



*Where Content Comes to Life™*

62ND ANNUAL  
**NAB BROADCAST  
ENGINEERING CONFERENCE**

April 12 – 17, 2008  
Las Vegas, Nevada

**SUMMARY OF PRESENTATIONS**

This booklet contains summaries of the presentations at the 62nd NAB Broadcast Engineering Conference held at the Las Vegas Convention Center, April 12–17, 2008, in association with 2008 NAB Show. The 62nd annual NAB Broadcast Engineering Conference will address the most recent developments in broadcast technology and focus on the opportunities and challenges that face broadcast engineering professionals around the world. The highly technical conference features presenters delivering papers in the various fields of broadcasting. We want to thank our conference partner, the Society of Broadcast Engineers (SBE), for its assistance in developing this year's sessions and for creating a special SBE Ennes Workshop for 2008. We would also like to thank the Institute of Electrical and Electronic Engineers (IEEE) Broadcast Technology Society (BTS) for presenting its BTS Tutorial. Finally, we wish to thank the PBS and NPR engineering communities for supporting this conference.

The full text of many of these presentations is contained in the NAB publication, "The 62nd Annual NAB Broadcast Engineering Conference Proceedings." This book and accompanying CD-ROM are available at any of the NAB store locations at the convention.

Co-produced by:



# TABLE OF CONTENTS

Saturday, April 12, 2008

## The Ennes Workshop presented by SBE

Chairpersons: Lewis Zager, Consultant  
Tom Mikkelsen, MediaFLO USA..... 12

### File-based Workflow 101

Harlan Neugeboren, The Workflow and Technology Group, LLC..... 12

### Opening Remarks

John Poray, Society of Broadcast Engineers..... 12

### Cross Platform: Workflow

Jim O'Brian, Building4Media..... 12

### Video Timing and Synchronization in a Web Services Environment

Al Kovalick, Avid Technology..... 12

### Understanding and Describing File-based Workflow

Clyde Smith, Turner Broadcasting..... 12

### Broadcast Exchange Format

Chris Lennon, Harris Broadcast Communications..... 13

### A Brief History of the Second

Al Kovalick, Avid Technology..... 13

### Implementing Workflow Changes

John Luff, Television Technology Consultant..... 13

### Business Process Analysis

John Footen, National TeleConsultants..... 13

### Codec Performance

Michael Wellings, ResearchChannel..... 13

### File-Based Transmission Process

John Wadle, OmniBus Systems Inc. .... 14

### Pathfire's Distribution of Files and the Impact on File Based Workflow

Joe Fabiano, Blue Sky Holdings, LLC..... 14

Saturday, April 12, 2008

## IEEE BTS Tutorial

Chairperson: Tom Gurley, IEEE..... 15

### Introduction-IEEE-BTS

Tom Gurley, IEEE..... 15

### Overview of ATSC Process

Mark Aitken, Sinclair Broadcast Group..... 15

## LG Electronics/Zenith/Harris "MPH" Proposal

Wayne Bretl, Zenith LG Electronics Corp  
John Mailhot, Harris Broadcast Communications..... 15

## Samsung/Rohde & Schwarz/Nokia Proposal

Junehee Lee, Samsung  
Joonsoo Lee, Samsung..... 15

## Thomson/Micronas Proposal

David Campana, Thomson  
Richard Citta, Linx Electronics  
Wen Gao, Thomson..... 15

Wrap-up..... 15

Sunday, April 13, 2008

## NAB Broadcast Engineering Conference Opening Session

Chairperson: Lynn Claudy, NAB..... 16

## We Can Work Together: Advice to DTV and HD Radio Engineers from the Consumer Electronics Retail Community

Diane Warren, HD Digital Radio Alliance  
Robert Schwartz, Consumer Electronics Retail Coalition..... 16

## DTV Broadcasting for Mobile and Handheld

Chairperson: Dave Converse, ABC/Disney Television Stations Group  
Mark Richer, Advanced Television Systems Committee..... 16

### Panel

## Managing the Unmanageable: Transforming Media for MultiChannel, Multiplatform Delivery

John Pallett, Telestream, Inc. .... 16

## Producing vs. Repurposing for Multiple Platforms

Pete Sockett, WRAL TV..... 17

## Make Your Mobile TV Network a Reality

Jean Macher, Thomson Grass Valley..... 17

## Creating Content for Broadcast, Film and the Internet

Michael Castro, National Geographic Television..... 18

## Local and Ultra Local Content in Broadcast MobileTV

Richard Lhermitte, Enensys Technologies..... 18

## The Role of File-based Workflows and Metadata in Repurposing Content for the Web and Mobile TV

Mark Bishop, Thomson..... 19

## Leveraging FEC Advances to Optimize DVB-H Networks

Marshall Porter, Digital Fountain..... 19

## New Techniques for Mobile TV Broadcasting based on ISDB-T

Masahiro Okano, NHK..... 20

Summary of Presentations..... 3

|   |    |
|---|----|
| <b>Preserving SFN in a Mobile TV Broadcast Network Using IP Distribution</b><br><i>Nicolas Fannechere, Enensys Technologies</i> .....                                     | 20 |
| <b>Encoding for Mobile TV - Lessons Learned for Successful Deployments</b><br><i>Boris Felts, Envivio Inc</i> .....   | 21 |
| <b>Digital Opportunities for Radio</b><br><i>Chairperson: Paul Shulins, Greater Media</i> .....   | 22 |
| <b>Conditional Access: The Next Stage in HD Radio™ Evolution</b><br><i>Tom Rucktenwald, NDS</i> .....   | 22 |
| <b>Managing Radio Metadata for Multiplatform Digital Distribution</b><br><i>Daniel Mansergh, KQED Public Radio</i> .....  | 22 |
| <b>The Future of Radio in a Changing World</b><br><i>Dave Wilson, CEA</i> .....   | 22 |
| <b>Seeding The Internet — Automating Podcasting with Open Source Tools</b><br><i>Frederick Gleason Jr., Paravel Systems LLC</i> .....                                     | 23 |
| <b>Digital Opportunities for Radio</b><br><i>Laura Jensen, NPR</i><br><i>Melinda Driscoll, American Public Media</i><br><i>Nick Kereakos, American Public Media</i> ..... | 23 |
| <b>Radio Technology Advancements</b><br><i>Chairperson: Milford Smith, Greater Media, Inc.</i> .....  | 23 |
| <b>Radio Broadcasters: Building File-Based Networks</b><br><i>Gary Pelkey, Wegener</i><br><i>Eric Wiler, Jones Radio Network</i> .....                                    | 23 |
| <b>HD Audio Quality and Netcasting</b><br><i>Greg Ogonowski, Orban/CRL, Inc.</i> .....  | 24 |
| <b>From ITM to ITWOM: Correcting, Completing, and Updating the Longley-Rice Irregular Terrain Model</b><br><i>Sid Shumate, Givens &amp; Bell, Inc</i> .....               | 24 |
| <b>Can the Public Internet be Used for Broadcast Applications?</b><br><i>Simon Daniels, APT</i> .....   | 25 |
| <b>A New Approach to Peak-to-Average-Power Reduction for FM IBOC Transmission</b><br><i>Philipp Schmid, Nautel</i> .....  | 25 |
| <b>Field Tests and Service Area and Handover Service in T-DMB</b><br><i>SangHun Kim, KBS</i> .....  | 25 |
| <b>An Improved Coverage Prediction Method for HD Radio</b><br><i>John Kean, National Public Radio Labs</i> .....  | 26 |

|  |    |
|--|----|
| <b>Brazil's Digital Radio Technology Choices</b><br><i>Acacio Luiz Costa, Mix TV Network</i> .....   | 26 |
| <b>Advances in Digital Measurement Technique for FM Broadcast</b><br><i>Tony Peterele, Audemat Inc.</i><br><i>Frederic Allard, Audemat Inc</i> ..... | 27 |

---

**Monday, April 14, 2008**

---

|  |    |
|--|----|
| <b>DTV Reception Issues</b><br><i>Chairperson: Al Grossniklaus, WTHR NBC 13</i> .....  | 27 |
| <b>DTV Reception in an Urban Environment</b><br><i>William Meintel, Meintel, Sgrignoli, &amp; Wallace, LLC</i> .....                                   | 27 |
| <b>New Neighbors: Can Wireless Microphones and Consumer Devices Coexist In the White Spaces?</b><br><i>Christopher Lyons, Shure Incorporated</i> ..... | 27 |
| <b>Measurement Results of Consumer Indoor Antennas</b><br><i>Dennis Wallace, Meintel, Sgrignoli, &amp; Wallace</i> .....                               | 28 |

---

**Monday, April 14, 2008**

---

|  |    |
|--|----|
| <b>Communicating with Management</b><br><i>Chairperson: Chriss Scherer, Radio magazine</i> .....   | 28 |
| <b>Communicating with Management Presentation</b><br><i>John Bisset, Broadcast Electronics</i> .....   | 28 |
| <b>Communicating with Management Panel</b><br><i>Don Kelley, Greater Media</i><br><i>Gary Kline, Cumulus Media</i><br><i>David Isreal, WFYV-FM/WMXQ-FM</i><br><i>Paul Tinkle, Thunderbolt Broadcasting Company</i> ..... | 28 |
| <b>TV News and Live Production</b><br><i>Chairperson: Wayne Kube, Belo Corporation</i> .....   | 28 |
| <b>News ML-G2: Metadata for News Exchange</b><br><i>Jean-Pierre Evain, European Broadcasting Union (EBU)</i> .....   | 29 |
| <b>Advanced Video Image Technologies for Live Sports TV Productions</b><br><i>Kimihiro Tomiyama, NHK</i> .....   | 29 |
| <b>Managing Multiformat Images for the Broadcast News Environment</b><br><i>Karl Paulsen, Azcar Technologies</i> .....   | 29 |
| <b>Live Integrated Production Systems Streamline Live Workflow</b><br><i>Ken Swanton, Broadcast Pix</i> .....  | 30 |

|  |    |
|--|----|
| <b>Best Practices: Using IP in Broadcast TV</b><br><i>Joel Wilhite, Harmonic Inc.</i> .....  | 30 |
| <b>High Definition Electronic News Gathering (HD-ENG) Field Test Report</b><br><i>Walter Sidas, CBS Broadcast Inc</i> .....                      | 31 |
| <b>Making Field Applications Bandwidth Efficient</b><br><i>Mick Gardina, iDirect Technologies</i> .....  | 31 |
| <b>NBC Universals New IPTV Distribution System</b><br><i>Robert Goldfarb, NBC-Universal</i> .....  | 31 |
| <b>Understanding and Implementing an Ultra-fast Time-To-Air Workflow by Integrating Metadata</b><br><i>Ed Casaccia, Thomson</i> .....            | 31 |
| <b>Alternative STL Technologies</b><br><i>Chairperson: Paul Shulins, Greater Media</i> .....   | 32 |
| <b>The HD Radio STL: Issues, Options and Technologies</b><br><i>Bob Band, Harris Broadcast Communications</i> .....                              | 32 |
| <b>The Best of Synchronous with the Best of IP</b><br><i>Guy Gampell, APT</i> .....  | 32 |
| <b>Robust HD Radio Exporter to Exgine Architecture</b><br><i>Tim Anderson, Harris Broadcast Communications</i> .....                             | 33 |
| <b>Digital Radio Worldwide</b><br><i>Chairperson: Barry Thomas, Lincoln Financial Media</i> .....  | 33 |
| <b>Bandwidth &amp; Frequency Allocation Issues in International Digital Radio AM &amp; FM Broadcasting</b><br><i>Chuck Kelly, Nautel</i> .....   | 33 |
| <b>New Standards and Codecs for European Digital Broadcasting</b><br><i>Olaf Korte, Fraunhofer IIS</i> .....                                     | 33 |
| <b>Mobile Coverage Optimization by Polarization Diversity in VHF and UHF Propagation</b><br><i>Myron Fanton, Electronics Research, Inc</i> ..... | 36 |
| <b>Does Your Yotta Byte?</b><br><i>Andrew Janitschek, Radio Free Asia</i> .....  | 36 |

