the city. TV towers are thus assets to the city as well as the organisation. TV towers are highly indeterminate and are subjected to a variety of loading conditions such as cyclones, earthquakes and temperature variations, besides the dead weight of tower itself, together with its appurtenances. Effort should be made to define future loading at the time the tower is initially specified. While some post-construction modification is possible, the ultimate tower capacity is limited by considerations in the initial design. It is also more costly to modify a tower at a future date than to build the capacity into the tower at the time of original construction. The advent of computers has resulted in more rational and realistic methods of structural design of TV towers. Recent advances in optimisation in structural design have also been incorporated into the design of such towers.

Television and radio transmitting towers are among the tallest and most fragile structures built, with some up to 600 m in height. Since the early 1930s, there have been hundreds of tower failures that have resulted in total or partial collapses. Losses can be due to wind loadings, ice formation, earthquakes, lightning, floods, collapses during erection, vandalism, additional loadings without strengthening and structural failures. Other losses can occur when aircraft collide with them. Structural failures are most often related to poor maintenance or overloaded structures. This paper expounds the requirements of tower strengthening and repairs for the hauling up of new DTT Antenna.

Design Considerations

Modern codes and standards require that a transmitting

tower be designed to resist dead and live wind and earthquake loads. Loads, forces, and stresses that result from temperature changes, movements due to differential settlements, or any combination of these should also be considered. Older towers should be carefully checked to ensure that no significant changes in design criteria have been required, since their original design and erection, which would increase the possibility of failure. It is not worthwhile to make any alterations or haul up any additional antenna etc. to a tower unless its structural capacity is established to be sufficient. To determine the tower's structural capacity, the tower design should be analysed using computer programs that model the towers mathematically. Requisite modifications or additions can be quickly and easily analysed with the aid of a computer to determine their effect on the tower by calculating static and dynamic loading effects on the tower.

The numerical methods of structure optimisation, with application of computers, automatically generate a near optimal design in an iterative manner. A finite number of variables have to be established, together with the constraints, relating to these variables. An initial guess-solution is used as the starting point for a systematic search for better designs and the process of search is terminated when certain criteria are satisfied. During the planning stage, careful consideration should be given to the stresses to which individual members and sections of the tower are subjected as the construction progresses. All TV towers support some type of equipment, like antennas, reflectors, microwave dishes. Other items may be attached to a tower. Often a continuous support is designed for the transmission line leading to the tower along with associated cat walks, ladders, and railings. Wind loads, sometimes referred to as "wind pressures" develop as air at some velocity (wind) moves past the members of a tower and its appurtenances, such as guy wires, antenna assemblies, reflectors, RF cables, lighting, anti-climbing devices and climbing and working facilities (platforms). The magnitude of the wind pressure that is developed on a body will depend, among other factors, on the geometrical shape of

its cross section. Besides the material, other design factors includes Risk factor (k_1) for 50 years life, Terrain /height factor (k_2) for mean hourly wind speed and terrain type, Topography factor (k_3) and Gust factor. The tower should maintain a galvanized (dull grey, not shiny) steel finish, painted a neutral colour so as to reduce visual obtrusiveness.

What if Original Design Information is Not Available

Effort should be made to define future loading at the time the tower is initially specified. While some post-construction modification is possible, the ultimate tower capacity is limited by consideration in the initial design. It is also more costly to modify a tower at a future date than to build the capacity into the tower at the time of original construction. The initial design is highly useful for the analysis of tower for additional loads. If the original design is not available, then physical measurements of the tower members should be carried out and new drawings should be prepared. Use of drones for taking video and photographs is a useful mechanism to understand the current status of a tower and develop the design drawings. Thereafter loads of other items like existing antenna and proposed new antenna, RF cables etc. should be considered. If computer modeling is not available, then a fresh program should be written for the tower. It will help during subsequent additions or modifications, which can be inexpensively investigated. A qualified professional tower consultant needs to be engaged.

In the selection of structural members, the designer is guided by his past experience gained from the behaviour of towers tested in the test station or actually in service. At certain critical locations, the structural members are provided with a higher margin of safety, one example being the horizontal members where the slope of the tower changes and the web members of panels are immediately below the neckline.

Physical Inspection

Physical inspection for cracked or broken welds on the base plate and guide flange at the tower junction must be carried out. Any bolts, clamping devices, and other hardware should be checked for tightness and corrosion. Ladders, platforms, and elevators, fixed ladders, rungs, steps, and platforms should be inspected for corrosion, the condition of the paint, tightness of bolts, and cracked or broken welds. The condition of any special safety devices should also be observed and tested according to the manufacturer's recommendation. Tall towers are very often equipped with elevators, the general condition of which should be carefully inspected to assure safe operation. It is recommended that the elevator's cable be checked along its entire length for frays, broken strands, and other signs of wear, along with its cable clips, fittings, and sockets. The cab should ascend and descend smoothly without binding or experiencing any other difficulty. The structure is divided into a number of groups and the analysis is carried out group wise. Then



Figure 1: Typical self-supporting tower base

the member forces are determined. The critical members are found out from each group. From the initial design, the objective function and the constraints are framed.

Foundations

Foundation is the part of structure below plinth level up to the soil. It is in direct contact with the soil and transmits load of super structure to the soil. Dry coarse and well graded dense sand have maximum shear resistance and maximum bearing capacity. In general, submerged soil and clay have less bearing capacity. The condition of the concrete used for the foundations is an important consideration, but unfortunately, the greater portion of these components is underground and cannot be easily inspected. It is, therefore, very important that foundations and guy anchors be properly designed and constructed initially. The design must take cognizance of the geo-technical investigation findings on soil and wind conditions at the installation site for purposes of determining bearing pressures (vertical and horizontal), other sub-surface conditions, the suitable foundation type (*reinforced concrete blocks, open foundation, cast in-situ driven piles, under reamed piles, standard pad and column, raft, preset rock anchors*) construction materials and installation method. In determining the dimensions of the raft, consideration should be given to the pressure distribution under maximum design loads to ensure that tensile forces do not develop under a significant part of the raft area. Column foundations need strengthening in the case of applying additional loads. Widening and strengthening of existing foundations may be carried out by constructing a concrete jacket round the existing footings.

The new jacket should be properly anchored to the existing footing and column neck in order to guarantee proper

transfer of loads. This can be accomplished by drilling holes into the existing concrete of footing and epoxy grouting the longitudinal reinforcement of the jacket. Another method known as **Dynamic Compaction** method used for improving bearing capacity of soil consists of dropping a heavy weight from a considerable height. This method is particularly effective in granular soils. When water is present in the subsoil, it is first drained out before using dynamic compaction method. The imaging of foundation may also be helpful if detailed foundation drawing is not available. Three basic physical forces will be taken into consideration whilst designing tower and masts foundations: **a. Vertical down load b. Base shear c. Uplift load.** The condition of the portions that are exposed and accessible should, however, be checked. Observations should be made to determine whether there has been any differential settlement of the foundations and guy anchors. The top of the foundation will be sloped to drain with a floated finish. Exposed edges of the concrete will be chamfered. To ensure an adequate soil report, be certain the number of borings and the depth of borings are sufficient for the type tower being considered.

