
Introducing the MPEG-H Audio Alliance's New Interactive and Immersive TV Audio System

Presentation at the HPA Tech Retreat, Palm Springs

Robert Bleidt – February, 2015

Based on the new MPEG-H Audio Open International Standard
ISO/IEC23008-3

MPEG-H Audio improves the listening experience

- The newest audio codec from MPEG expands the features of today's codecs:

- **Personalize the sound to what you want to hear**
- **Make surround sound more realistic**
- **Tailor reproduction to your listening environment and hardware**

- Next Generation TV Audio System beyond AAC
 - AAC today provides half the world's TV surround sound – BBC, NHK, Globo, ...
- For TV Broadcast and OTT New Media Delivery
 - Not a theatrical sound system
- Two envisioned initial applications
 - Live Sports Broadcasts – Interactive and Immersive sound
 - Features and Episodics – Immersive sound

MPEG-H Audio improves the listening experience

Personalize the sound to what you want to hear

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Personalize the sound to what you want to hear

- In addition to traditional channel-based audio, MPEG-H includes **audio objects**, sound elements that are transmitted separately to the decoder
- This allows the listener to adjust the elements to his liking
- Examples:
 - Simple case: Adjust the dialogue or commentary level in relation to the other audio elements such as ambient sound, music, or sound effects
 - Precursor 2011 Wimbledon “Grunt Controller” trials with BBC showed most listeners preferred either a higher or lower dialog level
 - Helpful for listeners with hearing loss or non-primary language or dialect
 - Additional language support becomes a simple matter of an additional 20-40 kb/s object

First practical use of objects: Dialogue Enhancement

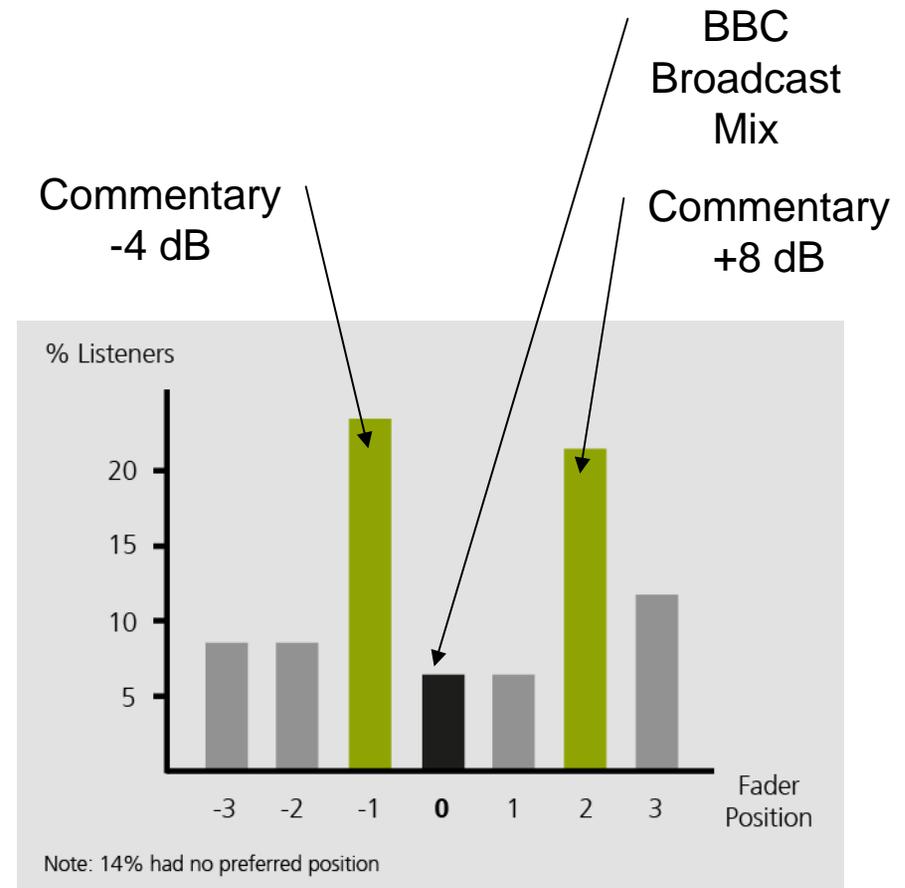
Allows viewers to set their own Dialogue levels