**Tuesday, April 15, 2008**

|  |    |
|--|----|
| <b>Video Content Creation &amp; Manipulation</b><br><i>Chairpersons: John Turner, Turner Engineering,<br/>Craig Tanner, Consultant</i> ..... | 37 |
| <b>File Formats in Television Archiving and Content Exchange</b><br><i>Peter Thomas, Blue Order Solutions AG</i> .....                       | 37 |

|  |    |
|--|----|
| <b>Watermarking and Fingerprinting: The Wave of the Future</b><br><i>Andy Nobbs, Teletrex</i> .....  | 37 |
| <b>Non-Real-Time Services</b><br><i>Richard Chernock, Triveni Digital</i> .....  | 38 |
| <b>All-Digital Media: Best Methods for Integrating and Distributing</b><br><i>Robert Lemer, Gefen</i> .....                                      | 38 |
| <b>BXF - The Promise of Reduced Costs and Increased Revenues</b><br><i>Chris Lennon, Harris Broadcast Communications</i> .....                   | 39 |
| <b>Seam Carving for Video</b><br><i>Michael Knee, Snell &amp; Wilcox Ltd</i> .....   | 39 |
| <b>An Integrated, File-Based Production Workflow for High Definition Television</b><br><i>Luk Overmeire, VRT Medialab</i> .....                  | 39 |
| <b>From MXF to SOA</b><br><i>Ernesto Santos, MOG Solutions</i> .....   | 40 |
| <b>Migration to All-IP Infrastructures for Distribution of Broadcast Services</b><br><i>Tom Lattie, Harmonic Inc</i> .....                       | 40 |
| <b>Forensic Marking for HD VoD and Broadcast Services</b><br><i>Pascal Marie, Thomson</i> .....  | 41 |
| <b>Camera to Home – Managing Aspect Ratio through the Production and Distribution Process</b><br><i>Larry Thaler, NBC-Universal</i> .....        | 41 |
| <b>Leveraging IT Technologies and Concepts to Enhance HD Sports Programming</b><br><i>Luis Estrada, IBM</i> .....                                | 42 |
| <b>Viewer Contribution – Dealing with Massive Media</b><br><i>Fred Fourcher, Bitcentral</i> .....  | 42 |
| <b>The State of Broadcast Automation</b><br><i>Sid Guel, Broadcast Automation Consulting</i> .....   | 42 |
| <b>New Technologies for Radio Listening</b><br><i>Chairperson: Steve Fluker, Cox Radio/Orlando</i> .....   | 43 |
| <b>Utilizing IP Networks for Seamless FM Simulcasting over Multiple Transmitters</b><br><i>Junius Kim, Harris Broadcast Communications</i> ..... | 43 |
| <b>Practical Considerations of Radio Broadcast Operations in an Arbitron PPM™ Market</b><br><i>Larry Paulausky, Greater Media, Inc</i> .....     | 43 |

**Consumer Ratings of Impaired Audio at Various Signal Noise Ratios**

*Elynn G. Sheffield, PhD, NPR Labs*  
*John Kean, National Public Radio Labs*..... 44

**Data Services for Digital Broadcasting**

*Alexander Zink, Fraunhofer IIS*..... 44

**Affordable IP Based Remote Monitoring and Control of Transmitter Sites**

*Johannes Rietschel, Barix AG*..... 44

**Audio over IP**

*Chairperson: Talmage Ball, Bonneville International*..... 45

**IP Based Audio and Control Distribution over Internet, Satellite, and Wireless Platforms**

*Johannes Rietschel, Barix AG*..... 45

**Rapid Radio Deployment Pack - Emergency Edition**

*Pierre Robidoux, CBC/Radio-Canada*..... 45

**Advanced Tech for IP Remotes**

*Steve Church, Telos Systems*..... 46

**Future Broadcast Technologies – A Worldwide Perspective**

*Chairperson: David Wood, EBU*..... 46

**Panel**

*Andy Bower, BBC*  
*Bernard Caron, Communications Research Center*  
*Klaus Illgner, IRT*  
*Alberto Morello, RAI*  
*K. Tanioka, NHK*  
*Colin Whitbread, BBC*..... 46

**Next Generation Public Alerting**

*Chairperson: Clay Freinwald, Entercom*..... 46

**Opening Remarks**

*Derek Poarch*..... 46

**Panel**

*Jerry LeBow, Sage Alerting Systems*  
*Darryl Parker, TFT Inc.*  
*Edward Czarnecki, SpetraRep*..... 46

---

**Wednesday, April 16, 2008**

---

**Monitoring and Measurements in the Broadcast Plant – TV**

*Chairperson: John Merrill, CBS5 KPHO-TV*..... 47

**Optimizing the QC Process in a File-based Workflow Facility**

*Rob Zwiebel, Harris Broadcast Communications*..... 47

**System Wide Video Quality Assurance**

*Ralph Bachofen, Triveni Digital Inc.*..... 47

**Controlling and Measuring Loudness for Digital Television Broadcast**

*Michael Babbitt, Dolby Laboratories*..... 48

**Reducing the Effects of Bit Errors in Serial-Digital Interface Links**

*Paul Briscoe, Harris Broadcast Communications*..... 48

**Television RF & Transmission Systems**

*Chairpersons: Louis Libin, Broadcomm*  
*Victor Tawil, MSTV*..... 48

**Implementing an 8-Transmitter Distributed Transmission Network**

*S. Merrill Weiss, Merrill Weiss Group LLC*..... 48

**Antennas for Distributed Transmission and Single Frequency Networks**

*Myron Fanton, Electronics Research, Inc*..... 49

**Evaluation of Buildings Penetration Loss for 100 Buildings in Belgium**

*David Plets, Ir., Ghent University/IBBT*..... 49

**Vertical Polarization for UHF DTV**

*Kerry Cozad, Dielectric Communications*..... 49

**A Mobile Television Transmitting Facility**

*William Hayes, Iowa Public Television*..... 50

**RF Coverage and Tower Motion**

*Myron Fanton, Electronics Research, Inc*..... 50

**Field Test of the Distributed Translators in Korea**

*Young-Woo Suh, KBS*..... 50

**Monitoring and Measurements in the Broadcast Plant – Radio**

*Chairperson: Talmage Ball, Bonneville International*..... 51

**Grounding Systems Why Important & Why Testing is Invalid 95% of the time**

*John Howard, Lyncole XIT Grounding*..... 51

**Measurements in Broadcast Transmission Systems**

*Tim Holt, Bird Technologies Group*..... 51

**The Role of the Detector in Spectrum Analyzer Measurement of Hybrid Digital Signals**

*David Maxson, Broadcast Signal Lab*..... 52

**RF Measurement Techniques for Broadcast Engineers**

*Myron Fanton, Electronics Research, Inc.*..... 52

**RF Signal Performance Measurements of Consumer FM Receivers and Coverage Effects**

*John Kean, National Public Radio..... 53*

**Fiber Optic Antenna Monitoring for Computer Modeled AM Directional Arrays**

*James Dalke, Dalke Broadcast Services, Inc..... 53*

**Technology Luncheon**

**Keynote: Funny, You Don't Look Like Your Avatar: New Media Conquers Old Problems**

*Ira Flatrow ..... 54*

**NAB Engineering Achievement Award Winners**

*Tom Silliman..... 55*

*Tony Uyttendaele ..... 56*

**Radio RF & Transmission Systems**

*Chairperson: Gary Kline, Cumulus Media..... 57*

**Save That Tower!**

*Anne Gabriel, Current: The Newspaper about Public TV & Radio ..... 57*

**AM Co-location-Money on the Table?**

*Lawrence Behr, LBA Technology, Inc. .... 57*

**Radio Transmitter Site Maintenance Back to Basics**

*Paul Shulins, Greater Media..... 57*

**Implications of IBOC Injection Levels above -20dB**

*Gary Liebisch, Nautel..... 57*

**FM IBOC Building Penetration Tests at Elevated Digital Subcarrier Levels**

*E. Glynn Walden, CBS Radio..... 58*

**Linear Effects of AM Narrow Band Antenna Systems: Characterization by Direct Measurement and Transmitter Based Equalization**

*Ben Dawson, Hatfield & Dawson*

*Tim Hardy, Nautel..... 58*

**Free Software Tools for Design of AM Antennas**

*Van Richards-Smith, RadioTab Network ..... 58*

**Amateur Radio Operator's Reception ..... 59**

---

Thursday, April 17, 2008

---

**Codecs, Compression Systems and Scaling for Video**

*Chairperson: Graham Jones, NAB..... 59*

**10 bit High Quality MPEG-4 AVC Video Compression**

*Matthew Compton, Tandberg Television..... 59*

**Practical Applications of Compression Standards**

*Todd Roth, Harris Broadcast Communications..... 60*

**Providing Spatial Scalability Using Scalable Video Coding to Mobile Broadcasting**

*InJoon Cho, Korean Broadcasting System..... 60*

**Scalable Video Coding and Broadcast Delivery of 1080P High Definition**

*Elie Sader, Harmonic Inc..... 60*

**Understanding and Implementing JPEG 2000 Compression for Long-form EFP Acquisition**

*John Naylor, Thomson..... 61*

**Bridging the Gap with HD Transcoding**

*Tim Simerly, Texas Instruments ..... 61*

---

Thursday, April 17, 2008

---

**Technology Innovations**

*Chairperson: Charles Jablonski, Consultant..... 62*

**Super Hi-Vision Transmission Experiment in the 21GHz Band**

*Hisashi Sujikai, NHK..... 62*

**HDMI as Television Application Platform for Interactive and More**

*Rainer Zwing, Thomson*

*Scott Francis, Thomson..... 62*

**11.88 Gb/s – Continuing the Evolution of SDI**

*Gareth Heywood, Gennum Corp*

*Ryan Latchman, Gennum Corp..... 63*

**Audio Mixing Requirements in Next Generation Broadcast Receivers for Audio Description and Other Enhanced Features**

*Roland Vlaicu, Dolby Laboratories..... 63*

**HDTV System on the Lunar Explorer Kaguya (SELENE)**

*Seiji Mitsuhashi, NHK..... 63*

Saturday, April 12, 2008 • 8 a.m. – 5:15 p.m.  
Las Vegas Convention Center • Room S219/S220

## The Ennes Workshop presented by the Society of Broadcast Engineers (SBE)

*Chairperson: Tom Mikkelsen, MediaFLO Inc., San Diego, Calif.*

*Chairperson: Lewis Zager, Consultant, Arlington, Va.*

**8 a.m.**

### File-based Workflow 101

This year's early-bird tutorial covers the basics of file-based workflow from acquisition through playback and archiving.

*Harlan Neugeboren, The Workflow and Technology Group, LLC, Stamford, Conn.*

**9 a.m.**

### Opening Remarks

*John Poray, Society of Broadcast Engineers, Indianapolis, Ind.*

**9:10 a.m.**

### Cross Platform Workflow

The days of one manufacturer supplying all parts of a broadcast system have largely faded as IT and file-based workflows grow in use across multiple manufacturers. Newsrooms are PCs, a growing number of editors and graphics suites are Macs, cameras output MXF but QuickTime is primarily used in digital file exchange for editing and compositing. Broadcasters' focus is on-air but simultaneous new media output is increasingly important, zoned advertising is underway and addressable advertising is coming. Discussed in this presentation are design considerations and developments in cross platform media operations and automation.

*Jim O'Brien, Building4Media, Los Angeles, Calif.*

**9:55 a.m.**

### Video Timing and Synchronization in a Web Services Environment

Covered in this presentation are the essentials of timing concepts across distributed software systems. With software becoming more important in all dimensions of video, this presentation covers the salient aspects of how to achieve frame accurate video control using Web services and Service Oriented Architecture (SOA) concepts.

*Al Kovalick, Avid Technology, Santa Clara, Calif.*

**10:35 a.m.**

### Understanding and Describing File-based Workflow

Material Exchange Format (MXF), Advanced Authoring Format (AAF), Broadcast Exchange Format (BXF), high-speed packetized networks, inexpensive computer platforms – all the enabling technologies have been developed. All that remains is to build file-based workflows. This presentation highlights efforts by users and manufacturers to develop and deploy file-based workflow solutions in the broadcast environment. Efforts to create a common understanding of the problem and the words used to describe it will be discussed. The presentation also brings into focus the fact that user-driven business analysis is required if these efforts are to be successful. Find out how organizations in the industry are working together to come up with proposals which solve real-world issues around file-based workflows.

*Glyde D. Smith, Turner Broadcasting Systems, Inc., Atlanta, Ga.*

**11:20 a.m.**

### Broadcast Exchange Format

Much has been written and said about BXF (Broadcast eXchange Format): it will eliminate Master Control Operators, automate ingest, turn traffic into a 24/7 operation, etc. This tutorial will sort through the hype and go into exactly what BXF was designed to do, what it can do today and what it might do in the future. Explored in this presentation are use cases, as well as the schema itself, with an eye toward making attendees much better versed on this promising new Society of Motion Picture and Television Engineers (SMPTE) standard.

*Chris Lennon, Harris Broadcast Communications, Mason, Ohio*

**1:15 p.m.**

### A Brief History of the Second

Covered in this presentation is development of timekeeping from water clocks to cesium fountain clocks to GPS and SMPTE 12M, and tying this discussion into to the needs of broadcasters.

*Al Kovalick, Avid Technology, Santa Clara, Calif.*

**1:30 p.m.**

### Implementing Workflow Changes

Changing from tape-based linear workflow in a broadcast plant to a file based non-linear workflow brings with it great benefits and significant challenges in implementation, training, maintenance and recruiting. A change this fundamental is, by nature, disruptive of existing methods. Discussed in this presentation are the planning and implementation of these changes from a holistic approach, centered on defining goals and managing change.

*John Luff, Television Technology Consultant, Sewickley, Pa.*

**2:15 p.m.**

### Business Process Analysis

Business Process Analysis is a structured methodology for defining workflow. Presented here is a discussion of workflow analysis as a critical component of defining the requirements for a system and therefore for assisting in selecting technologies for an organization. The presentation focuses on Service-Oriented Architecture (SOA), an architectural approach to systems design that best provides flexibility to change workflow over time as business requirements change. Also discussed are Business Process Management (BPM) technologies which allow the orchestration of complex workflows across multiple systems. The talk covers media-specific applications of these concepts and the very practical steps which can be taken by a broadcaster or media facility.