Ground Penetrating Radar (GPR)

RADAR (Radio Detection and Ranging) technology is used to perform investigations on reinforced concrete structure to detect reinforcements and defects. GPR is an electromagnetic method and is also known as surface penetrating radar or electromagnetic reflection method. It provides a number of advantages previously unavailable to individuals working in the areas of engineering, environmental management and geology. One advantage is that the scale of features resolvable using GPR can range from a few centimeters to tens or hundreds of meters using the selection of antennas available. Another distinct advantage is the ability of GPR to provide high-resolution continuous profiling of an area. The great majority of radar applications in civil engineering are aimed at the geometrical characterisation of the investigated structure. The simplest application is the detection and 2D-location of buried objects (reinforcements, tension ducts) or interfaces (asphalt-concrete, opposite end of a concrete element). If the velocity of electromagnetic waves is assessed or assumed, it is possible to use radar information to investigate the third dimension (depth of reinforcement, thickness of pavement layers, and thickness of concrete elements). Although the data images of GPR waves are displayed on the screen they still require someone with field experience to interpret them in order to accurately determine the findings.

Wind Speed & Steel Quantity

The quantity of steel for a given height of tower linearly depends on wind speed at a given site. The higher the wind speed the larger will be the quantity requirement for steel for a given tower height & given loads. For example the quantity of steel for a 150 m TV Tower – wind speed 39 m/s, steel quantity will be 188 MT; wind speed 47 m/s, steel quantity will be 233 MT; wind speed 50 m/s, steel quantity will be 255MT.

Guyed or Self-supporting

In most cases, the decision on whether a tower will be guyed or self-supporting will be dictated by the site selected. The decision on type of tower to be used depends on other factors such as, the purpose of the tower (e.g. transmission for AM, FM, or TV); the height of the tower; the size of the property on which it is to be built and the loads to which it will be subjected. As a general rule, above 100 feet high, guyed towers are less expensive. As the height is increased, the differential in price will increase greatly. However, if the desired location is in a downtown or metropolitan area where land is very expensive, it may still make economical sense to consider a self-supporting tower. Guyed tower land requirement guidelines are based on tower height, generally percentage of distance with respect to Tower height, the guy radius = 70%, one side = 125%, other side = 110%. As the guy radius is reduced below 70 percent, the downward pulling force of the guy system is increased as a result of the sharper angle of the guy relative to the structure. This increased downward force will result in the need for a stronger, more expensive tower and a heavier, more expensive guy system. If properly designed, shortening the guy system to 40-50 percent of tower height does not compromise the tower's ability to support the load. However, tower and foundation costs will definitely be greater.

Case Studies

A. Guyed Mast at Jaipur

There is a 100 m guyed mast at hilltop at Jaipur, to raise a VHF antenna of Band III between 77 m to 97 m. This tower has 63 panels, the base width of tower is 2

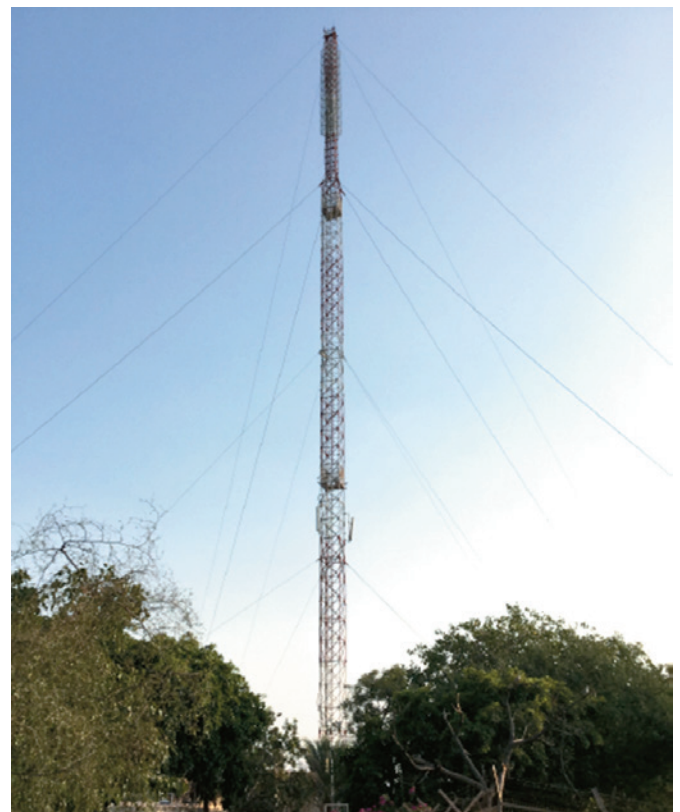


Figure 2: 100m guyed Mast at Jaipur

m (centre to centre) and guys are at 100 m and 74 m anchored at 60 m from tower and guys at 50 m and 26 m anchored at 40 m from the tower. All steel members conform to IS2062 grade A & B having minimum yield stress of 2600 kg/cm² and ultimate tensile strength of 4200 kg/cm². The guys consist of 7/7 steel wire rope having 180 kg/mm² UTS. It was analysed for mounting of additional UHF Antenna for DTT transmitter. This tower was modeled using SAP 200-14 software. The existing 22 mm guy at 100 m has been assumed as 32 mm to take additional loads. A new interface will be needed at 100 m for mounting of UHF antenna. An additional bracing L 50x50x6 mm will be required in panel from 74 m to 76 m height of tower. Further in panels between height 72 m to 74 m horizontal bracing need to be 2L 50 x50 x6. The safe bearing capacity of the soil is 26 t/m² at 2 m depth. The embedment length of the anchor beam inside the concrete foundation is about 1.5 m. The design of the existing foundation, anchor bolts and base plate are O.K.