- User benefit
 - Dialogue/Announcer can be adjusted up or down
 - Helps hearing impaired understand Dialogue
 - Helps for listening in noisy environment
- Broadcaster benefit
 - One signal broadcast to all viewers
 - Default mix played by existing receivers
- Public test by BBC during the Tennis Grand Slam Championships 2011 in Wimbledon
- Now undergoing standardization in DVB



Results of BBC Wimbledon 2011 Consumer Test

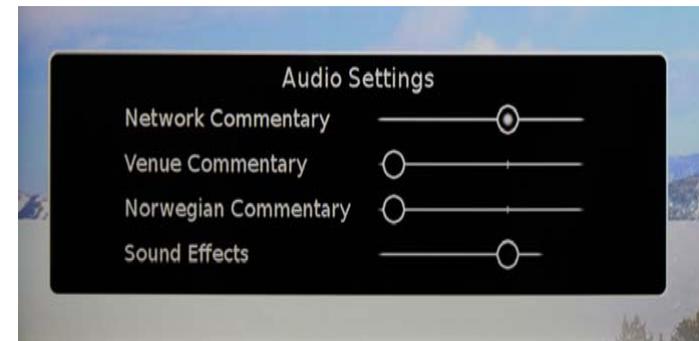
- (Each step in graph is 4 dB level change)
- Over 72% of the listeners agreed or strongly agreed that this kind of technology would benefit radio, and **84% thought the same for TV**
- (EBU TECHNICAL REVIEW – 2012 Q2, H. Fuchs, S. Tuff and C. Bustad)



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Personalize the sound to what you want to hear

- More complex examples:
 - 2014 Field Test with leading U.S. sports network at winter sports event
 - Pick your announcer and language
 - Want to hear more sound effects?
More audience sounds?
 - Demo content from NASCAR race
 - Pick your announcer and language
 - Mix in driver's radio
 - Hear car sounds/transducers
- Real-time decoding and rendering
- User selects audio mix from on-screen display sliders or **preset buttons**



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Personalize the sound to what you want to hear

- Summary: Personalization
- Audio objects allow listeners to:
 - Adjust elements in the sound mix to their liking
 - Boost dialogue for hearing-impaired or second language listeners
 - Listen to alternate audio content such as:
 - Home vs away team commentary
 - Driver to crew race audio
 - Alternate languages, simultaneous translation, or audio description
 - Many other future creative and revenue opportunities

MPEG-H Audio improves the listening experience

Contrasting Objects: Cinema vs Broadcast

- Cinema Theater:
 - Broad listening area
 - Listening primarily in reverberant field
 - Objects used for spatial accuracy and dynamic motion overhead
 - Standardized “house curve” and loudspeaker arrangement
 - Good practices to study for TV sound in the 5.1 era
- Broadcast to Consumer’s Living Room:
 - Sofa/recliner in middle of room
 - Closer to near-field at most frequencies
 - Objects used for personalization / interactivity
 - Dynamic objects may be used, but fewer due to transmission bandwidth
 - Wide range of receiving devices: home theater, 2.1 sound bar, TV speakers, tablet speakers, earbuds
 - Production concepts and sound design diverge in the 21st Century