*John Footen, National TeleConsultants, Glendale, Calif.*

**3 p.m.**

### Codec Performance

High-definition video has exploded in the mainstream consumer and professional marketplace, and it is finding its way into research and education applications. But the varied array of HD formats, resolutions, cameras, recorders and codecs makes for a staggering, and sometimes confusing, amount of options. To put it all in perspective, the engineers at the University of Washington and the ResearchChannel have analyzed HD codec performance and documented their results. Engineering Director Michael Wellings presents this data, along with an illustrative HD video showing codec loss using the SMPTE StEM uncompressed Mini-Movie.

*Michael Wellings, ResearchChannel, Seattle, Wa.*

3:45 p.m.

### Filed-Based Transmission Process

The impact of file-based content on broadcast workflows has focused initially on new methods of content acquisition and preparation, and the subsequent management of file-based content libraries. These file-based workflows rely on several new technologies including wrapper formats for metadata, broadband delivery of encoded content, use of low-resolution content proxies and hierarchical storage management. At the end of these new workflows, air-ready content files are typically delivered to legacy video servers for transmission.

In parallel with these workflows for primary video content, each type of secondary content such as graphics, additional audio and subtitles/captions is most often processed independently using the tools provided by manufacturers of the relevant broadcast devices. In other words, the workflows used to acquire, produce, prepare and manage video content do not apply to secondary content. Most critically the processes of managing primary and secondary content, and staging this content for air (e.g. caching), are often unique for each content type. One cause of this persistent disparity in workflows is the use of multiple special-purpose broadcast devices for the transmission process and the resultant, unique workflows imposed by these devices. As IT hardware increasingly provides the platform for file-based workflows, a logical next step is the extension of standard IT platforms into the master control suite as the host for a software-based transmission process.

This presentation will explore the impact and benefits of deploying a software-based transmission system in conjunction with file-based content workflows. Using the example of a typical transmission sequence of primary and secondary events, the steps involved in content acquisition, preparation, storage and staging of the content elements required and the processing of those elements by a software-based transmission system are examined.

*John Wadle, OmniBus Systems Inc, Lakewood, Colo.*

4:30 p.m.

### Pathfire's Distribution of Files and the Impact on File Based Workflow

Many of the HDTV standards are new enough that the ink is not yet dry. Pathfire has implemented a cross-vendor system that allows content from many source devices to be processed, objectified and distributed via IP network. At the receive end, the high-level features of this system include 16 channels of compressed editable audio (E2), MPEG2, high profile, high level content, 4:2:2 encoding, full metadata content including show rundown and edit decision list (EDL) for reassembly of show and ad content. This content is spliced, transcoded and delivered to eight different server platforms for playback. Four of these servers can take the content delivered over the network and splice and play it out natively with no transcoding required. The vertical ancillary data space (VANC) includes, closed captions (608 and 708 flavors), broadcast flag and audio metadata. This system also operates with content being moved automatically through receive gear, transcoding, splicing, file-transfer to server, automation system notification and update and play-out-to-air using an early BXF implementation known as Automation Connect.

*Joe Fabiano, Bright Sky Holdings, LLC, Alpharetta, Ga.*

Saturday, April 12, 2008 • 1 – 5 p.m.  
Las Vegas Convention Center • Room S226/227

## IEEE Broadcast Technology Society (BTS) Tutorial: Proposed ATSC Mobile/Handheld Systems

*Chairperson: Tom Gurley, IEEE Broadcast Technology Society,  
Washington, D.C.*

Co-produced by



1 p.m.

### Introduction-IEEE-BTS

*Tom Gurley, IEEE Broadcast Technology Society, Washington, D.C.*

1:15 p.m.

### Overview of Advanced Television Systems Committee (ATSC) Process

*Mark Aitken, Sinclair Broadcast Group, Cockeysville, Md.*

1:45 p.m.

### LG Electronics/Zenith/Harris "MPH" Proposal

*Wayne Bretl, Zenith Electronics Corp., Lincolnshire, Ill.*

*John Mailhot, Harris Broadcast Communications, Mason, Ohio*

2:45 p.m.

### Samsung/Rohde&Schwarz/Nokia Proposal

*Junehee Lee, Samsung, Ridgefield, N.J.*

*Joonsoo Lee, Samsung, Ridgefield, N.J.*

3:45 p.m.

### Thomson/Micronas Proposal

*Richard Citta, Linx Electronics, Palatine, Ill.*

*David Campana, Thomson, Princeton, N.J.*

*Wen Gao, Thomson, Princeton, N.J.*

4:45 p.m.

### Wrap-up

Sunday, April 13, 2008 • 9 – 9:30 a.m.  
Las Vegas Convention Center • Room S219/S220

## Broadcast Engineering Conference Opening Session

*Chairperson: Lynn Claudy, NAB, Washington, D.C.*

**9 a.m.**

### **We Can Work Together: Advice to DTV and HD Radio Engineers from the Consumer Electronics Retail Community**

Now that digital television (DTV) and HD Radio™ are on the air and receivers are in the marketplace, feedback from the consumer electronics retail world can help optimize these new services and increase the value proposition to consumers. In this keynote session, experts in retail issues associated with digital broadcasting will offer actionable advice from the consumer retail world that can be productively used in the broadcast engineering world to make the digital broadcasting services even more compelling. Robert Schwartz, a partner in the Washington, D.C. office of Constantine Cannon LLP and counsel to the Consumer Electronics Retailers Coalition, will cover DTV and Diane Warren, executive vice president for the HD Digital Radio Alliance, will talk about HD Radio in this insightful session.

*Diane Warren, HD Digital Radio Alliance, San Antonio, Texas*

*Robert Schwartz, Consumer Electronics Retailers Coalition, Washington, D.C.*

Sunday, April 13, 2008 • 9:30 a.m. – 5 p.m.  
Las Vegas Convention Center • Room S219/S220

## **DTV Broadcasting for Mobile and Handheld**

*Chairperson: Mark Richer, Advanced Television Systems Committee, Washington, D.C.*

*Chairperson: Dave Converse, ABC/Disney Television Stations Group, Burbank, Calif.*

**9:30 a.m.**

### **Panel**

*Mark Richer, Advanced Television Systems Committee, Washington, D.C.*

*John Godfrey, Samsung, Washington, D.C.*

*Wayne Luplow, Zenith/LG Electronics Corporation, Lincolnshire, Ill.*

*Dave Glenn, ION Media TV, St. Petersburg, Fla.*

*David Virag, Thomson, Indianapolis, Ind.*

**11 a.m.**

### **Managing the Unmanageable: Transforming Media for Multichannel, Multiplatform Delivery**

Content owners must quickly respond to a rapidly changing video environment, which includes publishing media to multiple platforms, including Web, mobile, Internet Protocol Television (IPTV) and video on demand (VOD). The multiplatform delivery challenge is complicated by the need to manage a multiformat workflow environment which not only supports transcoding between a broad range of input and output media file formats and devices, but extracting metadata, resizing, reshaping, branding and internationalizing media. This dynamic market affects traditional broadcast and cable companies as well as a complex environment of new service providers, including content aggregators, media hosting companies, Web portals and distribution networks.

For all, several key issues must be addressed. Transcoding to a broad range of input and output media file formats and resolutions are essential. The ability to automatically integrate the business rules of content owners and distributors is important, particularly in high-volume workflows. Extracting and inserting metadata which describes the media is critical for cataloging and search functions. Reshaping or tailoring media to meet the needs of each distribution platform is another key consideration, including format and length, the addition of bumpers, trailers, branding, subtitles and graphics. And, for some, being able to filter and handle user-generated source content from an extremely broad range of devices is now important. The extent to which these processes can be automated with flexible software solutions, the greater the opportunity to ensure consistent, reliable results, save time, effort and money while growing the bottom line.

*John Pallett, Telestream, Inc., Nevada City, Calif.*

**11:30 a.m.**

### **Producing vs. Re-purposing for Multiple Platforms**

Many stations repurpose their broadcast by recording the output to air then chopping it up for the Web. WRAL does not repurpose their video rather they produce for multiple platforms. This means that the fonts, graphics and image shown on each screen are legible and truly meet the viewer's expectations. When news is gathered and aired in HD with fonts, graphics and layout intended for a 50-inch HD display, simply shrinking this image leaves the fonts and graphics marginally legible. In addition a small 16X9 screen letterboxed on the Web or cell phone makes the subject matter look distant and lose impact. By producing specifically for cable, the Web, cell phones and small video players, WRAL delivers their viewers the highest quality news when and where they want it. Viewers have perceived the difference and have made the WRAL Web site number one per capita of any newspaper or television Web site in the country. Discussed in this presentation are the specifics of how WRAL produces for their 24-hour cable channel, Web site and WRAL's cell phone video service News over Wireless.

*Pete Sockett, WRAL TV, Raleigh, N.C.*

**1 p.m.**

### **Make Your Mobile TV Network a Reality**

With mobile television now moving from trials to commercial rollouts, it is important to ensure that the right technology is selected to support the business plan. Brought together in this presentation are the many technical elements required to create a service that appeals to audiences and can be delivered profitably.

Such a service requires an extension of broadcast skills in playing out content that is tailored for the medium, but it also has unique demands in the head-end and transmission chain. The presentation will look at many of the elements, including: network sharing and the multi-network operator approach how statistical multiplexing can make the best use of the bandwidth available, configuring the electronic service guide to optimize download and work consistently across a range of handsets considerations for digital video broadcast – handheld (DVB-H), IP encapsulation transmitter optimization, including achieving good indoor coverage as well as outdoor and network planning and redundancy. The presentation will draw on examples from working systems, and will address both operational and engineering considerations.

*Jean Macher, Thomson Grass Valley, Beaverton, Ore.*

**1:30 p.m.**

### **Creating Content for Broadcast, Film and the Internet**

Before broadband, companies produced programming for film and television. With the introduction of new media, how do you expand production capabilities to effectively meet demands of various platforms hungry for quality programming? Discussed are the challenges of aggressively expanding to accommodate a variety of audiences using different mediums, while keeping the editorial integrity of the programming. Also covered is the impact new media, including HD video, has on the operations of both the production and post production units. Celebrating 40 years of television production, National Geographic Television (NGT) continues to expand their own capabilities to meet the demands of the National Geographic Channel (NGC) as well as third parties such as PBS and the broadcast cable networks and now broadband.

*Michael Castro, National Geographic Television, New York, N.Y.*

**2 p.m.**

### **Local and Ultra Local Content in Broadcast Mobile TV**

Analysts announce broadcast mobile TV as next year's killer service. Broadcast mobile TV is already covered by different standards and has been launched using a varied range, including DVB-H, T-DMB and MediaFLO. These deployments and trials use existing national services and analyzing user feedbacks and needs for local contents, like regional channels, have been demonstrated. Ultra-local contents, like specific mall/area live services or event/stadium dedicated content, have been pointed out as natural extension.

This presentation will focus on broadcast mobile TV local content management and will detail ultra-local content delivery issues. Local services management and delivery can be done using centralized or distributed architectures. Depending on the broadcast network's characteristics (distribution network, SFN/MFN, etc.) each architecture has specific benefits and limitations. Ultra-local content delivery also bears specific issues. Due to the potential high number of services, global management could be difficult and specific distribution complex. Technical aspects must be solved to achieve ultra-local content providers' independence. Yet this independence implies that mobile TV service providers will not validate all the content delivered to end-users and must accept that subscribers' devices will display other services than their selected offering.

*Richard Lhermitte, Enensys Technologies, Rennes, France*

**2:30 p.m.**

### **The Role of File-based Workflows and Metadata in Repurposing Content for the Web and Mobile TV**

With many organizations recognizing that the majority of their future revenue growth will come from alternative ways to deliver their content, file-based workflows can provide the ability to customize content for multiple delivery streams through a create once publish everywhere (COPE) concept. Leveraging metadata, media outlets will transform themselves from traditional broadcasters to multidimensional content publishers—a key to securing their economic future.

Attendees will learn how by using COPE traditional and well-understood workflow that creates the primary media for television distribution doesn't need to change. It is simply supplemented through the insertion of content flagged with metadata that represent the specific areas of content that are going to be repurposed in one or more ways. In this way, users create associations not only with the audio and video essence, but also with descriptive metadata – who, what, when and where.

Attendees will discover that once proper metadata tags are inserted within a piece of content, it is the distribution medium itself which determines how those tags are used. That will include re-editing and re-framing, replacing broadcast style graphics with something more suited to the target device, and transcoding into the right compression format and bit rate for the delivery platform.

*Mark Bishop, Thomson, Beaverton, Ore.*

**3 p.m.**

### **Leveraging FEC Advances to Optimize DVB-H Networks**

Mobile broadcast networks such as digital video broadcasting – handheld (DVB-H) hold great promise for taking mobile entertainment to the next level, both in ubiquity and in terms of facilitating a more robust mobile consumer experience. Broadcast networks allow operators to scale, creating an environment that facilitates a new paradigm of content consumption. Operators today, however, have two main concerns with a DVB-H network.