Figure 3: 150m TV Tower Kodaikanal

B. 150 m High TV Tower at Kodaikanal

The TV tower of lattice type is 150 m high, 30 m base width and has a **square cross-section**. The leg members up to 106.4m height (14 panels from bottom) are made up of built-up box section with 4 plates welded on corners and the remaining panels were made up of solid rod. The TV tower members are made up of box section, solid rod, single angle, back-to-back angles, single channel, back-to-back channels for other panels. The analysis was conducted with the DTT antenna and it was found that **some members in the tower need to be retrofitted for the extra loads**. The existing 150 m high TV tower was designed for the wind loads calculated as per IS: 875-1964 and member design was carried out as per IS: 800-1962. The wind load calculations provided in IS: 875-1964 were based on the force coefficient method which is a static analysis

method. Static analysis was carried out for the dead and wind loads for both normal and diagonal wind conditions by using the STAAD Pro. The wind load is further distinguished as normal and diagonal wind. The governing forces for different tower members are computed from the combined loads. Further the IS: 800-1984 design guidelines are for the working stress method. The basic wind speed was considered as 46 m/s. The details of the deficient member in leg member (**e.g Panel 26** of 1000 mm length) which need to be replaced based on the analysis results is as below: **Compression:** Force 3060.5 kN, capacity of existing member is 2817.1 kN and capacity of proposed one is 3218.5. **Factor of safety** (F.O.S) of existing member is 0.92 and that of proposed one will be 1.052. Similarly for **Tensile force** will be 3040.1 kN, capacity of existing and proposed is 2789.1 kN and 3237.9 kN respectively. The F.O.S of existing and proposed section will be 0.917 and 1.065 respectively. Similarly some other members need to be replaced which have less strength. Tack welding needs to be provided at intermittent places at shop. The sections have to be dip galvanised.

C. 100 M Self-supporting FM Tower

The 100m high FM tower are with the following specifications for All India Radio (AIR):

- 100 m high self-supporting tower with 18m base
- Band II FM antenna 6 arrays over 81 m
- Band II FM antenna 4 arrays (future at 100 m top)
- Microwave dish 2 m diameters at 41 m level

The static analysis is carried out for two load conditions, namely:

- Wind parallel to the face of the tower and
- Wind parallel to the diagonal of the tower

The structural safety of members is ensured if actual stress < allowable stress, where the **actual stress = load/effective area of cross section**.

Allowable stress in tension is = 0.6 f_y and allowable stress in compression is

$$\sigma_a = 0.6 f_y f_{cr} / (f_y^n + f_{cr}^n)^{1/n}$$

$$f_{cr} = \pi^2 E / \lambda^2$$

f_{cr} = yield stress of steel = 250 MPa
 E = 200,000 MPa
 λ = slenderness ratio
 n = 1.4 for steel

Wind load effect on various sections of tower was examined. All members of truss were found to have stress less than the allowable value therefore all members are structurally safe.

Conclusion

The tower is a long-term asset for Radio & TV Broadcasting and needs to be designed considering the various loads including the future requirements, as the towers are to be used for multifarious uses. The design details should be kept in digital mode safely for further analysis if extra load

is to be considered. The design should take care of dead weights, wind loads of various items like Antenna etc. The advancements in computer software have resulted in more rational and realistic methods of structural design of TV towers. Some case studies of guyed and self-supporting towers are useful inputs for the concerned users.

Reference

1. Various Bureau of Indian Standards (IS) Codes
2. Field Experiences & Reports on DD/AIR Tower Strengthening
3. General inputs from various websites.

author

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Sh. M. S. Duhan has over three decades of experience in the broadcasting sector, with a predominant focus on digital terrestrial technologies, eco-system and solution. He brings vision for the system design and maintenance of all broadcasting organs encompassing studios, earth stations and transmitters of AIR and Doordarshan. He possesses degree in Electrical Engineering, MBA and Master of Mass Communication. Sh. Duhan has been a participant in various industry forums, events, Journals and TV talk shows. He is a recipient of numerous honours and awards including "The Best Article" and "Commendable First" awards conferred by ABU and various DD awards.

Sh. Duhan has published many papers/articles on issues related to terrestrial TV, radio transmission and usage of RF spectrum in national and international journals. He has contributed significantly in the system design, network planning and the implementation of DVB-T2 transmitters in India and finalisation of BIS standard for DVB-T2- HDTV STB and IDTV. He is currently posted at O/o ADG (NZ), AIR & DD, New Delhi and is responsible for maintenance of Doordarshan TV Network in North Zone. He is anchoring a new initiative in repair and measurement methodology for TV transmitters.

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WBU Position on C-Band

The World Broadcasting Unions Raises Concern Over the Increasing Interference Issues to C-Band Satellite Frequencies

The World Broadcasting Unions (WBU), a collective group representing the broadcasting unions around the world including the ABU, has warned of the increasing threat to the C-band satellite frequencies which are widely used by broadcasters in the region and around the world. These interferences are mainly caused by other terrestrial and mobile services licensed to operate on adjacent frequencies, but as most countries don't require the receive-only sites for these services to be registered, the operators often have little recourse when such problems are reported. The C-band fixed satellite services are extremely important and sometimes critical for the broadcast industry who extensively rely on these for contribution and distribution of their signals. In view of this difficult situation for broadcasters the WBU, on behalf of all broadcasting unions, has called on regulators and satellite operators around the world to work together to protect the C-Band satellite frequencies.

Background

The World Broadcasting Unions International Media Connectivity Group (WBU-IMCG) Intentional Interference to Satellite Services Working Group (IISS) has drafted the following proposal for a WBU position on C-Band. In producing the proposed position below, the group referenced and updated the 2015 WBU-ISOG (the WBU-IMCG was earlier known as the WBU-ISOG) position on C-Band. Examples of the impact on broadcasters of interference to their C-Band downlinks were invaluable in industry defence of C-Band spectrum at ITU WRC-15.

WBU C-Band Position

WBU members welcome technological change and the benefits it brings to both audiences and broadcasters. At the same time, many tried and tested technologies continue to deliver reliable and efficient services for WBU members. Satellite services have long provided valuable broadcasting services and remain an essential part of often complex broadcast supply chains serving our audiences, both nationally and internationally, for public service and commercial broadcasters.

C-Band FSS downlink frequencies between 3,400-4,200 MHz have been and are extensively used throughout the world by WBU members for Fixed Satellite Services (FSS) applications and will continue to be used for the foreseeable future, in particular above 3,600 MHz. Since FSS downlink sites receive extremely weak signals from satellites in geosynchronous orbit, they are particularly fragile and susceptible to interference. WBU members have experienced serious interference to services where this spectrum has been opened up to other users and, because few countries require these receive-only downlink sites to be licensed or registered, little recourse is available. The WBU encourages our members to register their downlink sites.

WBU members have been and will continue to be highly dependent upon the use of satellite services using C-Band spectrum to 100s of thousands of FSS downlink sites for contribution and distribution. C-Band allows the operation of reliable, efficient and cost effective global and regional contribution/distribution systems and is also ideally suited to delivering media services into rapidly developing regions of the world. The potential allocation of C-band FSS spectrum to Mobile Services will create chaos to the economics of broadcasting by satellite, potentially interrupting services to audiences around the world. Furthermore, C-Band is critical for satellite services in tropical regions as it suffers less from the attenuation effects of heavy rainfall than higher frequency bands.

