the standard
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Enhanced Audio for DTV:

ATSC Publishes New Digital Audio Compression Candidate Standards

ATSC's new Enhanced AC-3 specifications will expand audio capabilities for broadcast, cable, satellite, and DVD applications. ATSC first standardized the AC-3 digital audio system in November of 1994. Since then AC-3, popularly known as "Dolby Digital", has become widely used in digital television systems around the world.

"Enhanced AC-3 is a fine example of how ATSC is evolving standards in response to marketplace requirements," remarked Mark Richer, ATSC president. ATSC issued a Request for Information in December 2002 and Dolby Laboratories responded by submitting the Enhanced AC-3 (E-AC-3) specification.

E-AC-3 offers new coding tools that fundamentally improve performance and new features that allow operation over a wider range of bit-rates and numbers of channels. It can also be converted into legacy AC-3 for playback compatibility on consumer's existing A/V decoders.

According to Craig Todd, Dolby's senior technologist, "E-AC-3 or 'Dolby Digital Plus' has been designed to meet four major requirements of a next-generation broadcast audio codec: compatibility with legacy equipment, improved spectrum efficiency, cost effectiveness, and interoperability with other future media formats."

The enhancements to AC-3 are contained in ATSC Candidate Standard documents CS/T3-613 and CS/T3-614. Document CS/T3-613 specifies revisions to the ATSC Digital Audio Compression Standard (A/52) that can be used in a variety of media. Document CS/T3-614 describes additions to the ATSC DTV Standard (A/53) that specify use of E-AC-3 in the Enhanced VSB (E-VSB) robust mode currently under development in ATSC. Find more information on E-AC-3 in the "What it Does, and How!" feature inside this issue. ■

NAB2004 Attendees Flock to DTV Drafthouse

Attendees of NAB2004 in Las Vegas last month flocked to the DTV Drafthouse where they were offered captivating HDTV programming from ABC, CBS, HDVision and NBC on new HDTV products from Sharp/Aquos, RCA, Zenith, LG Electronics, Panasonic, Samsung, and Toshiba.

"Once again, the DTV Drafthouse was a huge success at the NAB Spring Convention. NAB was pleased to provide a forum with

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Advanced Television Systems Committee

Enhanced AC-3:
What it Does, and How!

First standardized in 1994, the AC-3 digital audio system known as "Dolby Digital" is widely used around the world. The new enhancements to AC-3, which will be marketed as "Dolby Digital Plus," are contained in Candidate Standards documents CS/T3-613 and 614. Enhanced AC-3 (E-AC-3) will provide the industry with expanded audio capabilities that can be used for broadcast, cable, satellite, and DVD applications.

CS/T3-613 adds technical specifications to the ATSC Digital Audio Compression Standard (A/52) that can be used with a variety of media. The document details features that are relevant to ATSC television systems, and also specifies features that are likely to be used in other (non-ATSC broadcast) applications. A/52 is the fundamental source document for AC-3 and is relied upon by other (non-broadcast) industries. Inclusion of the additional features in the E-AC-3 specification will enable the use of E-AC-3 in other applications, indirectly benefiting the ATSC digital television system. CS/T3-614 describes additions to the ATSC DTV Standard (A/53) that specify use of E-AC-3 in the Enhanced VSB (E-VSB) robust transmission mode currently under development in ATSC. The E-VSB mode would allow broadcasters to trade-off throughput for robustness. With an E-VSB transmission, some of the approximately 19.4 Mbps data is allocated to the robust mode and the rest is allocated to the normal 8-VSB mode. The robust mode symbol stream includes additional forward error correction bits to improve reception under weaker signal and stronger multipath (ghost) conditions.

Since E-AC-3 builds upon the current version of AC-3 specified in ATSC Standard A/52A, all decoders for the enhanced version will also decode all legacy A/52 AC-3 bit streams. In addition, although the new enhanced audio format is not directly compatible with current A/52 decoders, it is feasible to perform a modest-complexity conversion into a compliant A/52 bit stream syntax, thus enabling backwards compatibility to legacy decoders that have S/PDIF bit stream inputs.

Important technical capabilities of Enhanced AC-3 that relate directly to ATSC broadcast applications include the following:

Expanded data rate flexibility. E-AC-3 allows the number of blocks per sync frame and the number of compressed data bits per frame to be adjusted to achieve significantly more data rate flexibility than standard AC-3, including a greater maximum theoretical data rate and finer data rate granularity.