The downside to DVB-H mobile broadcast networks is that the infrastructure costs run into the hundreds of millions of dollars per country. As with mobile unicast networks, operators or broadcasters (and sometimes a consortium of operators working with a managed service provider), must deploy a complex physical infrastructure to blanket the covered territory. By some estimates, a DVB-H network build-out to cover the U.S. alone could approach \$800 million. Yet by deploying advanced technologies designed to optimize content delivery, mobile operators can increase link margins by upwards of 8 dB, ultimately allowing operators to deploy broadcast services with far less physical infrastructure. The increased link margin results in a drop of the required capital expenses by 25 percent or more, meaning that operators can save hundreds of millions of dollars in infrastructure costs, directly affecting the bottom line.

This presentation will address the challenges unique to the build-out and deployment of streaming video services over a broadcast infrastructure, and will communicate to operators and broadcasters how those challenges can be overcome through the adoption of unique technologies to optimize content delivery.

*Marshall Porter, Digital Fountain, Fremont, Calif.*

**3:30 p.m.**

### **New Techniques for Mobile TV Broadcasting Based on ISDB-T**

Mobile interactive TV service, called One-Seg, launched in Japan in April 2006. One-Seg is based on Integrated Services Digital Broadcasting – Terrestrial (ISDB-T), which is the digital terrestrial television broadcasting system widely deployed in the country. One-Seg has become popular in Japan as the new digital service for interactivity and for enjoying broadcasts anywhere, anytime.

Shipments of cellular phone-type One-Seg receivers reached about 11 million by the end of July 2007. In this presentation, a technique is proposed to realize an emergency warning broadcasting service using One-Seg terminals and a new method of retransmission for One-Seg terminals. An emergency warning broadcasting signal automatically activates warning receivers in an emergency when they are in stand-by mode. A remote activation system has been developed with low power consumption, and its receiving capability and the effects of reducing its standby power are described. In addition, as an efficient means of retransmission for locations where broadcast waves from transmitting stations cannot be directly received, a method of One-Seg connected retransmission is proposed. This method extracts One-Seg signals by receiving individual broadcast waves, combines them and retransmits the signal. The characteristics, functions and performance of this system are described.

*Masahiro Okano, NHK, Japan's Sole Public Broadcaster, Tokyo, Japan*

**4 p.m.**

### **Preserving SFN in a Broadcast Network using IP Distribution**

Today, IP technology equipment prices have dropped significantly, and the never-ending IP network interconnections make it possible to send data from one part of the world to anywhere without additional infrastructure cost. The broadcast and telecommunications engineering community have logically thought of using such a transport technology to carry their digital video programs at lower costs while moving to a multi-transmission sites-based network like DVB-H.

On the other hand, COFDM-based transmission standards, such as DVB-H, developed the concept of Single Frequency Network (SFN) broadcast to anticipate and overcome frequency licensing shortages. SFN broadcast schemes are based on the fact that every transmitter is synchronized using GPS information to avoid any perturbation in reception areas.

This presentation aims at presenting advantages and constraints of using IP distribution to transport DVB-H content from head end to transmission premises while preserving an SFN mode of operation. Moving Pictures Expert Group (MPEG2) transport stream (TS) over IP transport, forward error correction and SFN synchronization will be detailed, and the possible solutions to optimize network operational expenditure (OPEX) (using IP distribution) as well as capital expenditure (CAPEX) investments (reducing the number of radio frequency licenses to obtain) will be highlighted.

*Nicolas Fannechere, Ensys Technologies, Rennes, France*

**4:30 p.m.**

### **Encoding for Mobile TV — Lessons Learned for Successful Deployments**

Mobile TV has become a key, if not the key, application that mobile operators need to deploy to attract new subscribers, or simply retain their existing base. While the business models and killer applications for mobile video are still being researched, mobile operators and broadcasters already face a wide variety of mobile video distribution standards, devices, and applications that deeply affect how those services are deployed.

This presentation will focus on the knowledge gained from early trials of Moving Pictures Expert Group (MPEG4) encoders for mobile TV. Featured highlights include case studies on the Orange 3GPP and Doordarshan DVB-H deployments, their technical challenges as well as current requirements for successful mobile TV deployments. The value of pure IP, maintaining high picture quality at ultra-low data rates and the migration towards multi-rate, multi-format encoding will be covered. Also presented in this session is an analysis of the different standards that are being deployed, their pros and cons and their impact on how and what services can be offered.

*Boris Felts, Envivio Inc., South San Francisco, Calif.*

**Sunday, April 13, 2008 • 9:30 a.m. – noon**  
**Las Vegas Convention Center • Room S226/227**

## **Digital Opportunities for Radio**

*Chairperson: Paul Shulins, Greater Media, Boston, Mass.*

**9:30 a.m.**

### **Conditional Access: The Next Stage in HD Radio Evolution**

No longer a theory, HD Radio conditional access (CA) is here – available as a product, affordable to implement and easy to both deploy and manage. Developed specifically for radio broadcast managers and engineers, this presentation explores the operational aspects of CA as well new and unique abilities enabled by CA including advertising substitution. In addition, this work includes recent examples of real HD Radio deployments, highlighting the challenges and opportunities they have created.

*Tom Rucktenwald, NDS, Costa Mesa, Calif.*

**10 a.m.**

### **Managing Radio Metadata for Multiplatform Digital Distribution**

Listeners have high expectations for rich descriptive metadata integrated with audio programming, cultivated by exposure to satellite and cable audio services, portable media players, computerized music libraries and podcasting. As broadcasters and audio program producers leverage the opportunities of multicasting and enhanced portable application description (PAD) support afforded by new digital radio technologies, developing an efficient, high-quality metadata management workflow for multiple distribution channels alongside traditional audio-only production and distribution workflows has become a significant challenge.

Reviewed in this presentation are the current status of metadata standards, tools, and best practices for developing efficient programmatic data management systems, with a focus on the practical implications of deploying a consolidated data/audio workflow in a large radio production and broadcasting organization. An integrative approach to data systems architecture is proposed, drawing from the fields of library and information sciences, database management, Internet application development and broadcast engineering.

*Daniel Mansergh, KQED Public Radio, San Francisco, Calif.*

**10:30 a.m.**

### **The Future of Radio in a Changing World**

Discussed in this presentation are modern consumer technology, changing consumer expectations for electronic media and how they are affecting free local radio. It will consider possible changes to free local radio's technical infrastructure and to its frequency allocation rules. Changes like these could make free local radio more competitive in a changing world.

*Dave Wilson, Consumer Electronics Association, Arlington, Va.*

**11 a.m.**

### **Seeding the Internet – Automating Podcasting with Open Source Tools**

Podcasting has become a well-established way to push multimedia content out to consumers via Internet, targeting portable MP3 players as well as the more traditional PC platform. However, maintaining a podcast feed can be a

time-consuming and resource-intensive process, often requiring knowledge of such arcane technologies as XML and RSS. "Seeding The Internet" will demonstrate how to use the freely-available Rivendell radio automation system to automate away much of the drudgery of day-to-day feed operations while making it easy for content producers and other non-technically trained personnel to keep online content (both multimedia and text) fresh and up to date. Extensive live examples will be used to demonstrate how the system works in a real-world environment.

*Frederick Gleason Jr., Paravel Systems LLC, Warrenton, Va.*

**11:30 a.m.**

### **Digital Opportunities for Radio**

Making your content live in multiple platforms is key to your success. With an understanding of converging technologies and thoughtful production methods, you can pinpoint who you want to reach, how you want to reach them and be smart about it. From HD Radio and podcasts to mobile devices and Public Radio Satellite System (PRSS) ContentDepot, you'll learn how to turn technical challenges into opportunities across a converging media landscape.

*Laura Jensen, NPR, Washington, D.C.*

*Melinda Driscoll, American Public Media, St. Paul, Minn.*

*Nick Kereakos, American Public Media, St. Paul, Minn.*

**Sunday, April 13, 2008 • 1 – 5:30 p.m.**  
**Las Vegas Convention Center • Room S226/227**

## **Radio Technology Advancements**

*Chairperson: Milford Smith, Greater Media, Inc., Lawrenceville, N.J.*

**1 p.m.**

### **Radio Broadcasters: Building File-Based Networks**

The challenge for national radio broadcasters is to provide programming to multiple locations while at the same time giving the (local) listener the impression of local presence of the station.

Many radio networks today integrate multiple devices at each affiliate station for local ads, station identifiers, local traffic and weather. A more efficient means of achieving these goals is to leverage a centralized solution that uses addressable devices to receive live audio broadcasts, store regionalized to local content and seamlessly combine them to customize broadcasts. This solution can be achieved through a seamless combination of network control, content management and media server technology. Jones Radio Networks is an example of a large radio network utilizing this technology.

In this paper Jones Radio Networks and Wegener will discuss how an intelligent centralized solution allows radio networks to support the technical and business needs of today's radio networks. The technical portion will discuss how one-time distribution of repetitive material to addressable media servers can be used to enhance national live programming.

It will also discuss how the same technology supports the business aspect of national radio networks to help increase ad revenue through regional to local programming; timeshifting and low cost multicasting.

*Eric Wiler, Jones Radio Network, Englewood, Colo.*

*Gary Pelkey, Wegener, Duluth, Ga.*

**1:30 p.m.**

### **HD Audio Quality and Netcasting**

The way consumer audio is being consumed is changing rapidly. This includes retail music and broadcast radio. The main driving forces are the technological advances in delivery mechanisms, ranging from new portable music players for downloadable music to new streaming players and wireless mobile devices. These devices have become mainstream and are now frequently overlooked features of electronic components like home theater receivers. Streaming is another broadcasting opportunity that has finally reached technical maturity, but its implementations and audio quality issues need to be addressed if it is to be taken seriously by the consumer while favorably competing with the many diverse forms of media delivery. You only have one chance to make a first impression.

*Greg Ogonowski, Urban/CRL, Inc, Tempe, Ariz.*

**2 p.m.**

### **From ITM to ITWOM: Correcting, Completing and Updating the Longley-Rice Irregular Terrain Model**

The Longley-Rice Irregular Terrain Model used by the Federal Communications Commission (FCC) and by radio engineers worldwide consists of (1) the ITM version 1.2.2, a core set of National Telecommunications and Information Administration (NTIA) subroutines, and (2) custom wrap-around input-output software sold commercially or written by the user. At the 2007 Broadcasting Engineering Conference (BEC), free copies of an expanded open-source wrap-around input-output software package were presented and distributed. However, the core subroutines in this software were not responding properly to the input data, and would not produce good results for 3-arc-second terrain databases. It was necessary to analyze the NTIA core.

Seven problem areas were found, including dysfunctional least-squares line fitting, confusion over common versus natural logarithms and subroutines that were still designed to operate only with a fixed number of intervals. Multiple errors were found in calculating the take-off angles, terrain irregularity factor and terminal effective heights. Two key subroutines were found to have never been completed to properly calculate path loss when obstructions occur in the path prior to the sum of the two estimated maximum horizon distances.

The original ITM subroutines have been corrected and completed to properly consider major obstructions. Updates then added include consideration of Barrick's equations. The misapplication of diffraction loss calculations prior to an obstruction are replaced with updated average clutter effect calculations to match the 1 to 50 km results of ITU-R P.1546-2. This presentation will be the first unveiling to the general public of the results: the Irregular Terrain with Obstructions Model (ITWOM).

*Sid Shumate, Givens & Bell, Inc., Haymarket, Va.*

**2:30 p.m.**

### **Can the Public Internet be Used for Broadcast Applications?**

With IP audio networking moving into the mainstream of audio broadcasting, radio station engineers are faced with a bewildering choice of IP links over which to transfer their content. Examined in this presentation are the various options looking at dedicated IP LANs, MPLS links, contended lines and the public Internet. Issues such as quality of service, service level agreements and network design will be examined and recommendations given as to the best approach for specific circumstances. While common broadcast practice dictates the need for dedicated lines, broadcasters are realizing that decent remotes can be conducted using contended services such as the public Internet, wireless evolution data optimized (EVDO) at

substantially less cost and effort. Some examples of remote broadcasts over contended IP links will be examined as will the key points in ensuring their success. Also discussed are ways to overcome issues such as jitter and latency, and recommendations are provided regarding essential features on IP codec equipment.

*Simon Daniels, APT, Belfast, Northern Ireland*

**3 p.m.**

### **A New Approach to Peak-to-Average-Power Reduction for FM and IBOC Transmission**

Many broadcasters have not yet transitioned to In-Band/On-Channel (IBOC) broadcasting because of the significant conversion costs. One chief cost factor is associated with handling the drastically different IBOC signaling scheme. IBOC uses orthogonal frequency division multiplexing (OFDM) for improved spectral efficiency. This presents challenges to broadcast transmitter designs. The time domain effects of superimposing multiple independent carrier frequencies, causes the signal envelope to fluctuate drastically with intermittent power spikes as much as 12 dB above the average IBOC signal power, referred to as the peak-to-average-power ratio (PAPR).