WBU members therefore call on satellite service providers and government regulators to protect the availability of the upper part of the C-Band spectrum, where the band has been allocated to satellite services and is currently used to provide many broadcasting services, enabling broadcasters around the world to continue to provide vital broadcasting services to billions of people across the world.



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News

from the ABU Region

ESPN and Mediacorp Enter Strategic Digital Collaboration

ESPN and Singapore media company Mediacorp, have joined forces in a strategic digital collaboration to super-serve sports fans and marketers. The agreement combines Mediacorp's multiplatform audience reach and deep commercial relationships with ESPN's global leadership in sports coverage and content. The collaboration is part of Mediacorp Partner Network, an initiative that brings Mediacorp together with world-class partners to deliver a richer experience for consumers and advertisers in Singapore.

Under a multi-year agreement with ESPN, Mediacorp will be the exclusive representative for all ad sales in Singapore for top sports destination ESPN.com. ESPN will launch a dedicated Singapore edition of the signature ESPN site – espn.com.sg – in the coming months. The site will deliver a mix of local sports news and features in addition to unmatched coverage of the most relevant and popular sports and leagues from around the globe. The site will offer a world-class, mobile-first, video-rich platform that will give Singapore sports fans industry-leading coverage of global football, golf, tennis, boxing, MMA, cricket, rugby, NBA, NFL, MLB and more.

(Mediacorp)

The National Broadcasting Services of Thailand Terminates its Analogue Broadcasting Services

The switch, which is accompanied by investment in modern equipment, vastly improves the station's broadcast quality. The termination came after the Office of the National Broadcasting and Telecommunications Commission gave its approval to the station's transition plan to move from analogue to digital services.

The NBT operated on the analogue system for more than three decades. It has been testing its digital system over the past two years while maintaining its analogue services. The station's administration decided that it is ready for full-on digital services and terminated the analogue system on the night of 15 July. Deputy Director-General of the Public Relations Department Dr Charoon Chaisorn and members of the NBT board visited Baiyoke Tower II and personally switched off the outdated system, officially marking the arrival of the station's digital era.

NBT staff also deployed the latest technology and equipment to ensure the highest quality of the station's programmes. The NBT's live broadcasting capacity has also expanded to cover all corners of the Kingdom.

The station's digital programmes can be viewed on modern

televisions. Older TV models can also view its High-Definition content via set-top boxes. Alternatively, Internet users can watch NBT online on its NBT2HD Facebook fan page.

(ThaiNews)

CCTV to Help Botswana Set Up an Agriculture TV Channel

Botswana's agricultural sector has not been performing well due to the fact that Botswana is a semi-arid country, with limited and unpredictable rainfall – harsh climatic conditions worsened by climate change. On his part, Head of Delegation and Director of China Central Television (CCTV-7) Agricultural Programme, Zhao Zekun, said they want to deepen relations between Botswana and China by availing Botswana citizens with information and expertise on agricultural technologies. This he said will ensure that Africans, not just Botswana, have better food.

Mr Zhao and his 21-member delegation that consists of media personnel from CCTV-7, pharmaceutical company representatives, and those from the advertising sector among other potential investors from China attended the Botswana summit after visiting Namibia and South Africa in the same vain. CCTV-7 offered Botswana Television its agricultural content, as showcasing farming in Africa and Asia, with the establishment of the television channel solely focused on agriculture, more advantages are however envisioned for the country.

The CCTV-7 Agricultural Programme runs a daily broadcaster for 8 hours, has 14 agricultural TV columns and its audience coverage reaches 1.3 million. Ranked first in China, CCTV-7 has a history of over 60 years, years of experience that Botswana found itself wanting to benefit and learn from. The interest emanates from the fact that the media is seen as better placed in spreading information on new farming techniques and technology across the world, reaching the rural poor.

(yourbotswana.com)

TRT Helps Turkish Students to Visit 30 Countries

Turkish Radio and Television Corporation (TRT), the Turkish Cooperation and Coordination Agency (TIKA), Turkish Airlines (THY) and Anadolu Agency (AA) have organised the "2018 Experience Sharing Programme".

Some 500 Turkish students will undertake various projects in 30 countries between July 29-September. 8. Students from 117 universities are participating in the programme. The first team which is going to Niger and Jordan spoke to Anadolu Agency prior to their journey. Batuhan Zeki Ozturk, a law student at Selcuk University, said he is excited about going

to Niger. "Instead of going to European countries, I chose to take the opportunity to see our Muslim brothers and sisters in Africa and to understand their life. The spirit in that land is much different. Everyone can go to developed countries, but fewer people go to Africa. So I am very grateful to TIKa for giving such opportunities to young people," he said.

(ABU News)

Globecast Partners with JungoTV – English Content in Indonesia

Globecast has partnered with JungoTV to provide content for 12 English language channels for distribution on Indonesian mobile platform OONA TV, in partnership with Telkom Indonesia. The channels, which bring high-quality content to 135 million in Indonesia, launched on 1 June.

JungoTV is an international media company that specialises in cross-border content, monetisation and digital platforms. It was co-founded by Dr. Mehmet Oz, Emmy Award-Winning television personality. Last year, OONA announced its partnership with Telkom Indonesia to launch OONA into the Indonesian market.

The programming supplied to JungoTV to OONA offers a mix of sports, drama, action and children's shows. The channels include: Kartoon Circus, Kids Central, The Xzone, Sci Fi Dimensions, Sound Emerge, Gaia, ICN, Lifestyle, CCN, Prime Time Drama and Ready Action Set, with JungoTV is providing COMBAT GO. The project expands Globecast's overall channel portfolio to over 130 networks from around the world.

(globecast)

5G Spectrum Auction One Step Closer

The Australian Communications and Media Authority (ACMA) is preparing to auction 125MHz of available spectrum in the 3.6GHz band later this year. In preparation for the auction, the Ministry has directed the ACMA to impose allocation limits of 60MHz in metropolitan areas and 80MHz in regional areas.

These limits account for existing spectrum holdings in the broader 3400–3700MHz band (which is all suitable for 5G), meaning that carriers which already have significant holdings in this band would be limited in the amount of new spectrum they could bid for, or may not be able to participate in the auction.

These allocation limits will allow for a competitive auction process while preventing any one bidder from acquiring an amount of spectrum which could preclude other telcos from rolling out 5G networks. The limits were set following careful consideration of advice from the Australian Competition and Consumer Commission, which consulted with relevant parties.

(C+T)

Freeview FV Reaches 1 Million Downloads

World-first free-to-air TV live streaming app Freeview FV has recorded one million downloads over the past 18 months. The milestone marks a strong uptake of the award-winning app since its launch in 2016, with Freeview cementing its

status as a premiere BVOD (Broadcast Video on Demand) service in Australia.