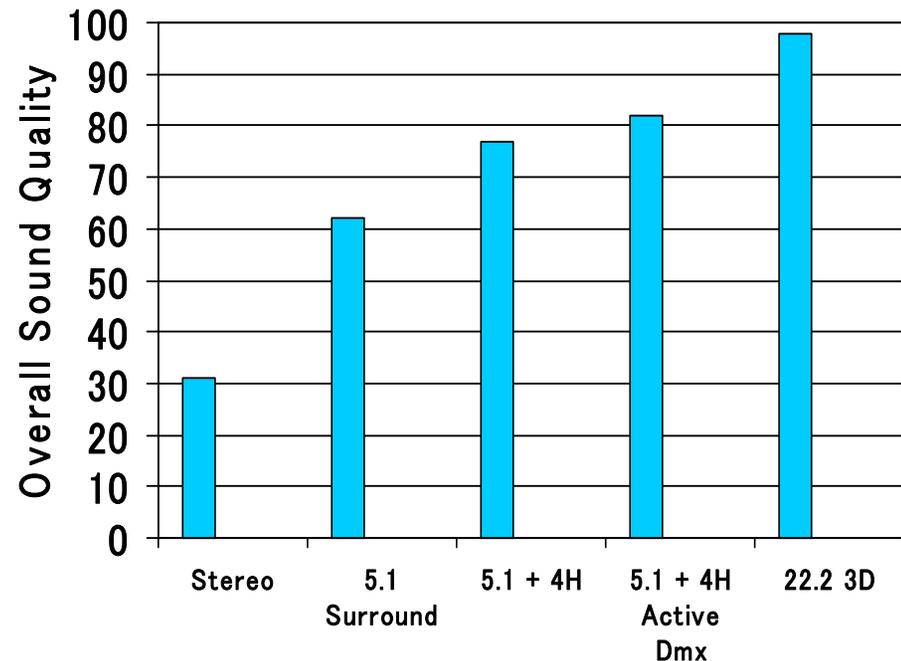
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Making surround sound more realistic

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Making surround sound more realistic

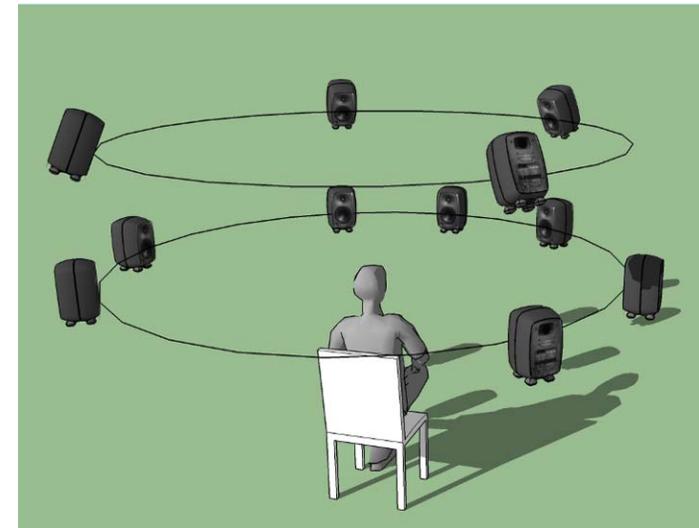
- 3D audio systems add height information (more channels or audio objects) to the sound field to improve realism
- It becomes difficult for the listener to perceive he is hearing a recording
- Our studies show adding **four height speakers** provides a substantial improvement without the 22 speakers of classical 3D systems



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Making surround sound more realistic