Various PAPR reduction schemes exist in literature and have been fielded in various OFDM applications. By reducing the signal's peak power requirements, the range of required linearization across the power amplifier is effectively reduced allowing for reduction of the Input Backoff (IBO) and an increase in the transmitter's digital power output and efficiency. iBiquity Digital Corporation has included a PAPR reduction option in its standard IBOC modulator that effectively reduces the signal's PAPR ratio from 12 dB to under 7 dB. The effects on the IBOC signal constellation and the resulting error vector magnitude (EVM) are detailed in this presentation.

In addition to this standard PAPR reduction technique, novel means of drastically reducing the PAPR without impacting the IBOC signal are introduced. By making alternate PAPR reduction schemes available to broadcasters, HD Radio conversion costs can be reduced by achieving a broadcaster's digital transmitter power output (TPO) in a smaller size transmitter while maintaining a low on-air EVM.

*Philipp Schmid, Nautel, Inc., Bangor, Maine*

**3:30 p.m.**

### **Field Tests for Service Area and Handover Service in T-DMB**

Terrestrial-Digital Multimedia Broadcasting (T-DMB) started its main service in Korea about two years ago and Korean Broadcasting System (KBS) launched a nationwide service in August 2007. It is important to measure the exact service area and get rid of shadowing areas for a good quality service. To do this work in T-DMB, the measurement considering Single Frequency Network (SFN) attributes such as time and frequency synchronization, transmitters spacing and its output power is essential. In addition, the mobile measurement of Quality of Service (QoS) for transmission channel and received services and analysis of service area based on the measured results are also important factors.

Considering the above requirements, an integrated measurement and analysis system has been developed. The developed system was applied to the implementation of T-DMB network of KBS and field tests to measure service area. In this presentation, T-DMB networks of Korea are described as are the newly developed measurement and analysis system and subsequent field test results.

*Sang-Hun Kim, KBS, Seoul, Korea*

**4 p.m.**

### **An Improved Coverage Prediction Method for HD Radio**

During 2007 NPR Labs carried out a multi-part project to understand the coverage and interference characteristics of In-Band/On-Channel (IBOC) digital radio broadcasting (HD Radio) under funding from the Corporation for Public Broadcasting (CPB). This project involved the lab testing of large numbers of consumer FM and IBOC receivers for radio frequency (RF) performance and interference susceptibility, which led to the development of a theoretical model for the prediction of interference-limited HD Radio coverage. That model was confirmed by measurement of mobile signal reception of ten stations across the U.S. broadcasting in hybrid FM-IBOC mode, using a unique multi-signal logger system developed at NPR Labs.

With the inclusion of signal interference and other factors the results showed significantly higher agreement between predicted and measured results than the first studies of HD Radio coverage, previously reported to the 2006 NAB Broadcast Engineering Conference. This model was then developed into a computerized coverage and interference prediction program to map FM and IBOC coverage of nearly one thousand public radio stations in the U.S. Discussed in this presentation are the measurement processes and further, the results of the HD Radio mapping program are examined, which was prepared as part of the CPB-funded project.

*John Kean, NPR Labs - National Public Radio, Washington, D.C.*

**4:30 p.m.**

### **Brazil's Digital Radio Technology Choices**

In June 2006, Brazil's Minister of Communications Helio Costa announced that his nation had selected the Japanese ISDB-T standard as the country's model for terrestrial digital television (DTV), choosing it over the well-proven ATSC system and the already installed European DVB-T technology. The road to this decision was ten years long from the first tests and demonstration in 1998 to 2008 when the first real DTV stations are scheduled to go on the air. Now broadcasters, advertisers and manufacturers alike are moving full steam ahead to implement the technology.

Now is the time for Brazil to select a digital radio standard. Digital rights management (DRM), DRM+, digital audio broadcasting (DAB) and DAB+ are all contenders, with HD Radio technology appearing to be the standard preferred by most Brazilian broadcasters and associations. There are still choices to be made but networks and organizations have made it clear that they wish to move much faster than did their TV counterparts. This presentation will cover the technical and commercial issues informing Brazil's digital radio choices, including an update on the technical tests and implementation status.

*Acácio Luiz Costa, Mix TV Network, Sao Paulo, Brazil*

**5 p.m.**

### **Advances in Digital Measurement Techniques for FM Broadcast**

Advances in Digital Signal Processor (DSP) technology have made possible new concepts and techniques in measuring and analyzing signals used in FM broadcast facilities. This presentation explores the advantages and limitations of this technology in FM broadcast measurement. The differences between the architecture of traditional analog measurement equipment and the new digital model are explored, and new theories and mathematics employed in making accurate measurements within the more open structure of digital equipment are expanded upon. The digital designs approach

theoretical ideals in terms of filtering and accuracy, and this presentation will attempt to explain in solid terms the relevance and expectations of this capability in real-world applications.

One of the novel concepts to be explored is undersampling. Considered here are the Shannon theorem and present practical and mathematical evidence that undersampling a signal for analysis can produce excellent, accurate results. The presentation will then provide a brief explanation of digital measurement techniques as they apply to each part of a broadcast FM signal – audio, composite/MPX, and final complex RF emission.

*Tony Peterle, Audemat Inc, Miami, Fla*

*Frederic Allard, Audemat-Aztec, France*

**Monday, April 14, 2008 • 10:30 a.m. – noon**  
**Las Vegas Convention Center • Room S226/227**

## **DTV Reception Issues**

*Chairperson: Al Grossniklaus, WTHR NBC 13, Indianapolis, Ind.*

**10:30 a.m.**

### **DTV Reception in an Urban Environment**

Over the past ten to 15 years, much work has been done developing a plan for terrestrial digital television broadcasting in the U.S. However, almost all of that work has been based on prediction models that do not consider the unique challenges of providing reliable service to viewers in an urban environment. This presentation will discuss the findings from a number of recent research and field measurement projects conducted by the firm of Meintel, Sgrignoli, & Wallace, LLC. These projects included an assessment of the availability and an evaluation of the performance of indoor antennas, research into the various factors affecting reception indoors and in an urban areas, computer models that have been used elsewhere for urban area predictions, and finally, a large scale field measurement project to evaluate reception in a dense urban area, including the effectiveness of a distributed transmission system (DTS). In the presentation, each of these will be discussed and then tied together to show how a new evaluation model would be created to provide more reliable predictions in urban areas taking into consideration the use of indoor antennas and DTS.

*William Meintel, Meintel, Sgrignoli, & Wallace, LLC, Warrenton, Va.*

**11 a.m.**

### **New Neighbors: Can Wireless Microphones and Consumer Devices Coexist in the White Spaces?**

The FCC is changing the rules that govern the use of the ultra-high frequency (UHF) spectrum in the U.S., and other countries are moving in the same direction. The new rules will permit consumer wireless products (PDAs, smartphones, etc.) to use the spectrum in between occupied TV channels, known as white spaces. These frequencies are home to wireless microphones and other equipment used by broadcasters, content and event producers. What impact will these new devices have on each other? Can wireless devices employing different technology, used for different applications, and operated by users with different expectations live happily together?

This presentation will examine the relationship between incumbent users of the white spaces and their new neighbors. Also to be reviewed is the status of similar spectrum reorganization outside the U.S.

*Christopher Lyons, Shure Incorporated, Niles, Ill.*

**11:30 a.m.**

### **Measurement Results of Consumer Indoor Antennas**

The presentation will include an overview of a project undertaken by the firm to research and measure the performance of consumer indoor antennas. A selection of antennas were measured in an anechoic chamber and the results of the measurements were compared with the published specifications for the antennas tested. Also, the results of these measurements were then incorporated into DTV indoor service predictions based upon an indoor reception propagation model. The model was then utilized to predict indoor antenna coverage in an urban environment.

*Dennis Wallace, Meintel, Sgrignoli, & Wallace, Waldorf, Md.*

**Monday, April 14, 2008 • 10:30 a.m. – noon**  
**Las Vegas Convention Center • Room S228**

### **Communicating with Management**

*Chairperson: Chris Scherer, Radio magazine, SBE, Overland Park, Kan.*

**10:30 a.m.**

### **Communicating with Management Presentation**

*John Bisset, Broadcast Electronics, Manchester, N.H.*

**11:15 a.m.**

### **Communicating with Management Panel**

*Don Kelley, Greater Media, Boston, Mass.*

*Gary Kline, Cumulus Media, Atlanta, Ga.*

*David Isreal, WFYV-FM / WMMQ - FM, Jacksonville, Fla*

*Paul Tinkle, Thunderbolt Broadcasting Company, Martin, Tenn.*

**Monday, April 14, 2008 • 1 – 5:30 p.m.**  
**Las Vegas Convention Center • Room S226/227**

### **TV News and Live Production**

*Chairperson: Wayne Kube, Belo Corporation, Dallas, Texas*

**1 p.m.**

### **News ML-G2: Metadata for News Exchange**

For the European Broadcasting Union (EBU) and its Eurovision network, news is a core activity through which EBU members are able, 24/7, to report on events within their area and beyond. With thousands of raw news items being exchanged every year, it is easy to see the importance of sharing information describing content to allow users to select what is contextually relevant. Exchange can also occur between EBU members independently, which requires a similar solution. In each case, it is vital to facilitate the access to this information using a common language, either directly or after mapping to an internal operational system. Various EBU proposals to manage audio-visual material have now been largely incorporated into NewsML-G2, which now fulfils EBU needs for news.

NewsML-G2 is a major breakthrough in the world of news and news exchange. As the result of collaboration between EBU and International Press Telecommunications Council (IPTC) joining broadcasters and major news agencies forces, NewsML-G2 now properly addresses metadata for audio-visual news exchange. The standard is planned for public release in March 2008. This presentation will include an overview of the NewsML-G2

standard and an introduction to the EBU profile being implemented in EBU's Eurovision news gathering network.

*Jean-Pierre Evain, European Broadcasting Union (EBU), Grand Saconnex, Switzerland*

**1:30 p.m.**

### **Advanced Video Image Technologies for Live Sports TV Productions**

There is strong demand for more dynamic and impressive images for live sports TV productions. In response to this demand, Japan Broadcasting Corporation (NHK) is seeking to establish a new visual production process using a multi-view HDTV system and an ultrahigh-speed, high-sensitivity color TV camera. The multi-view HDTV system can generate multi-view HDTV images of a sports scene by matching the shooting directions and shooting angles of the individual camera images by using projective transformations. Described in the presentation is an example of practical use of this system in a live broadcasting of a gymnastics competition. The other system, the ultrahigh-speed, high-sensitivity color TV camera, has been used in broadcasting of sports events, such as baseball night games and golf tournaments. The camera is able to take clear slow motion images of the moment of impact of the bat or club with the ball. It is a powerful tool for new forms of video expression.

*Kimihito Tomiyama, NHK (Japan Broadcasting Corporation), Tokyo, Japan*

**2 p.m.**

### **Managing Multiformat Images for the Broadcast News Environment**

Developing approaches for handling 4:3 and wide screen standard definition to produce high definition content for broadcast news requires new workflows be integrated into the acquisition, transport, editing, storage/archive, playout, and exchange of media. Addressing the challenges faced by the industry in managing wide screen formats, while also retaining compatibility with others will be the topic of this presentation, which will cover practical systems design that allows for flexibility and adaptability going forward. Using implementation and case studies where the users wished to maintain one portion of an existing workflow while migrating to full high definition operations for live broadcast, the practical applications for conversion hardware and software will be examined, as well as how hardware solutions were applied to real workflows including automated systems that prevent negative results by keeping humans' hands off. A view as to how these systems were designed and operated, plus where they are headed in actuality will be presented.

*Karl Paulsen, Azcar Technologies, Canonsburg, Pa.*

**2:30 p.m.**

### **Best Practices: Using IP in Broadcast TV**

Broadcasters and their viewers want their television pictures to be perfect. To deliver them using an efficient and flexible architecture, providers look to find and refine the best practices to deliver video services on their IP network. There are several techniques to deploy and deliver transport streams, using newer IP-based technologies. With new technology come the struggles and problems engineers encounter during integration. Since moving transport streams over IP, much has been learned from early implementations. This paper will explore some requirements for integration, describe some problems and offer solutions based on experience.

*Joel Wilhite, Harmonic Inc, Sunnyvale, Calif.*

3 p.m.

### **Live Integrated Production Systems Streamline Live Workflow**

Twenty years ago post production and live production were both done with expensive suites of individual components. Since then, computer-based integrated systems have revolutionized the post production industry, but live production is still usually done in control rooms built up from individual components, including a switcher, character generator (CG), clip server, still store, monitoring, etc. Recently, live integrated production systems (LIPS) have begun to be used in many broadcasting, webcasting and other live studios. They provide dramatic improvements in workflow, cost and staffing when compared to conventional control rooms. Moreover, they produce compelling live video that is equal to or better than the more cumbersome traditional approach. This paper describes the contemporary LIPS, its workflow advantages, and three typical installations.

*Ken Swanton, Broadcast Pix, Burlington, Mass.*

3:30 p.m.