Spectral extension. Enhanced AC-3 decoders support a new coding technique called spectral extension. Like channel coupling, spectral extension codes the highest frequency content of the signal more efficiently. Spectral extension recreates a signal's high frequency spectrum from side data transmitted in the bit stream that characterizes the original signal, as well as from actual signal content from the lower frequency portion of the signal. Because in some circumstances it may be desirable to use channel coupling for a mid-range portion of the frequency spectrum and spectral extension for the higher-range portion of the frequency spectrum, spectral extension is fully compatible with channel coupling. Both tools can be enabled at the same time, for different portions of the frequency spectrum.

Transient pre-noise processing. This is an optional decoder tool that improves audible performance through the substitution of audio segments just before transients to reduce the duration of pre-noise distortions. This technique is called time scaling synthesis, where synthesized PCM audio segments are used to eliminate the transient pre-noise, thereby improving the perceived quality

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Enhanced AC-3

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of low-bit rate audio coded transient material. To enable the decoder to efficiently perform transient pre-noise processing with no impact on decoding latency, transient location detection and time scaling synthesis analysis is performed by the encoder and the information is transmitted to the decoder. The encoder performs transient pre-noise processing for each full bandwidth audio channel and transmits "helper" information once per frame, only when necessary (for example, when transients are present that will benefit from the technique).

Adaptive hybrid transform processing. In 1995, the transform employed in A/52 AC-3 — based on a modified discrete cosine transform (MDCT) of length 256 frequency samples — provided a reasonable tradeoff between audio coding gain and decoder implementation cost. With continuing advances in silicon manufacturing processes over the years, the integrated circuit complexity that constitutes a reasonable level has now increased. This increase in chip performance provides an opportunity to improve the coding gain of AC-3, and hence perceptual audio quality at a given bit-rate, by increasing the length of the transform. This is accomplished through use of the Adaptive Hybrid Transform (AHT), which adds a second transform in cascade in order to generate a single transform with 1536 frequency samples.

Enhanced coupling. This is a new tool that improves the imaging properties of coupled signals by adding phase compensation to the amplitude-based processing of conventional coupling. Prior to downmixing the coupled channels to a single composite signal, the encoder derives both amplitude and additionally interchannel phase information on a sub-band basis for each channel. The phase information includes a decorrelation scale factor as a measure of the variation of the phase within a frame. This side chain information is transmitted to the decoder once per frame. The decoder uses the information to recover the multiple output channels from the composite signal using a combination of both amplitude scaling and phase rotation. The result is an improvement in soundstage imaging over conventional coupling. This improvement allows the technique to be used at lower frequencies than conventional coupling, thus improving coding efficiency.

The E-AC-3 documents are available at www.atsc.org under Candidate Standards. ■

Letter from the Editor

In 1989 Bob Hopkins offered me a position as Executive Assistant with the full disclaimer that "ATSC would be in existence for just two years." My indoctrination was quick, starting with a phone call on my second day asking for the "financial report for the upcoming FCC ACATS meeting," and me having to ask, "ah, what is ACATS?"

Fifteen years later I can proudly say that I have had a front row pass to witness an historical event, the development and deployment of digital television. It was my privilege to play a small supporting role in this endeavor and know many brilliant individuals throughout the process. I've watched as ATSC has grown, and I grew with it, enjoying new opportunities such as this newsletter.

I've had the extreme pleasure of working for and with people I respect and care about. I will miss you all as I embark on my next career. Many members have followed the growth of my family, receiving emails announcing the births of Chloe, Alexa, and Declan. I doubt it will come as a surprise that I have decided to direct my attention away from standards development to focus entirely on child development. Thank you for making my tenure at ATSC a treasured one. My best to you all!

Christy Kehlbeck

DTV Drafthouse and ATSC's DTV University Are Hits with NAB2004 Attendees

(from NAB2004 on page 1)

CEA and ATSC in showcasing the best in digital and high definition television technology," observed NAB president and CEO Eddie Fritts.

In the Drafthouse 'See What's Brewing' section, KBS, LG, Samsung, and Aircode demonstrated interactive television using the ATSC Advanced Common Application Platform (ACAP) Candidate Standard. ATI, Dolby, Microsoft, LSI Logic, and Zenith exhibited Enhanced VSB (E-VSB) with new coding technologies. ETRI featured a Digital On-Channel Repeater (DOCR) for extending signal coverage; and CPB/WGBH-NCAM showcased the latest in digital closed captioning technology. Mark Richer, ATSC president noted that, "The DTV Drafthouse was a great opportunity for ATSC to demonstrate some of the innovative technologies resulting from our standards work."