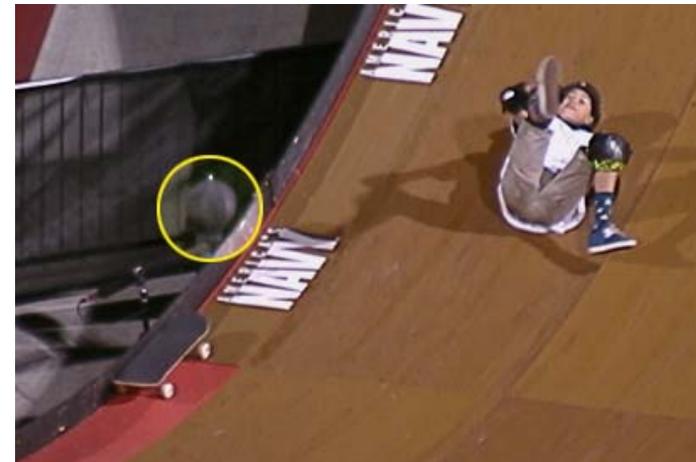
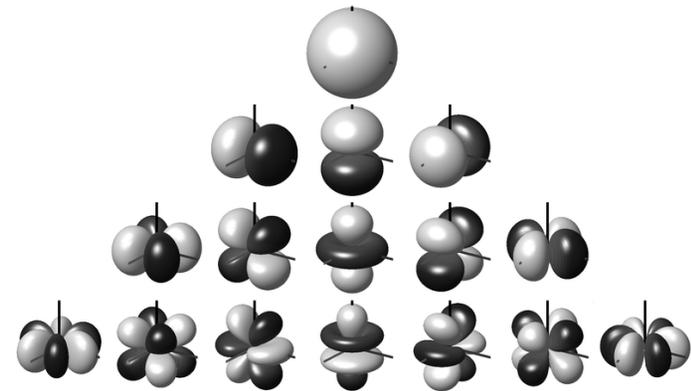
- MPEG-H currently has defined speaker configurations from 1.0 (mono) to 22.2
 - Bitstream support for up to 128 channels and 128 objects
- **Our recommendation for immersive sound:**
 - **7.1 Blu-ray surround configuration**
 - **4 Height Speakers above corner speakers as shown**
- Other configurations are possible, for example:
 - 5.1 + 4H
 - Using front wide 7.1 configuration or 9.1



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Making surround sound more realistic

- MPEG-H includes sound field capture technology for alternative means of capturing and reproducing 3D sound
- Based on Higher-Order Ambisonics techniques
- Transmits predominant sounds and ambience in separate tracks, independent of speaker format
- Allows one-microphone capture of sound field or ambience
- As with channel-based system, may be combined with audio objects for interactivity or personalization

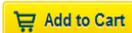
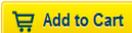


“The average consumer will never hear 3D, they listen to stereo today”

- It is true today’s consumers listen mainly on stereo in-TV speakers or with simple 2.0 or 2.1 soundbars
- 5.1 or 7.1 AVR + speaker systems aren’t seen as the logical match for that new sleek, slim flat-panel TV
- So why do 3D audio if most of the audience won’t hear it?
 - The same reason we do surround today – the high-value viewers will have 3D in their home theaters
 - Right?

Recommended For You



 <p>Samsung - 2.1-Channel Soundbar with Wireless Subwoofer \$299.99</p> <p></p>	 <p>Samsung - AudioBar 2.1-Channel Soundbar System with Wired \$179.99</p> <p></p>	 <p>Samsung - 2.1-Channel Soundbar System with Wireless Active Subwoofer \$1,299.99</p> <p></p>
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Fraunhofer demonstrates future 3D listening for mainstream consumers with prototype “3D Sound Bar”

- Concept demonstration of our vision of mass consumer delivery of 3D audio
- Décor-friendly – no external wires or speakers
- No confusing AVR setup menus – unbox, hang on wall, enjoy
- Could be integrated into TV or offered as a separate frame
- **Dramatic improvement over today's stereo soundbars**
- Home theater enthusiasts will still want 11.1 speakers (or more) for ultimate sound quality
- Shown at the Fraunhofer IIS booth at NAB 2014, IBC 2014, AES 2014, CES 2015



MPEG-H Audio improves the listening experience

Making surround sound more realistic

- Summary: Immersive Audio
- Immersive audio provides a substantial increase in sound quality beyond surround sound
- Four height speakers provide a good tradeoff between cost and sound quality
- “3D sound bar” technology could be built into TVs or soundbars to enable a dramatic improvement in sound quality and immersive sound for the mainstream consumer
- Higher Order Ambisonics offers an alternative method of capturing and transmitting 3D sound

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Tailoring the sound to the listener's environment and hardware