### **Making Field Applications Bandwidth Efficient**

For broadcasters, satellite bandwidth is an expensive resource. And when it comes to data connectivity in the field, most are forced to use it inefficiently. For example, the current single channel per carrier (SCPC) delivery method for IP data requires broadcasters to pay for a fixed satellite link that is locked into a constant data throughput rate for every supported location. Broadcasters pay for this dedicated access whether they're capturing live news or the truck is in the shop.

Satellite systems today can accommodate a much more flexible and cost-efficient use of bandwidth and support all IP communications in the field, including data, voice and video. This presentation will examine a typical broadcaster's use of bandwidth over a 24-hour period, revealing how broadcasters can establish data throughput parameters for a diverse range of applications based on lulls and bursts in bandwidth activity. These include live video capture, VoIP, video file transfer, Web browsing and email. Broadcasters will learn how they can measure their IP bandwidth needs and craft appropriate bandwidth levels to match.

*Mick Gardina, iDirect Technologies, Herndon, Ill.*

4 p.m.

### **High Definition Electronic News Gathering (HD-ENG) Field Test Report**

Discussed in this presentation are the results of High Definition Electronic News Gathering (HD-ENG) field tests performed by CBS in an urban environment. Analysis of the data collected is used to determine the optimal operating parameters and performance of HD-ENG in New York and that expected in other major U.S. cities. Described are the objectives, methodology and field tests performed using the new FCC-mandated 2 GHz, 12 MHz channel plan, compressed HD signals at bit rates from 18 to 28 Mbps, and reception using Coded Orthogonal Frequency Division Multiplexed (COFDM) modulation.

Six COFDM configurations were tested to determine the maximum bit rate that could be reliably delivered. The COFDM signals were transmitted from typical locations used for newsgathering, and received at the Empire State building. Paths included near and distant Line of Sight (LOS) and bounce transmissions. Also tests were performed with standard definition (SD) digital (COFDM) signal transmission using the new 2 GHz plan. Adjacent channel performance was verified using 6 and 8 MHz transmission channels (pedestals) at several modulation and data rates. Finally, a 35 Mbps,

16 QAM (non-COFDM), fixed forward error correction (FEC) modulation transmission system was tested to determine its application in an urban environment.

*Walter Sidas, CBS Broadcast Inc., New York, N.Y.*

4:30 p.m.

### **NBC Universal's New IPTV Distribution System**

The NBC Network has traditionally used an analog closed circuit CATV system to distribute various remote and internal feeds through out its headquarters at 30 Rock. These feeds have been made available to certain key production areas in the building through consumer television receivers. The existing system was limited, aging and in clear need of an upgrade.

In looking for a new solution, NBC faced some challenges. The integration of the MSNBC Network into 30 Rock added 400 more production personnel with 50+ more required feeds all within NBC's existing space. With a majority of NBC's News, Sports and Entertainment programming originating in high definition, HD infrastructure needed to be supported. Given all of these considerations, NBC best option was to go with an IPTV based solution, which was recently deployed. Advances in IPTV technology made this the clear choice for cost, scalability and support. This paper will detail NBC's new IPTV Distribution system and will highlight many of the advantages that this approach has given them.

*Robert Goldfarb, NBC-Universal, New York, N.Y.*

5 p.m.

### **Understanding and Implementing an Ultra-fast Time-To-Air Workflow by Integrating Metadata**

In news, being able to get a story to air first "before the competition" can have a very positive effect on ratings and the bottom line. During this presentation, attendees will learn how the implementation of metadata throughout the news production chain can completely change the way facilities work with media content and decrease time-to-air.

Covered here is a description of metadata and what it brings to news production, as well as a primer on how to implement metadata within a news operation from the news assignment desk, to the engineering crew in the field, through post production and asset management, to playout and distribution. It will also explained here just how metadata used during news gathering can bring a faster time-to-air for alternative distribution channels, such as the Web and mobile TV.

*Ed Casaccia, Thomson, Beaverton, Ore.*

**Monday, April 14, 2008 • 1 – 2:30 p.m.**  
**Las Vegas Convention Center • Room S228**

## **Alternative STL Technologies**

*Chairperson: Paul Shulins, Greater Media, Boston, Mass.*

**1 p.m.**

### **The HD Radio STL: Issues, Options and Technologies**

This presentation will address the challenges involved in getting the HD Radio signal from the studio to the transmitter. HD Radio technology brings with it a whole new set of questions that didn't apply to the traditional FM standard template library (STL): should the importer and exporter be at the studio or the transmitter site? What are the bandwidth requirements for each of these options? How does adding HD2 and HD3 affect the requirements? What are the pluses and minuses involved in using 950 MHz, T1, IP, or spread spectrum for the link? What else can be done on the STL additional audio programs, return audio, off premise extensions, LAN bridging, control data? These issues, and more, will be looked at in the quest to find the ideal STL for your particular situation.

*Bob Band, Harris, Mason, Ohio*

**1:30 p.m.**

### **The Best of Synchronous with the Best of IP**

The foundation of the broadcast industry for many years, synchronous networks have been considered the industry standard for audio transport worldwide. However, the reign of synchronous links as the preferred choice for STLs is currently coming under threat from a new challenger in the form of IP based network technology. While IP technology does have some disadvantages for audio transport, the benefits over existing synchronous networks are increasingly proving too persuasive for broadcasters to ignore: cost, greater flexibility, greater scalability, widespread availability, network efficiency and resource efficiency.

Despite the scalability, cost-efficiency and flexibility of IP networks, packetized audio transport is not a perfect solution and broadcasters must take care that the quality of their audio and reliability of their audio delivery is not sacrificed in the interest of cost savings. This presentation provides an overview of the most important issues that broadcasters need to consider before embarking upon IP migration and examines if it is possible to combine the two approaches to achieve an audio network offering the ultimate flexibility, reliability and cost efficiency.

*Guy Gampell, APT, Belfast, Ireland*

**2 p.m.**

### **Robust HD Radio Exporter to Exgine Architecture**

The HD Radio System presents opportunities as well as significant challenges from the perspectives of both traditional broadcast systems engineering and IT infrastructure engineering. The various signals involved in the creation and distribution of HD Radio are digitally based with a mixture of AES audio, IP based streaming, timing and control. The ability to support main program and multicast audio services with minimal delay over a moderately low bandwidth unidirectional link makes UDP well suited to the real-time streaming nature of E2X over STL and satellite. However, the lack of native Forward error Correction and the Engine's source synchronous dependence, create a virtually insurmountable challenge. The result is a less-than robust transport resulting in dropped audio, unstable diversity delay and link failures. These issues have often been a source of frustration for listeners and station engineers alike.

This paper explores the realities and challenges of the Generation 3 HD Radio system architecture, network communications and synchronization requirements. It discusses the latest enhancements that have been developed, as well as several different approaches that are in development to make the E2X transport more robust and reliable.

*Tim Anderson, Harris, Mason, Ohio*

**Monday, April 14, 2008 • 3 – 5 p.m.**  
**Las Vegas Convention Center • Room S228**

## **Digital Radio Worldwide**

*Chairperson: Barry Thomas, Lincoln Financial Media, Atlanta, Ga.*

**3 p.m.**

### **Bandwidth & Frequency Allocation Issues in International Digital Radio AM & FM Broadcasting**

In the move towards digital radio implementation on the AM and FM bands outside the U.S., broadcasters and regulators are dealing with issues of occupied bandwidth and the impact of digital rights management (DRM) and HD Radio implementation on co-channel, as well as adjacent channel interference. Analysis, both theoretical as well as real world examples from around the world will be presented.

*Chuck Kelly, Nautel, Inc., Hacketts Cove, Nova Scotia, Canada*

**3:30 p.m.**

### **New Standards and Codecs for European Digital Broadcasting**

While HD Radio is being deployed here in the U.S., Europeans are deploying a new version of digital audio broadcasting (DAB) as well as new systems such as digital multimedia broadcasting (DMB) and digital video broadcasting – handheld (DVB-H). The background of these systems and their operational appeal to both public and private broadcasters will be explained in this presentation, contrasting these systems to the efforts being made to introduce HD Radio to Europe.

*Olaf Korte, Fraunhofer IIS, Erlangen, Germany*

# M\*MediaStar

Let TitanTV make your life easier.

TitanTV's MediaStar is the leading program management tool for local broadcasters. From scheduling, reporting and distribution to PSIP capabilities, MediaStar is all you need to manage your local programming. TitanTV's MediaStar has set the standard for efficiency and ease-of-use.

To find out what we can do for you:

Come see our sales team in person at booth C457 in the Central Hall for a demonstration.

Give our sales team a call at 1-800-365-7629

Check out [www.TitanTV.com](http://www.TitanTV.com)

*"MediaStar is a breeze to use. Once the programming has been set up, it takes only a few seconds to add or change a program. Our account executives have Internet access to up-to-date programming whenever and wherever they need it. The reports feature made this quarter's E/I report virtually painless."*

-- Adriana Sanchez  
KECY-TV El Centro/Yuma

**TITANTV**<sup>®</sup>

4 p.m.

### **Mobile Coverage Optimization by Polarization Diversity in VHF and UHF Propagation**

Orthogonal polarizations in radio frequency (RF) transmissions from a broadcast antenna provide increased channel capacity and improved channel performance. In the same channel frequency band, two independent signals may be transmitted and received with isolation provided by dual-linear or dual-circular polarizations. This technique has wide application in communications: satellite communications, terrestrial microwave, cellular phone networks and broadcasting.

Transmitting antennas that provide polarization isolation for channel combining are analyzed and found to be successful and efficient in applications such as the in band on channel (IBOC) FM scheme and DTV simulcast applications. However, the ultra high frequency (UHF) and very high frequency (VHF) broadcast propagation channel may not preserve the polarization sense and purity of the transmitted signal, in some cases degrading reception. The possibility of overcoming these problems and application of the multiple-input multiple-output (MIMO) channel is discussed.

The use of orthogonal polarizations to increase channel capacity for VHF and UHF broadcasting is analyzed. Dual-polarized receive antennas have been found to dramatically increase mobile signal reception and virtually eliminate disconnects from the base station, and the application to broadcast DTV and IBOC transmission is made. The application of dual-polarized channels in distributed transmission networks and low power broadcast repeater networks is also described.

*Myron Fanton, Electronics Research, Inc., Chandler, Ind.*

4:30 p.m.

### **Does Your Yotta Byte?**

Terms like gigabyte and terabyte are part of our everyday language. Others like 1080i, HD Radio, HDMI, and voice over IP are part of the daily vernacular for most, but only a few years ago, they were virtually unknown terms. This presentation takes us beyond "the now" to the not-too-distant future where the unknown expressions of today will soon become part of our everyday speech, as the focus of engineering continues to be on larger storage capacity, faster data transmission, smarter broadcasting and greener engineering. Just in terms of data storage, the industry is quickly moving away from standards like megabyte and gigabyte and is now poised to think in terms of terabytes and petabytes. Data transmission rates in the gigabit-per-second range will give way to terabits-per-second. What other technological advances will change the way people live and work? Examined here are some new broadcast technologies and, of course, the associated terms that will be used in the future.

*Andrew Janitschek, Radio Free Asia, Washington, DC*

Tuesday, April 15, 2008 • 9 a.m. – 5 p.m.  
Las Vegas Convention Center • Room S226/227

### **Video Content Creation & Manipulation**

*Chairperson: John Turner, Turner Engineering, Mountain Lakes, N.J.*

*Chairperson: Craig Tanner, Consultant, Washington, D.C.*

9 a.m.

### **File Formats in Television Archiving and Content Exchange**

As broadcasters migrate to digital file-based acquisition, production, distribution and archiving, a plethora of questions continue to arise. One quite interesting topic is the selection and the operational use of file formats in television. What is the best file format for overall operation? Should embedded descriptive metadata be used, and if so, where and which? Which benefits and which penalties are associated with a certain file format selection? Are there interoperability issues when exchanging content between systems or even enterprises? Provided in this presentation are some answers to these questions and some guidelines for the decision making process. You'll learn about the requirements for interoperable metadata transfer in files, the use of file formats for archiving, and the various content exchange and transfer processes in television. For certain key scenarios, an opinion is given on the use of descriptive embedded metadata. In addition, the advantages and disadvantages of using MXF vs. QuickTime in these scenarios are discussed, and a proposal is made for when to use what.

*Peter Thomas, Blue Order Solutions AG, Kaiserslautern, Germany*

9:30 a.m.

### **Watermarking and Fingerprinting: The Wave of the Future**

These are exciting and challenging times for today's broadcast and cable television network programming executives, as they are faced with shrinking budgets, fragmented audiences and a variety of new media platforms on which to view content. Content owners face new challenges in adapting to the changing environment, as traditional business models no longer suffice in the new media world and more emphasis is placed on the bottom line. In the past, it was sufficient for programming executives to claim credit for successful shows, but with ROI metrics becoming increasingly important, executives now have an inherent need to measure and track content to determine where and when it appears.