Freeview CEO Liz Ross said the number of downloads demonstrates the growth of BVOD in Australia, with over 432,000 Freeview users recorded in May across its streaming and catch up programmes, up 25 percent from the same time in 2017.

Holding nine out of the top 15 ranked OTT apps and brands in Australia, free-to-air BVOD brands continue to rise in popularity, with seven million Australians 5 streaming more than two billion minutes of catch up and live streaming content each month, and Freeview alone seeing a growth of over 70 percent in app downloads since June last year.

Available on iOS iPhone, iPad, and Android phones for download through the App Store or Google Play, Freeview FV provides access to live-streaming and catch-up content from 20 channels including: ABC, SBS, Seven, Channel 9, TEN, ONE, ABC COMEDY/ABC KIDS, ABC ME, ABC NEWS, SBS Viceland, NITV, 7TWO, 7Mate, 7Flix, Racing.com, 9Gem, 9Go! ,9Life Extra, One, Eleven, TVSN and Spree TV. More live channels will be added as they become available.

(freeview.com.au)

Astro Radio Makes 'High Stakes' Commitment to Lawo

Installing a third generation of consoles in its radio studios, Kuala Lumpur's Astro Radio has standardised on virtual studio technology from German broadcast manufacturer, Lawo. "We had to re-think how a studio broadcast console should be in a rapidly evolving commercial FM radio industry," said Astro Radio Chief Technology Officer, Bala Murali Subramaney.

Astro began operation in 1996 using a cutting-edge audio routing system and digital broadcast consoles custom manufactured to meet its specific technical requirements. By 2006, greater functionality was required to simplify studio workflows and to allow on-air talent to focus on content.

This success has now taken Astro Radio to its third generation of console for new studios in Kuala Lumpur as, in 2017, the operation acquired two new radio stations and needed space for new on-air studios, producer workstations and equipment room – on top of its existing 13 on-air studios, seven news studios, three voice booths, eight audio production studios and edit suites, and six equipment rooms. Plans for the consoles and routing system were already in hand, when the station relocated to share premises with other Astro company divisions in order to accommodate its expanded studio requirements.

The mixing requirements were all met by Lawo's Virtual Console, whose control surface is software, driven by a multi-touch interface on a high-resolution computer display, and which had been successfully trialled in Astro Radio's newsroom. Without the limitations of physical knobs, buttons and faders, the screen presents users with only relevant controls and information, hiding anything not needed for the task at hand.

(C+T)

Digital Broadcasting Update

DVB Fosters Licensing Programme for DVB-SIS Technology



The DVB Project announces that it is fostering the formation of a licensing programme covering patents essential to the DVB specification “Metadata generation and deterministic DVB-T-megaframe/DVB-T2-MI stream generation from MPEG2 Transport Stream(s) for a DVB Single Illumination System (DVB-SIS)”.

The DVB-SIS technical specification was approved by the DVB Steering Board in February 2018, and subsequently sent for formal standardisation by ETSI.

As part of its policy governing the licensing of patents essential to its specifications, DVB fosters the formation of voluntary licensing programmes (patent pools). It is expected that the patent holders will promptly select a commercial facilitator to take forward the pooling effort. Participation in any licensing programme that develops from this process will be voluntary and non-exclusive.

About DVB-SIS

The Single Illumination System allows for the combination of DVB-T/T2 contribution and DVB-S/S2/S2X distribution in a single satellite beam. Ideally signals used for DTH distribution and DTT contribution would be identical, so that one satellite transponder would be sufficient for both applications. This concept, called Single Illumination, was previously not possible since terrestrial transmitters expect a signal compliant to the DVB-T2 Modulator Interface (T2-MI) specification. This provides the timestamps required to synchronise several transmitters in a Single Frequency Network (SFN). Furthermore, even if the T2-MI signal could easily be derived from the underlying Transport Stream, DTH satellite receivers could not process it.

The DVB-SIS specification, “Metadata generation and deterministic DVB-T-megaframe/DVB-T2-MI stream generation from MPEG2 Transport Stream(s) for a DVB Single Illumination System (DVB-SIS)” resolves this issue by specifying how signals received by all DVB-S/S2/S2X receivers can also simultaneously feed DVB-T/T2 networks.

The specification has been finalised and approved by the DVB Steering Board. It has been published as DVB BlueBook A175 and forwarded for formal standardisation by ETSI (European Telecommunications Standards Institute) as an ETSI Technical Specification.

(DVB)

DAB+ Software Library Upgrade Improves in-vehicle Reception of Digital Radio

With its DAB+ software library, the Fraunhofer Institute for Integrated Circuits IIS offers a software defined radio solution that enables the implementation of digital radios with DAB+ (Digital Audio Broadcasting) functionality. Available now, the update to the established library uses efficient spur suppression technology to significantly improve the quality of digital radio reception. It moreover enhances the reception sensitivity of the radio receivers. In turn, this extends the range of coverage for broadcasters and increases the number of channels that can be received in vehicles.

The Fraunhofer IIS DAB+ software solution paves the way for radio and chip manufacturers to implement DAB+ in radio systems. In concrete terms, the software library serves as the baseband decoder for DAB+ signals. An added advantage is the library's compatibility with audio and data decoding components also developed at Fraunhofer IIS. Available as C- or object code, the DAB+ software solution is optimised for typical software defined radio platforms for automotive applications. It follows stringent coding standards to fulfil the automotive industry's strict quality requirements.

Efficient spur suppression for higher in-vehicle reception quality

Newer vehicles, and electric vehicles in particular, feature complex open- and closed-loop electronic control systems. These can interfere with digital radio reception, causing brief but repeated signal disruptions. The newly integrated technique enhances the radio receiver robustness to interference, which significantly improves the quality of digital radio reception and the listening experience in the car.

Wider selection of stations and Emergency Warning Functionality (EWF)

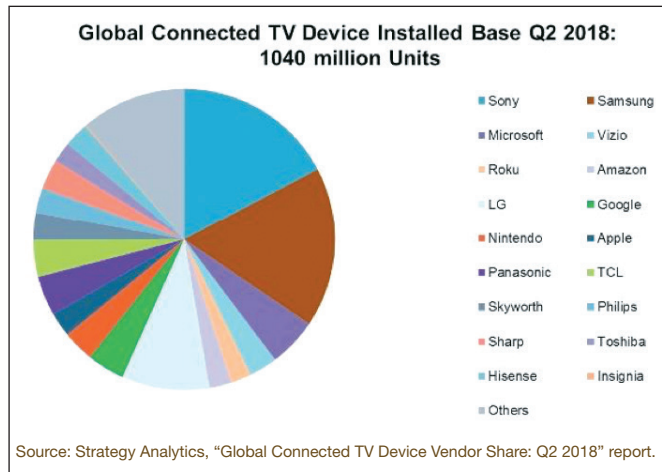
The optimised DAB+ software solution greatly improves radio reception characteristics. Notably, it increases the sensitivity of the radio receivers, making more stations available over even greater distances while maintaining perfect reception.