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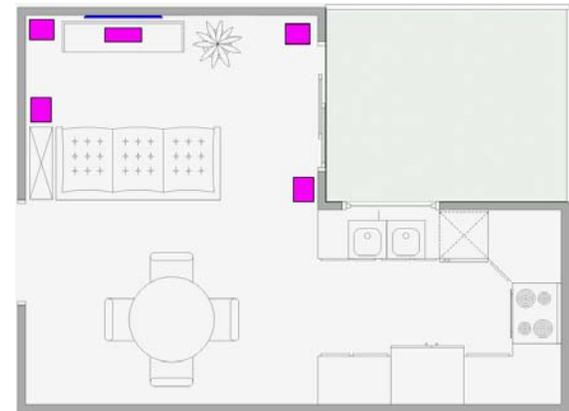
Tailor reproduction to your listening environment and hardware

- Multi-platform loudness control
 - Loudness measurement built into the encoder
 - Or use external values
 - Uses existing AC-3 metadata in legacy mode
 - Adjustment of dynamic range to match listening environment and device capabilities
 - Examples:
 - Home listening on good speakers
 - Listening on earbuds at airport on mobile phone
 - Listening at home on tablet

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Tailor reproduction to your listening environment and hardware

- Speaker-foolproof rendering for legacy speakers
 - May be able to correct for misplaced speakers in consumer's home
 - HDMI 2.0 will allow communication of consumer's installed speaker locations
 - May offer a limited impression of height on existing 5.1 or 2.0 consumer speakers
- Binaural rendering for headphone reproduction
 - Listener perceives sound stage in front of him, instead of between his ears
 - May be extended to tablet speakers with Fraunhofer Cingo technology

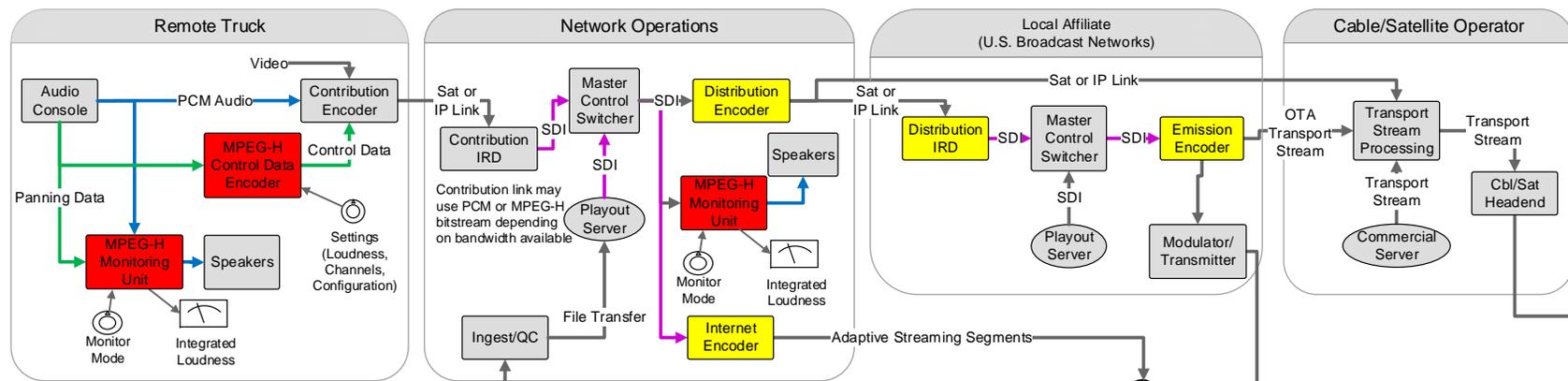


Implementing MPEG-H in TV Broadcasting

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Developing a TV Audio System Based on MPEG-H

- The MPEG-H Audio Alliance is developing a practical TV audio system based on the MPEG-H standard
- Includes not just audio coding, but a complete end-to-end system for content production, transmission and consumer delivery
- We propose a four-stage process for implementation by broadcasters:
 - From the start, consumer decoders will support all features of our system
 - Broadcasters can choose what features to use and when to implement them