In order to keep up with these demands, executives need to embrace new technologies and services that can be used to their advantage. In the past few years, watermarking and fingerprinting technologies have grown in acceptance as a means of broadcast video tracking and online content control. Networks such as NBC, CBS and FOX are using this technology to electronically monitor as much content as possible, measuring market-by-market details down to the minute, ensuring affiliate stations are fulfilling obligations to run promotions and determine which promos are working – all of which have a significant impact on the bottom line. Discussed in this presentation is how investing in watermarking and fingerprinting technologies can help programming executives successfully manage their video assets and measure ROI, and can provide real-world examples of where this technology is currently being used effectively.

*Andy Nobbs, Teletrax, New York, N.Y.*

10 a.m.

### **Non-Real-Time Services**

Television viewers are increasingly becoming used to an on-demand world. Digital television (DTV) technology is rapidly changing to enable new consumption and distribution models. Receiving devices contain persistent storage, personal media players are commonplace and inter-device connectivity is practical. These factors combine to allow a shift from linear TV viewing to on-demand consumption of content. One of the main enablers of this shift is the capability for non-real-time (NRT) delivery of content that is delivered in advance of use and stored for access on demand.

NRT content includes traditional TV fare – information that is not now part of traditional TV fare or that is presented in a customized and non-traditional way – as well as information not aimed at the TV, including content targeted to PCs, handheld media players or even commercial platforms. Typical applications for NRT services include push video-on-demand (news, information and weather services), personalized TV channels, music distribution, reference information and applications (e.g., games). Adding non-real-time services to traditional linear programming allows service providers to provide a more valuable package to their customers. The basic concepts of non-real-time services will be introduced in this presentation. Illustrative scenarios and technical requirements for building NRT services will also be discussed.

*Richard Chernock, Triveni Digital, Princeton Junction, N.J.*

10:30 a.m.

### **All-Digital Media: Best Methods for Integrating and Distributing**

The popular digital formats of HDMI 1.3, dual link DVI and HD SDI have all secured firm ground in today's electronic media, but integrating an audio/video system that uses all three still takes some connectivity magic. And with computers and entertainment systems coalescing to create tomorrow's standard, the time is ripe for understanding the methods available to easily combine multiple connectivity formats to create a seamless, highly efficient and cost-effective audio/video workflow throughout the studio.

High definition video delivered through the HDMI format is different from high definition video delivered through the DVI format. One is intended for consumer applications, the other for high-end computer applications, but both can still be integrated easily if the proper format conversions are understood. Because of bandwidth issues, high definition video can only be extended over cable for a few feet before the signal starts to break down. But with various extension technologies combined with cabling, signals can be successfully extended up to thousands of feet if needed. Wireless transmission technologies are making waves. Find out what methods are best suited for audio/video applications in this presentation.

*Robert Lemer, Gefen, Chatsworth, Calif.*

11 a.m.

### **BXF - The Promise of Reduced Costs and Increased Revenues**

Broadcast eXchange Format (BXF), also known as SMPTE-2021, has been in the works for some time now. There is no question that BXF has the ability to take formerly time-intensive, manual processes and make them significantly simpler and more automated. The implication here is not only cost savings, but also the enabling of expanded revenues.

As BXF is implemented into broadcast systems by a variety of vendors, the challenge broadcasters face is sorting through the hype and getting to the root benefits. Some say that BXF will eliminate master control operators, automate ingest, turn traffic into a 24/7 operation, etc. Explained in this presentation will be exactly what BXF was designed to do, what it can do today and what it might do in the future. Also provided are a grounded basis from which to understand exactly how BXF can be of assistance in a broadcaster's operation, how it can be used to streamline workflows and its potential for helping a broadcaster's bottom line.

*Chris Lennon, Harris, Mason, Ohio*

11:30 a.m.

### **Seam Carving for Video**

Seam carving has caused quite a stir in the image processing world. It is a technique for content-aware image resizing in which the size and shape of regions of visual importance are preserved without resorting to cropping. With user interaction, unwanted objects can also be removed from an image with minimal effect on the remainder of the picture. The results on still pictures have been spectacular, but extending the idea to moving video presents significant challenges. Described in this presentation is how seam carving can successfully be modified and extended to work with moving video. The resulting algorithm is robust, computationally efficient and gives pleasing results. It can be combined seamlessly with dynamic reframing and conventional resizing to provide a rich toolkit for content-aware repurposing of video. Applications include post-production, conversion between HD and SD TV standards, aspect ratio conversion, repurposing for mobile devices and internet video.

*Michael Knee, Snell & Wilcox Ltd., Liss, UK*

1 p.m.

### **An Integrated, File-Based Production Workflow for HD Television: Expected Impact and Challenges**

Flemish public broadcast company VRT has introduced the Digital Media Factory, which brings about a fully integrated file-based workflow for news and mainstream media production in standard definition (SD). The architecture consists of four independent layers: storage and network infrastructure, production environment, information flow and business process. It is organized around a central media asset management system, which is carefully integrated with added-value craft tools based on open standards (MXF, AAF, P/Meta, SOAP). While a substantial part of storage, interoperability, compression and file format issues have already been resolved for SD, new challenges emerge with the forthcoming transition to high definition (HD) television.

The VRT Medialab has investigated the expected impact on the final HD production architecture from the multi-layer perspective, encompassing HD-ready storage infrastructure, new HD and proxy compression formats, further refinement of the file format strategy and SOA- and BPM-based production workflows. Presented here is a case study on the technical challenges of a gradual transition to a file-based HD production architecture, building on the knowledge acquired for SD. The experience and reflections presented are valuable for all technical practitioners facing the introduction of a file-based workflow for SD and HD production.

*Luk Overmeire, VRT Medialab, Ghent, Belgium*

1:30 p.m.

## From MXF to SOA

The professional media industry realized years ago the urgent need to move towards information technology-based solutions in order to reduce costs, improve product quality and reduce time-to-market. The first step was defining a standard way to represent audiovisual material in computer systems. As a result the MXF file format was born. The ability to hold both the audiovisual material and its related metadata makes MXF an ideal vehicle for the content, as it traverses the different stages of the content lifecycle. Systems can feed on that metadata to automate decisions and add to that metadata to convey information to other automated systems. Therefore, the workflow itself is becoming automated, enabling humans to focus more and more on creativity. However, in order to orchestrate all the systems in such a collaborative environment, usually spanning across computer networks, two kinds of interfaces are required: data and behavior.

As the data interface consolidates with MXF becoming an established technology, initial work on behavior interfaces confirms this as the logical next step. These interfaces expose the service(s) that a system provides as well as the ones it needs to consume in order to contribute to the collaborative environment. One solution is Service Oriented Architecture (SOA), a concept bound to have a tremendous impact on the media industry. Explored in this presentation are the key aspects of how to build on the consolidation of MXF file-based production to design the next generation SOA-based workflows.

*Ernesto Santos, MOG Solutions, Maia, Portugal*

2 p.m.

## Migration to All-IP Infrastructures for Distribution of Broadcast Services

Since the mid-1970s, satellite has dominated as the delivery method for primary distribution of pay-TV services. While technical advances in RF modulation and video compression have enabled satellite distribution to keep pace with the expansion of content, paradigm shifts in how content is packaged and consumed require a new method for dissemination moving forward. The unprecedented growth of specialized programming and projected HD explosion demand distribution networks that can scale exponentially.

Content providers no longer rely on a handful of operator networks to reach consumers. Growth in high-speed Internet and advancements in CE devices have enabled a new breed of service providers with radically different business models. As a result, programming can reach the consumer's living room via an ever increasing number of networks and formats. The established model of linear play-out via satellite only serves a subset of service providers in this new market and the approach of building separate systems for each delivery network will not scale.

Technological advancements in video compression and world-wide IP infrastructure allow content providers to realize new business models and revenue streams by taking a completely new approach to primary distribution. Discussed in this presentation are the delivery of mezzanine quality material via IP networks, video compression technologies that improve network scalability, applicability of Internet Content Delivery Networks (CDN) for broadcast television, methodologies for targeting primary distribution services on a shared infrastructure, and workflow innovations for repurposing mezzanine sources at the edge of the network.

*Tom Lattie, Harmonic Inc, Sunnyvale, Calif.*

2:30 p.m.

## Forensic Marking for HD VOD and Broadcast Services

With the acceleration of post-theatrical distribution calendars, content owners need to protect their premium content. Forensic marking solutions enable studios to add an extra layer of protection that helps operators shield their programming from illicit redistribution. Forensic marking, based on digital watermarking technologies, complements encryption and rights management in the battle against broadcast piracy, and also deters illegal copying and illegal redistribution. Combined with content signature technology which locates copyrighted material, forensic watermarks isolate the source of the leak.

Watermarks are invisible or inaudible, which preserves the consumer experience. They ensure serialization of the content into the IPTV, satellite, cable or traditional broadcast STB video stream upon display. A recovery system extracts this information from illicitly redistributed materials to pinpoint the source of the leak. Such systems will help protect all forms of content – feature films, TV programming and live events – viewed through live broadcast, video-on-demand (VOD), push-VOD or PVR.

It is key that digital video watermarking technology can be integrated into an STB with any combination of CAS and middleware, and operated with any compression scheme (MPEG2, H.264, VC-1). The integration with a selected CAS or DRM system will ensure the serialization of the content based on a transaction, STB or subscriber id.

*Pascal Marie, Thomson, Cesson-Sévigné, France*

3 p.m.

## From Camera to the Home – Managing Aspect Ratio through the Production and Distribution Process

As the percentage of high definition televisions in the home continues to grow, networks face increasing pressure to tailor their programming for both the standard definition (SD) and high definition (HD) audiences. This trend has challenged broadcasters to find innovative ways of producing and distributing content. High on this list of challenges is aspect ratio. Programming content will continue to originate in both SD and HD for years to come. Broadcasters must have a strategy that maximizes production and distribution efficiencies while maintaining the presentation quality for each home viewer.

Adding further complexity, the digital television (DTV) switchover deadline is looming. What can broadcasters do to ensure consistent delivery of their programming in all markets after February 17, 2009? How could the changing distribution path affect how programming is displayed in homes? What decisions should you be making now? Outlined in this presentation is how NBC has been tackling these issues and its strategy for navigating through the transition.

*Larry Thaler, NBC-Universal, New York, N.Y.*

**3:30 p.m.**

### **Leveraging IT Technologies and Concepts to Enhance HD Sports Programming**

The evolution of television programming to high definition (HD) brings the need for dramatically more cost-effective methods for data transport, storage and retrieval. Distributing HD content in today's dynamically changing environment over new distribution channels presents a challenge. Professional sports television audiences are proving to be the first solid adopters of HD. Every network and league needs to secure this type of programming in order to increase ratings and attract advertisers. Yet, increasingly, sports broadcasters and Web sites find themselves challenged to build the platforms to support these services and deliver content more quickly and efficiently

This presentation will focus on implementing an optimized digital workflow through an IT-based HD capable infrastructure, including how to manage HD content and huge sports files; keep the costs in line; integrate traditional broadcast transport; and encode standards DVB, ASI, MPEG2) with IT industry open standards (Linux, LTO, SQL, HTTP, Java), using a media-aware Service Oriented Architecture (SOA) for workflow design, transforming content into the right format for Web portals, IPTV, mobile, etc., and, repurposing HD content for alternative delivery. Using industry examples, this presentation will examine how sports and other broadcasters can improve efficiency, responsiveness and the quality of their output to meet current and future customer demands.

*Luis Estrada, IBM, Atlanta, Ga.*

**4 p.m.**

### **Viewer Contribution – Dealing with Massive Media**

Now that stations are soliciting viewers to contribute video and images in every format conceivable, how does a station manage this mass of media? Video formats are rapidly evolving and with viewers contributing video from cell phones to HD cameras how can all this media be easily managed? Addressed in this presentation are such topics as gathering media from viewers via the Web, cell phones and e-mail; managing large volumes of still images; ensuring metadata standards across all forms of media, formats and transcoding; ensuring integration with newsroom systems and news production systems; quickly organizing all forms of media, archiving and retrieval; and enhancing the quality of low-resolution images.

*Fred Fourcher, Bitcentral, Irvine, Calif.*

**4:30 p.m.**

### **The State of Broadcast Automation**

Automation is surprisingly alive and well considering how many companies manufacture automation equipment. Latest estimates show 50 broadcast automation companies worldwide. Veteran broadcast automation companies have been successful in keeping their system technology current to stay competitive and desirable. Also, several companies have expanded their portfolio of products and now sell into other areas of the broadcast facility.

*Sid Guel, Broadcast Automation Consulting, San Antonio, Texas*

**Tuesday, April 15, 2008 • 9 – 11:30 a.m.**  
**Las Vegas Convention Center • Room S228**

## **New Technologies for Radio Listening**

*Chairperson: Steve Fluker, Cox Radio/Orlando, Orlando, Fla.*

**9 a.m.**

### **Utilizing IP Networks for Seamless FM Simulcasting Over Multiple Transmitters**

FM simulcasting uses multiple, geographically dispersed RF transmitters operating on the same carrier frequency. By using multiple transmitters, geographic coverage area is expanded. An FM receiver will simultaneously demodulate the (simulcast) audio program carried on multiple RF transmitters. Audio modulation must be closely time-aligned from the multiple transmitters to provide the best receive quality.