The software upgrade moreover includes the DAB+ Emergency Warning Functionality (EWF) that enables the radio receivers to automatically switch to emergency broadcasts – a simple, reliable and extremely quick way to alert the public to natural disasters and emergencies. In addition to audio announcements, detailed multilingual text information can be received. Not only do radios with integrated EWF switch to the emergency broadcast in a crisis situation, they also wake up automatically if they are on standby mode.

You can find more information about the DAB Receiver Kit from Fraunhofer IIS website

(Fraunhofer IIS)

Connected-TV Devices Top 1 Billion Worldwide



More than one billion connected-TV devices are now in use worldwide, according to new research from U.K.-based Strategy Analytics.

Smart TVs, which account for nearly 60 percent of the total installed base of these devices, are leading the way, according to the firm's latest quarterly report, which defines connected-TV devices as products that allow users to stream Internet video to a TV and breaks them into the sub-categories smart TVs, smart Blu-ray players, game consoles, and digital media streamers.

"The popularity of connected TV devices – in particular Smart TVs and dedicated media streaming devices such as Roku, Amazon Fire TV, and Chromecast – has grown dramatically over the last few years and has led to a fundamental shift in how consumers view and engage with content on the TV set," said David Watkins, director of Strategy Analytics.

"Companies such as Roku have managed to build hugely successful businesses selling dedicated streaming devices on the back of this trend towards the online consumption of video in the living room."

The report, which tracks the world's top 18 connected-TV device vendors, puts Sony and Samsung neck-and-neck in terms of overall installed units with Samsung poised to take the lead in the second half of 2018. Amazon and LG ranked No. 3 and No. 4, respectively, in the survey.

"Sony has long been the global leader in Connected TV devices in terms of devices installed in homes thanks not only to its strength in smart TV and Blu-ray but also as a result of its leading position in the global game console market," explained VP David Mercer. "However, as smart TVs take an ever-growing share of the overall market, Samsung will replace Sony at the top of the device footprint rankings later this year thanks to its dominant position in the world's smart TV market."

Strategy Analytics expects more than 55 million digital media streamers to ship globally this year, which compares with a smart TV market that will exceed 150 million units in 2018.

(soundandvision)

SMPTE Publishes Standards for Binding IDs to Media Assets Using Audio Watermarking Technology



SMPTE® has announced published standards for binding Ad-IDs to commercials and Entertainment ID Registry (EIDR) codes to programming content. The standards specify use of Kantar Media's audio watermarking technology, an open solution available for licensing.

The SMPTE 24TB Open Binding of IDs Drafting Group created and published two new sets of standards and recommended practices: ST 2112-10 and RP 2112-11 for the Open Binding of Content Identifiers (OBID) and ST 2112-20 and RP 2112-21 for the Open Binding of Distribution Channel IDs and Timestamps. The availability of these standards for persistent binding of identifiers into advertising and programming content establishes a fundamental building block for the advancement of full cross-platform measurement and content integration.

Supporting real-time identification of a piece of content or an ad – whether on a TV set, in a set-top box, or outside of the set using a metering device or smartphone app – the standards will help mitigate numerous inefficiencies in the cross-platform video distribution and measurement workflow, including time-consuming, legacy processes for matching programme and ad names back to the time of airing and the distributor.

The ability to embed standardised identifiers throughout the media ecosystem will have a significant impact on the efficiency of cross-media workflows for ad agencies, media companies, and marketers. Television networks and digital content publishers will also be better equipped to create integrated multiscreen experiences.

By facilitating faster reporting for ad verification and audience measurement, the use of standardised identifiers will eventually enable marketers to better optimise live and on-demand advertising much as they now optimise online advertising.

In addition to enhanced tracking of assets and improved workflow efficiency, an open standard for ID-to-asset binding can deliver a wide array of capabilities, including:

- Reduced barriers to deployment of cross-platform dynamic ad insertion
- Better second-screen integration and improved multiscreen content discovery
- Enhanced automated content recognition and detection
- Accelerated digital content locker adoption and complete long-tail content monetisation
- An enhanced ability to trigger surveys, quizzes, or coupons on mobile devices

(SMPTE)

Equipment Trends

New Series 4K HDR TVs

Sony Electronics, Inc. has announced two new television series, both offering extraordinary picture quality by virtue of employing multiple proprietary technologies and solutions, leading with Sony's next-generation Picture Processor X1™ Ultimate. The new A9F and Z9F models arrive as the MASTER Series – a name Sony has reserved exclusively for its highest picture quality TV models. Sony's goal is to create a TV capable of displaying images that faithfully convey the creator's full intent. Sony's new MASTER Series provides picture quality approaching that of a professional-grade monitor in a movie studio and was developed by following a very strict set of product evaluation criteria set by its most experienced picture quality engineers.



Both the A9F and Z9F MASTER Series models come equipped with a newly developed, next-generation Picture Processor X1™ Ultimate. This processor plays a vital role in delivering the high-quality picture in the MASTER Series. With a long history and expertise in developing professional cameras and monitors, Sony recognises that precision in constructing fine signal processing components results in an immediately visible difference to the whole image. The Picture Processor X1™ Ultimate can intelligently detect and analyse each object in the picture through Sony's new Object-based Super Resolution for exceptional accuracy and detail. The Object-based HDR remaster has been updated and now allows each object to be remastered individually for better depth, accurate texture and an overall more realistic picture.

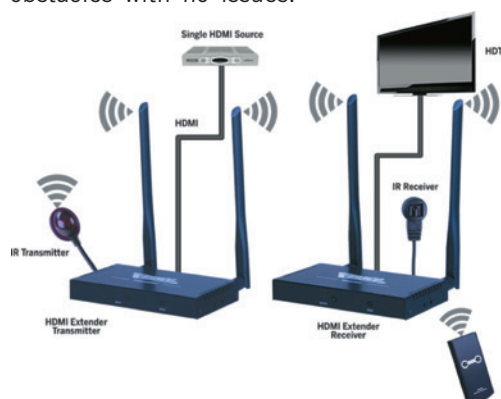
For the MASTER Series, Sony has worked with Netflix to develop Netflix Calibrated Mode. The new feature was specially developed to mirror the same picture quality as a studio evaluation master for television in order to preserve the artist's creative vision and intent.

Additionally, the MASTER Series is ready for CalMAN®, the industry-leading display calibration software from Portrait Displays. CalMAN is widely used by professionals as a tool to ensure quality control of the strict requirements demanded by content creators in broadcast, production and post-production. CalMAN eliminates the struggle of maintaining the picture quality throughout the life of the TV.