Jae Sub Hwang of the Korean Broadcast System (KBS) demonstrates interactive television using ACAP.

One of the show's most popular educational sessions was the ATSC Digital Television University. With 15 tutorials on how to implement PSIP to the fullest, and the latest on video and audio encoding standards focusing on Dolby Digital Plus (Enhanced-AC-3), AVC/H.264, and Windows Media 9 (VC-9), attendees were impressed with a wealth of valuable information on available ATSC applications. A highlight of the seminar's PSIP session was the new ATSC Programming Metadata Communication Protocol (PMCP) that will enable manufacturers and broadcasters to implement systems that automatically communicate information quickly and accurately between different systems such as traffic, program management, listing service, automation, MPEG encoder, and the PSIP generator. ■

Gerry Field of CPB/WGBH-NCAM demonstrates the latest in DTV closed captioning for John Taylor, LG Electronics.

ATSC Board member Ira Goldstone, Tribune Broadcasting, receiving the Television Engineering Achievement Award from fellow Board member Lynn Claudy, NAB, during the technology luncheon at NAB2004.

Annual Meeting In Brief

DTV leaders shared their vision with ATSC members in a day of presentations, demonstrations, and camaraderie at the Annual Meeting on March 30.

NAB's Eddie Fritts, NCTA's Robert Sachs, and CEA's Gary Shapiro each gave a state of their industry address. Presentations ranged from new HD programming and DTV products to standards activities within ATSC and around the world. New technology demonstrations were conducted by ATI, Dolby, Microsoft, LINX Electronics, LSI Logic and Zenith.

Graham Jones of NAB, pictured with Bernie Lechner, received the Bernard J. Lechner Award for Outstanding Technical Contributions.

The generous support of our sponsors contributed to the event's success: ATI, Harmonic, LG Electronics, LINX Electronics, Panasonic, ST Microelectronics, Tandberg Television, and Zenith Electronics. ■

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ATSC thanks this issue's sponsors.

DigiKnow?

And the award goes to…

John Taylor, LG Electronics, who received the Academy of Digital Television Pioneers' *DTV Industry Leadership Award* at the CEA HDTV Summit.

Taylor was honored as "the industry leader most influential in advancing digital high-definition television." Involved in digital television for 17 years, Taylor is credited with countless high-profile demonstrations of DTV technology and recognized for driving inter-industry DTV collaboration and consensus.

The Academy of Digital Television Pioneers is a select group of 203 individuals who have played a significant role in the effort to make digital television a reality for consumers. ■

Profile: Cox Communications' Craig Smithpeters

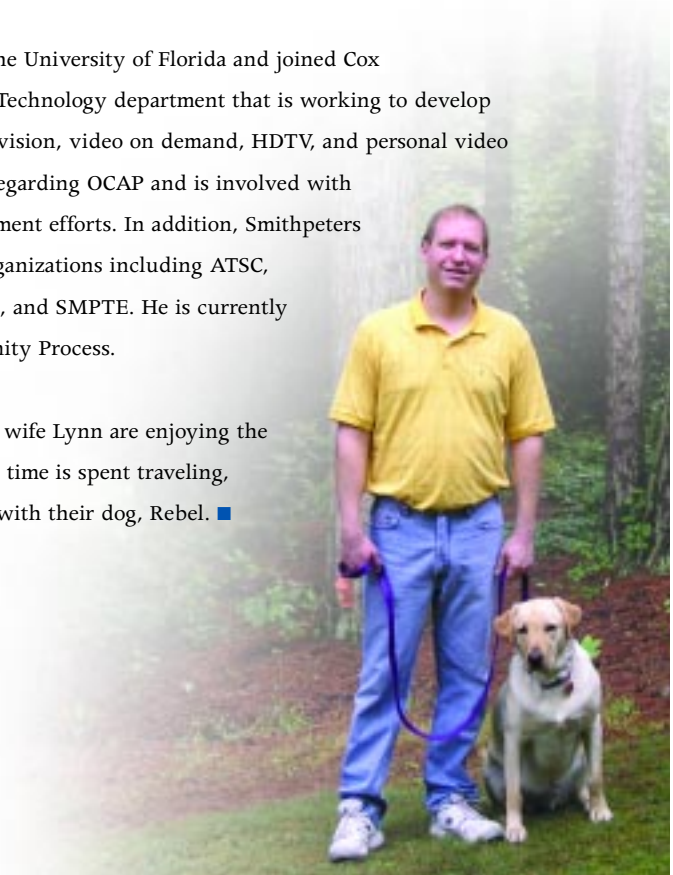
"Standards work is a combination of technical and political activities, hopefully leading to standards that enrich the lives of end users. I greatly enjoy and value this interaction with my industry peers," says Craig Smithpeters, Cox Communications.