Proposal for Implementation in Stages

- **Stage 1** – Drop-In replacement for AC-3
 - Benefit: Lower audio bitrate, better loudness control
- **Stage 2** – Add some static objects to the 5.1 or 2.0 channel bed:
 - Second or third language dialogue
 - Audio Description / Visually Impaired
 - Primary language dialogue (for Dialogue Enhancement)
 - Sound Effects
 - Benefit: Multiple Languages, VI description at 20-40 kb/s each, User-adjustable dialog level, Personalized audio mix
- **Stage 3**: move to practical 3D audio – perhaps 5.1 or 7.1 + 4 height channels
 - Benefit: Immersive, 3D audio – parity with cinema, Blu-ray
- **Stage 4**: Add dynamic (moving) objects:
 - Benefit: ability to track screen action with mono objects

Implementing MPEG-H in Broadcasting and New Media

Testing MPEG-H in the field

- Winter extreme sports competition (skiing, snowboarding, snowmobile racing) carried on major cable network
- Summer extreme sports competition (skateboarding, motorcycle racing) carried on major cable network
- NASCAR race (with pit crew radios) using material from NASCAR
- DTM (European race series) auto race carried on major European sports channels



Tonmiester Stenzel adjusting 3D microphone array at Aspen half-pipe



Sound Designer Baxter adjusting spot mic at Austin skateboard ramp



Post-production mixing at Technicolor/Paramount in Hollywood

Implementing MPEG-H in Broadcasting and New Media

Real-time hardware ready for tests and trials

- Real-time encoder and decoder prototype
- SDI with 16 audio channels or objects
- Audio contribution encoding at 1 Mb/s
- Audio emission encoding at 384 kb/s
- M-JPEG, AVC, or HEVC video encoding
- Each encoder or decoder is 2 RU computer, including video encoding/decoding
- Audio monitoring on standard Wolher SDI monitor panel
- Decoder has IR interface to remote control for consumer interface emulation
- Demonstrated at IBC, AES, CES, and here in the demo room



Implementing MPEG-H for New Media Delivery

Implementing MPEG-H in Broadcasting and New Media

Encoding Immersive Film Audio with MPEG-H

- Feature films now being released with immersive mixes for cinema distribution
- First near-field immersive mixes being produced for Blu-ray release
- MPEG-H delivery of immersive films demonstrated at CES 2015 on speakers and 3D Soundbar using Higher-Order Ambisonics mode of MPEG-H
- Hear “Teenage Mutant Ninja Turtles” on Technicolor Set-Top box in the demo room with MPEG-H’s immersive binaural rendering.



Progress with MPEG-H continues

- The MPEG ISO/IEC 23008-3 Standard at DIS stage
 - Final Draft International Standard expected next week
- Being considered for upcoming ATSC 3.0 and DVB TV standards
- Pioneering experiments in sports broadcasting and other media to test production with MPEG-H's new features
- Visit the Fraunhofer's demonstration in the demo room to learn more
- Or go to www.iis.fraunhofer.de/tvaudio or www.mpeghaa.com

- Be sure to visit the Fraunhofer booth at NAB!

Fraunhofer, Qualcomm, and Technicolor

Bring MPEG-H to the world's media and devices

■ Fraunhofer

- Developer of AAC and MP3 standards, deployed in 7 billion devices each.
- 15 years of TV audio experience, providing half the world's TV surround sound. Used by broadcasters such as the BBC, TV Globo, and NHK.
- Developer of open-source FDK library – the surround sound codec of Android

■ Qualcomm

- Provider of comprehensive mobile chipset solutions for all types of smart connected devices, including powerful multi-media platform capabilities
- Supplier to all major mobile OEMs
- Strong multi-media design expertise, with major contributions to audio and video standardization

■ Technicolor

- Largest Post-Production Sound facilities in the world
- Close ties to content Creators and Distributors in Hollywood
- Co-developer and co-licensor of the MP3 format with Fraunhofer
- Major presence in home delivery equipment (set-top boxes) and services



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