(Sony)

HDMI Wireless Extender and Receiver

The Vanco HDWIRKIT/RX extends HDMI signals wirelessly from a source to a display up to 131ft/40m using wireless technology. There are no cables that are required between the transmitter and receiver which makes for a clean and easy installation, especially where cabling is difficult or impossible to run. Using a 5GHz operation frequency, the HDWIRKIT Transmitter and Receiver do not require line of site transmission, the wireless signal will travel through most obstacles with no issues.



Out of the box, the HDWIRKIT works as a point to point configuration, however also supports having multiple sets on the same site (up to 10) and one to multiple (1 TX to up to 4 RX) displays using HDWIR-RX receivers (sold separately). A great solution for splitting a single source signal wirelessly. Also features dual band IR call back to control the source from any display location connected. With the ability of sending HDMI signals wirelessly, whether point to point or splitting to multiple displays, the HDWIRKIT and optional HDWIR-RX are easy solutions where running cable is an issue.

(Vanco)

12G-SDI Distribution Amplifier

Extron Electronics has introduced the new DA4 12G HDSDI, a compact fouroutput distribution amplifier for multirate SDI digital video signals. It supports all common serial digital video data rates up to 11.88 Gbps, while passing HDR, embedded audio, and other ancillary data allowed by the SMPTE and ITU standards. Automatic input cable equalization adds up to 984 feet (300 meters) for SDI, 787 feet (240 meters) for HDSDI, 590 feet (180 meters) for 3G-SDI, 295 feet (90 meters) for 6G-SDI, and 230 feet (70 meters) for 12G-SDI digital video, when using RG6 cable. Automatic output reclocking reshapes and restores signal timing at each output for added headroom when connecting multiple devices.

The DA4 12G HD-SDI is housed in a quarter rack width,



metal enclosure, providing integration-friendly mounting options into both new and existing AV systems.

Key Features

- Automatically adapts to SMPTE and ITU digital video standards for SDI signals up to a 12G-SDI data rate
- Supports data rates from 270 Mbps to 11.88 Gbps
- Support for HDR – High Dynamic Range video
- Automatic input equalization
- Automatic output reclocking
- Passes ancillary data including HDR, embedded audio, closed caption, and time code

(Extron)

Series of 4K HDR Matrix Switchers for Multi-Zone AV Distribution

Atlona Opus™, a powerful series of three HDMI-to-HDBaseT matrix switchers and one receiver for high performance 4K HDR signal distribution and extension, is engineered with a comprehensive range of control system integration and audio matrixing features, making it ideal for a wide range of small-to-medium-sized residential and commercial applications requiring multi-zone AV distribution.



The Opus Series includes the **AT-OPUS-46M** (4x6); **AT-OPUS-68M** (6x8); and **AT-OPUS-810M** (8x10) matrix switchers, all of which feature HDBaseT outputs for transmission of HDMI, Ethernet pass through, bidirectional IR, and RS-232 control signals up to 330 feet (100 meters). Opus switchers are ideal for whole-house residential AV distribution, as well as light commercial, education and corporate projects that require compatibility with new and emerging devices for 4K presentations.

Opus matrix switchers are HDCP 2.2-compliant and support 4K/UHD video (including HDR10) at 60 Hz with 4:4:4 Chroma sampling, as well as HDMI data rates up to 18 Gbps. Visually lossless VESA Display Stream Compression (DSC) enables HDR and 4K/60 4:4:4 signal extension over HDBaseT with no latency. Each Opus model enables routing to HDBaseT outputs plus two additional HDMI outputs providing exceptional flexibility for the custom installer.

Prominent Opus Series features include:

- An equal count of fixed HDMI to HDBaseT I/Os with two additional HDMI outputs satisfy a range of output

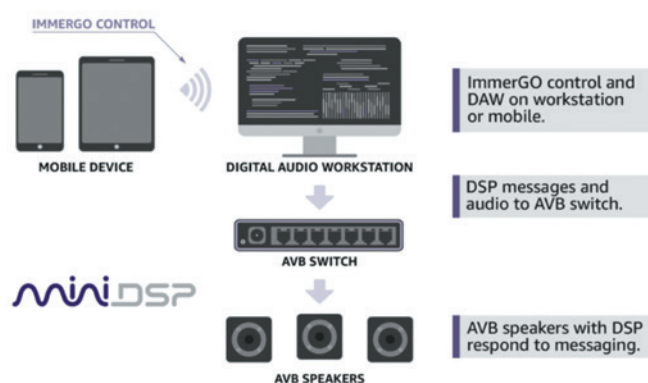
needs and designations and assist with right-sizing small to medium AV routing requirements without the need to stock multiple I/O card SKUs.

- Visually lossless VESA Display Stream Compression delivers extremely high, pristine image quality and 4K/60 4:4:4 signal extension over HDBaseT with zero latency.
- Simultaneous TOSLINK and analogue stereo outputs for each HDBaseT output result in multiple options for integrating whole-house audio solutions.
- Control capability via the IR remote, front panel control and GUI-based integrated web server, as well as IR integration between locally connected sources, remote displays over HDBaseT and control system.
- Integrated display control via CEC
- Ultra-quiet 2U enclosure with active cooling ensures continuous reliability.

(Atlona)

Object-Based 3D Audio System

immerGO Enables a User to Select Sound Channels and Move Them in 3D Space and Record These Movements for Later Playback; Perfect for Live Events, Theme Parks, Museums, and Many More Applications



miniDSP has announced the launch of immerGO object-based 3D audio. Featured as a live presentation during the recent InfoComm trade show, it was enthusiastically received as an ideal solution for live events, theme parks, large and small AV installations, museums, art galleries, soundscapes, and many more immersive audio applications.

The server is a standard Mac or PC that runs a DAW (such as Reaper) and controls AVB devices on a plug & play AVB network. The client control is provided via a web interface on the server or a separate mobile device. immerGO enables a user to select sound channels, move these channels in 3D space, and to record these movements for later playback. An immerGo system can be used to localise sound sources in live shows, theater productions, and/or theme parks, amongst other environments. The location of sounds can be controlled as the show progresses, or soundscapes can be recorded and played back during a show.

The immerGo series includes:

- miniDSP N-DAC8 8-channel digital to analogue convertor
- miniDSP PWR-16 400-Watt ultra-compact, highly-efficient audio power amplifier
- miniDSP SPK-4P PoE+ full range loudspeaker
- miniDSP SPK-4 pocket-size full range loudspeaker (fitted with a 3.5-inch full range driver)

(immerGO)

New Members

Additional Full Members

Star TV

Star Television/United Broadcasting Corporation LLC/ was first founded in 2010 and shifted to full HD format in 2014. Star TV is one of the 16 television stations (out of more than 60 local channels) that have the official right to broadcast throughout Mongolian territory.