Smithpeters is the chair of the ATSC's T3/S2 specialist group on the Advanced Common Applications Platform (ACAP), which is continuing to develop the ACAP specification (CS/101). Of their efforts Smithpeters states, "It's very rewarding to be working so closely with such an extremely talented and diverse group as T3/S2." Smithpeters has been involved with ACAP since 2002 when the first joint ATSC-CableLabs meeting to discuss harmonizing DASE and OCAP was convened, and he actively participated in the many "DCAP" meetings that ensued from June 2002 through September 2003.

After graduating from the University of South Florida's College of Engineering with a B.S. in Information Systems, Smithpeters began a career as a software developer with Capital One in Tampa. Upon discovering that a true IT career was not his real calling, he joined Nielsen Media Research's Technology R&D group in 1999. Smithpeters' main activity at Nielsen was applied research efforts targeted at improving the technology used for television audience measurement. Among the results of his time there are multiple patents pending, and an interest in ATSC standards born during one of his first projects, writing a prototype PSIP parser. During his tenure at Nielsen, Smithpeters was active in several standards organizations and in the development of OCAP and DASE, serving as vice-chair of the ATSC's T3/S17 specialist group.

In 2003 Smithpeters completed an M.B.A. degree at the University of Florida and joined Cox Communications, where he is part of the Multimedia Technology department that is working to develop and deploy advanced services such as interactive television, video on demand, HDTV, and personal video recorders. Smithpeters is in charge of all Cox efforts regarding OCAP and is involved with several other iTV middleware and application deployment efforts. In addition, Smithpeters also represents Cox in multiple industry standards organizations including ATSC, CableLabs, CEA, DVB, Java Community Process, SCTE, and SMPTE. He is currently the specification lead for JSR 242 in the Java Community Process.

Recently relocated to Atlanta from Tampa, he and his wife Lynn are enjoying the change of scenery and lifestyle in their new city. Free time is spent traveling, attending concerts and theater, camping, and hiking with their dog, Rebel. ■



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The ATSC is an international, non-profit organization developing voluntary standards for digital television. The ATSC has member organizations representing the broadcast, broadcast equipment, motion picture, consumer electronics, computer, cable, satellite, and semiconductor industries.

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New from the Society of Motion Picture and Television Engineers

"SMPTE's role is to define the way that the content, including all necessary metadata, is handled in the studio and distribution environments so as to be available at the ATSC encoder," explained Peter Symes, SMPTE Engineering vice president. "Recently we have enjoyed very active and productive cooperation among the ATSC and SMPTE experts, and we look forward to continued efforts to serve all our members."

SMPTE Standard 401M: Extended Content Control Information

Work on Extended Content Control Information (or ExCCI) was started in June 2003 in response to the need for an in-studio mechanism to activate ATSC's Redistribution Control Descriptor "Broadcast Flag." This Standard was recently approved — the fastest ever process of a SMPTE Standard.

Proposed EG 43: System Implementation of CEA-708-B and CEA-608-B Closed Captioning

This Engineering Guideline (EG) provides guidance for system implementation of closed captioning for DTV (DTVCC) as defined in CEA-708-B, concentrating on different techniques that are required for DTVCC implementation when compared to existing captioning systems for NTSC. It identifies the relevant standards that exist for different parts of the system and, where possible, indicates guidelines for areas that are not standardized.

The need for this EG was first identified by the ATSC Implementation Subcommittee. EG 43 has completed trial publication without comment, and is now out for the Standards Committee process review, the final step before publication as an approved Engineering Guideline. Publication should be before the end of June.

Proposed Standard: VC-9 Video Codec

This codec, part of Microsoft Windows Media 9, is one candidate identified by the ATSC Specialists Group on Video and Audio Coding (T3/S6) for use with the E-VSB robust transmission mode. Microsoft has asked SMPTE to consider adoption of the codec as a Standard. Though still at an early stage, substantial progress has been made.

SMPTE Standard 377M

This document specifies the format for MXF (Media eXchange Format) files, critical to many organizations' migration to server-based systems. This basic format document is supplemented by some fifteen additional standards already published and more that are in the trial publication phase, all specifying MXF content and other aspects of this complex technology.

For more information on SMPTE standards, visit www.smpte.org. ■