Our target demographic is 13-40 year olds. 70% of our viewers are 18-35 year-olds, so our programs are oriented towards younger audiences.

Star TV ranks #8 out of more than 60 channels available in Mongolia in terms of viewers, according to research by local cable provider, Skymedia.

Star TV has a total of 48 full and 8 part time employees. We broadcast 19 hours of programming each day and 570-588 hours per month.

Current Foreign Content

Star sports news is cooperating with NBA for seasonal highlights of the games. Recently we have started cooperating with IMG / WMA for several programs, including live broadcasting of Miss Universe and Victoria's Secret, sports and entertainment programs as well as the hit TV drama, The Night Manager.

We are looking to further expand our range of foreign content, to appeal to our growing young audience, many of whom are interested in international, well-known entertainment programs.

Associate Members

New Media Networks

New Media Networks is an international company producing high impact initiatives to support and strengthen the media sector. We bring together multi-disciplinary teams of associates to provide strategic expertise, experience and contacts to develop productions, media strategies, training and research.



We work with international agencies, broadcasters, media practitioners and academic institutions across countries in Asia, Africa and Europe.

We have a proven track record of innovation with international recognition e.g;

- Children on air for the first time on BBC World Service and UNICEF
- Introduction of live audiences' interaction with decision makers for radio broadcast across Bangladesh
- Bespoke live/as-live events designed for broadcast with the engagement of audiences for the Commonwealth Broadcasting Association
- Designed a unique practice based module for the University of East Anglia's Master's programme in Media and International Development
- Designed an EU interactive training course for broadcasters in Fiji, Jamaica and Rwanda to build skills to produce multi-platform drama

- Commissioned first whole country audience insight study in Myanmar
- Introduced the use of Bollywood stars and merged Routine Immunization and Polio campaigns for the Global Polio Eradication Initiative in India
- ABU – delivery of storytelling workshops and masterclasses at events in Indonesia, Thailand and Sri Lanka using 'Fast Fiction' – a process to produce creative, responsive radio/online drama to reflect fast moving and changing situations

Affiliate Members

WSL

WSL is a Sports Management System provider for Multi-Sports Meets and was recently the Official ICT Provider for the Kuala Lumpur 2017 and some other previous SEA Games and previous 10 editions of the Malaysian National Games (SUKMA) and is currently working closely with ABU Sports Group to potentially provide the Host Broadcast Support Services and Management in the Asian Para Games 2018, Jakarta.

WSL's role in the broadcasting involves providing some of the required services in such Sports environment namely:

- to provide data-driven real-time tv graphics eg. CG templates etc.
- to integrate with sports-specific timing & scoring results systems such as the running clock, game clock/time, photo-finish images etc.
- to provide augmented reality technology and graphics platforms
- to integrate with live-streaming capabilities to 2nd screen applications or other platforms
- to provide media support services and platforms such as media information systems and commentary information systems etc.
- and many others.

EEVA Productions

EEVA PRODUCTIONS is a production studio for creative auditory-image design and story branding that helps elevate your brand activation strategies.

It is both a production house that produces micro-films, programs and written content; as well as a provider unique media and communications training.

EEVA serves as a media platform, an education centre and a cultural network all-in-one and is a studio led by a fearless visionary and dreamer who is full of personality.



Xtra Insights

Xtra Insights is a company based in Australia with almost 15 years media focused Music, Content and Audience research, providing services in numerous international markets. Their services extends to cover leading radio networks/ stations in countries who have the top rating stations i.e. SCA Australia, MediaWorks New Zealand, Europa Spain, SPH Radio Singapore and Mahaka Media Indonesia. In 2015, Xtra Insights was awarded the exclusive contract from Commercial Radio Australia to provide official Radio Audience Measurement results for all of Australia's regional radio markets. In 2017, they again won the exclusive contract to continue providing Radio Audience Measurement. Xtra Insights has now one of the largest dedicated online radio communities in the world with 700,000 listeners hosted in numerous radio station branded platforms on their web application, Airtime Surveys.

Personalities & Posts

Leader of TV Innovation Dies in US

Dr Joseph A Flaherty

A leader of innovation in the television industry, Dr Joseph A Flaherty, has died in the US at the age of 87. Dr Flaherty worked for CBS for decades, most recently as Senior Vice President of Technology. He served as chair of the North American Broadcasters Association Technical Committee for almost a decade.

Many ABU members knew him through his time as Chairman of the WBU-TC and his work in ITU-R study groups.

In the 1970s, Dr Flaherty revolutionised the television news industry by changing the process by which news stories were captured. His foresight led to the phasing out of 16 mm film to gather news, and its replacement with electronic news gathering (ENG).

In the early 1980s, he was a pioneer in the development of HDTV.

During his long career, Dr Flaherty won many broadcasting awards and honours, including four Technical Emmy Awards. He leaves his wife, four sons and a daughter.



HFCC Founder Oldrich Cip Dies

Oldrich Cip, founder and Vice Chairman of the High Frequency Coordination Conference, known as the HFCC, died on 27 July following a sudden illness.

Mr Cip was involved in radio since he was a child – first as an amateur radio hobbyist and later as a staff member of Czechoslovak and then Czech Radio in the international broadcasting departments.

After the end of the Cold War, he believed that broadcasters from both sides of the conflict should come together and develop a new system of planning and coordination for shortwave broadcasting. This led to the establishment of the HFCC in 1991.

Mr Cip was Chairman of the HFCC until 2015. Since then, he was a Vice Chairman of the group.

Jeff White, Oldrich's successor as HFCC Chairman, said: "The shortwave broadcasting and listening communities have lost one of our most important proponents. The contributions of Oldrich over the years are simply unequalled. He was a humble man, but people in this industry realized the importance of his work."



ABU TECHNOLOGY CALENDAR OF EVENTS

2018

15 Aug-14 Sep	ABU Technology Webinars	Online
13-18 Sep	International Broadcasting Convention 2018	Amsterdam
30 Sep-5 Oct	ABU General Assembly & Associated Meetings	Ashgabat
1-2 Oct	ABU Technical Committee Meeting	Ashgabat
23-25 Oct	Regional Workshop on OTT and IBB Technologies and Services for Media (ABU-AIBD)	Kuala Lumpur
14-16 Nov	Inter BEE 2018	Tokyo
20-21 Nov	15th Iran Media Technology Exhibition & Conference, IRIB Annual Technical Assembly	Tehran
26-27 Nov	ABU-AIBD-DRM Regional Workshop on Digital Radio	Kuala Lumpur
3-7 Dec	Training Course on Engineering Fundamentals for Broadcasters 2018 (ABU-AIBD)	Kuala Lumpur

2019

4-7 Mar	ABU Digital Broadcasting Symposium 2019	Kuala Lumpur
8 Mar	ABU Technical Bureau Mid-Year Meeting	Kuala Lumpur

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