When using Internet Protocol (IP) networks for Studio-to-Transmitter Links (STL) audio transport, a constant and precise STL delay between all the links must be maintained. Described here is a simulcasting IP system that uses a precision time reference provided by Global Positional System (GPS) receivers. Using this reference, the system measures the STL delay between sites. This information is used to program a digital buffer delay to reach a precise delay. Buffer delay changes are hitless for no disturbance of the audio program. The system is constantly and automatically measuring STL delay and correcting for any changes in IP network delay.

*Junius Kim, Harris Broadcast Communications, Mason, Ohio*

**9:30 a.m.**

### **Practical Considerations of Radio Broadcast Operations in an Arbitron PPM™ Market**

Arbitron, Inc.'s new Portable People Meter (PPM) electronic ratings system completely replaces the traditional "diary" system that had been in place for decades. PPM ratings are based on the recovery by portable pager-sized listening devices carried by survey respondents of unique subaudible identifying codes which are added to each audio channel by broadcasters.

It is essential that broadcasters in PPM markets develop systems that can reliably detect encoding problems as soon as they occur and that will immediately notify technical responders of problems. This paper will describe the system developed to monitor the twenty-two unique program streams originated by Greater Media's five-station cluster in Philadelphia, and will provide tips and insights to the PPM encoding process that will help readers plan their own installations as PPM technology is rolled out to their markets over the next few years.

*Larry Paulausky, Greater Media, Inc., Bala Cynwyd, Pa.*

10 a.m.

### **Consumer Ratings of Impaired Audio at Various Signal/Noise Ratios**

This study determined how consumers would rate broadcast audio samples with specific levels of noise impairment and at what level of impairment consumers would decide to turn off their radios. Three different kinds of interference were tested at six different audio signal-to-noise ratios, using an IEC-standard psophometer, which renders a weighted quasi-peak SNR. Testing was held in Studio 5A at NPR headquarters in Washington, D.C., where 30 participants were each presented a total of 112 separate audio clips and asked to assess sound quality, annoyance of background noise and whether they would continue listening under the conditions presented. This study provides a unique opportunity to associate objective SNR measurements with actual listener opinion.

Noise susceptibility is fundamental to any specification of RF sensitivity and interference used in broadcast channel planning, and consequently the results presented here provide an updated look at planning factors with current consumer ratings. In addition to presenting the results of the listener tests, the effects on radio coverage are shown with signal maps using the consumer measurements.

*John Kean, NPR Labs, National Public Radio, Washington, D.C.*

*Elyn G. Sheffield, PhD. (co-author), NPR Labs and Towson State University*

10:30 a.m.

### **Data Services for Digital Broadcasting**

Presented here is an explanation of the current status of data services carried over digital broadcasting in the US and Europe. The Fraunhofer Journaline technology for personalized, location-based data services and our projects with partners will also be detailed.

*Alexander Zink, Fraunhofer IIS, Erlangen, Germany*

11 a.m.

### **Affordable IP Based Remote Monitoring and Control of Transmitter Sites**

Remote monitoring and control of station and transmitter equipment is mandatory to achieve high uptime, reliable operations and high listener satisfaction. Commercial radio stations have invested significantly in equipment, services and communications to monitor and control their transmitters. In the days of ubiquitous, affordable Internet connectivity, new, extremely cost effective solutions are possible. Using off-the-shelf equipment which is application programmable, even custom monitoring algorithms can be set up and multi-path alarming can ensure operators are informed of any abnormal conditions when they occur.

To relieve station owners from running 24/7 servers, reliable, hosted data collection, monitoring and alarm services are available at low monthly fees. Such services can be configured to monitor many remote locations and alarm operators in case of failures. Nearly every IP-based connection (ADSL, Modem, WiFi, GPRS) from the transmitter location suffices to deliver alarms and actual data for monitoring. This presentation will cover both monitoring of actual audio reception using tuners and IP-based audio streaming equipment as well as extremely affordable IP-based, programmable control and data collection solutions that can be combined with a hosted service to relieve small broadcasters of setting up servers to log transmitter performance, output levels, environmental data and more.

*Johannes Rietschel, Barix AG, Zurich, Switzerland*

### **Audio over IP**

*Chairperson, Talmage Ball, Bonneville International, Salt Lake City, Utah*

1 p.m.

### **IP-Based Audio and Control Distribution Over Internet, Satellite and Wireless**

From station identification to local messaging, radio broadcasters have an ongoing requirement to send control and data information from studio to transmitter. The goal is to synchronize the delivery of this information with the audio in the STL transport stream for over-the-air delivery to the consumers' receiver.

Using IP-based audio distribution is becoming the de facto standard, as it allows the usage of affordable equipment and transmission technologies to deliver audio in excellent quality. Using existing technologies such as Shoutcast Metadata and RTP, it is possible to also deliver control information in the same stream, in synch with the audio, using very affordable equipment. Control information can be sent along with the audio in both point-to-point (STL) as well as multipoint applications, and distribution can even be done over the public Internet using third party hosted relay servers. Discussed here is how professional radio broadcasters can benefit from these technologies, where the limitations are, and what delivery method (Shoutcast or RTP-based) is best for specific applications in both traditional terrestrial broadcasts as well as IP satellite distribution.

*Johannes Rietschel, Barix AG, Zurich, Switzerland*

1:30 p.m.

### **Rapid Radio Deployment Pack – Emergency Edition**

The Rapid Radio Deployment Pack – Emergency Edition (RRDP EE) concept is a portable multiple inputs/outputs (EVDO, POTS, IP, VSAT, BGAN, Line-Of-Sight STL) IP-based modular radio studio including satellite news alert feeds and remote control. As is well known, installing a remote production studio may require a lot of resources and could take quite a long time, which is not suitable in many circumstances. A portable studio is needed, as it can be installed rapidly for special events and emergencies when a phone or an IP codec for a single reporter is not enough and when an OB van is not suitable. Furthermore, this is especially useful when the head office has to be evacuated, main network production facility and operations need to be maintained from a remote location, basic network and local programming needs to be continued, all regional stations' programming needs to be interrupted for special news bulletins.

The presentation will cover technological and operational aspects of the RRDP EE concept, such as several modular audio production units, modular control, basic automation and communication units, wideband 3G and other remote contribution/distribution paths, IP strategy, as transport via public and private networks, remote access to main production and transmission sites, reliability, user friendliness and affordability, and portability and ease of deployment.

*Pierre Robidoux, CBC / Radio-Canada, Montreal, Quebec, Canada*

2 p.m.

### Advanced Tech for IP Remotes

SDN has served broadcasters well. Indeed, it was a small-scale revolution when it first appeared in the early nineties. Compared to the equalized analog "broadcast loops" that were the only high-fidelity telephone service before, ISDN was miracle. While ISDN is still a perfectly good technology, it does have some drawbacks: usage is billed by the minute, installation usually has a multi-week lead time and a significant cost. In some areas, ISDN is being discontinued or has become difficult to get. IP networks are becoming the new way to get broadcast audio to here from there. A broadcast codec taking advantage of new technology and optimized for the real-world conditions makes this a practical reality, even on the public Internet.

*Steve Church, Telos Systems, Cleveland, Ohio*

**Tuesday, April 15, 2008 • 3 – 4 p.m.**

**Las Vegas Convention Center • Room S228**

### Future Broadcast Technologies – A Worldwide Perspective

*Chairperson: David Wood, EBU, Geneva, Switzerland*

It's not just Internet development that is moving in 'dog years.' Across the globe, broadcast research laboratories are driving broadcast technology forward. This session will allow you to take in and question the frontiers of the research for some of the most active laboratories in the world and see the possible future of broadcasting

#### Panel

*Andy Bower, BBC, UK*

*Bernard Caron, Communications Research Center, Canada*

*Klaus Illgner, IRT, Germany*

*Alberto Morello, RAI, Italy*

*K. Tanioka, NHK, Japan*

*Colin Whitbread, BBC, UK*

**Tuesday, April 15, 2008 • 4.- 5 p.m.**

**Las Vegas Convention Center • Room S228**

### Next Generation Public Alerting

*Chairperson: Clay Freinwald, Entercom, Seattle, Wash.*

Come discuss the status of development of the next generation Emergency Alerting Systems. Industry representatives will discuss and answer questions about technology and implementation, so broadcasters can gain an understanding of what will be expected of them in the future.

**3:30 p.m.**

#### Opening Remarks

*Derek Poarch, FCC, Washington, D.C.*

**3:35 p.m.**

#### Panel

*Jerry LeBow, Sage Alerting Systems, Tye Brook, N.Y.*

*Darryl Parker, TFT Inc. San Jose, Calif.*

*Edward Czarnecki, SpectraRep, Chantilly, Va.*

**Wednesday, April 16, 2008 • 9 – 11 a.m.**  
**Las Vegas Convention Center • Room S226/227**

### Monitoring and Measurements in the Broadcast Plant – TV

*Chairperson: John Merrill, CBS 5 KPHO-TV, Phoenix, Ariz.*

**9 a.m.**

#### Optimizing the QC Process in a File-Based Workflow Facility

Ensuring content quality in a multichannel explosion has become increasingly challenging for broadcasters, as compressed digital content may be comprised of differing standards, formats and resolutions. Automated media analysis server technology provides broadcasters with a more efficient, consistent and cost-effective method of verifying the content of all popular formats and parameters. The need to support many file formats (MXF, QuickTime, etc.) and compression standards, including but not limited to MPEG2/IMX 50, MPEG-2, DV25, DVCPRO 50, DVCPRO 100, VC1 (WM9) and MPEG4-H.264, necessitates a machine that functions irrespective of ingest format.

While traditional stream monitors test for compression and syntax errors, a robust media analysis server checks visual (pixel by pixel) and aural (sample by sample) quality assurance (QA) parameters, including video and audio levels, video color space compatibility, audio phase, low audio and letter and pillar box limits. By automating the quality assurance process at rates faster than real time, QC productivity increases, providing broadcasters with confidence in the quality of their digital assets.

*Rob Zwiebel, Harris Broadcast Communications, Mason, Ohio*

**9:30 a.m.**

#### System Wide Video Quality Assurance

Digital television (DTV) broadcast has become quite complex. Ensuring the quality of the broadcast is necessary for viewer satisfaction and retention. Additionally, business pressures are forcing consolidation of operations and expertise for broadcast station groups. A consequence of this consolidation is the need to assure video quality for an entire enterprise from centralized locations – either because operations or expertise have become centralized.

Introduced in this presentation is an architecture for centralized system-wide quality assurance. Components of this architecture include monitoring (unattended comparison of stream parameters against pre-established rules), troubleshooting (active analysis of stream conditions to determine causes of impairments), consolidation (collection of system-wide conditions into a usable form), communication (generation of reports and identification of targeted alarm responses), and configuration (centralized configuration of all monitoring and analysis systems). With a system-wide video quality assurance strategy, impairments can be found and corrected more quickly. The overall effect of having an integrated view of monitoring will be a higher quality service, with a lower cost of operation.

*Ralph Bachofen, Triveni Digital Inc., Princeton Junction, N.J.*

10 a.m.

### **Controlling and Measuring Loudness for Digital Television Broadcast**

Loudness discrepancies have been a major source of headaches for the broadcast professional, and only seem to be getting worse in digital television (DTV) broadcasts. Before corrective action can be taken, program loudness must be measured and the behavior of the professional integrated receiver/decoder (IRD) understood. A broadcaster's best efforts at controlling loudness and reducing the number and frequency of viewer complaints can be undermined by just a few outlier programs or a delivery path that has not been appropriately managed. A systemic approach is necessary to achieve the best results and reduce viewer complaints.

*Michael Babbitt, Dolby Laboratories, San Francisco, Calif.*

10:30 a.m.

### **Reducing the Effects of Bit Errors in Serial-Digital Interface Links**

Serial-digital television systems inherently suffer from transport bit errors. However, the broadcast industry lacks characterization of and standards associated with these errors. Despite the existence of these errors, serial links which today's businesses are built have been successfully developed and deployed. But how much lost airtime can be attributed to these errors? As the industry moves to ever-higher bit rates, this problem will become more pervasive.

Other serial paradigms have understood and characterized the behavior and pitfalls of these systems for many years and have adopted techniques for minimization and management. Discussed in this presentation are the incidence of errors in serial systems and the factors that cause them, as well as the impact of these errors on various signal types, both baseband and compressed. Error detection, correction and concealment are also discussed and specific techniques used in SDI products and systems to manage errors are explained and their limitations explored. The need for a new generation of error management is also addressed. Finally, product attributes and system design techniques that minimize these issues are described.

*Paul Briscoe, Harris Broadcast Communications, Mason, Ohio*

**Wednesday, April 16, 2008 • 11 a.m. – 4:30 p.m.  
Las Vegas Convention Center • Room S226/227**

### **Television RF and Transmission Systems**

*Chairperson: Victor Tawil, Association for Maximum Service Television, Washington, D.C.*

*Chairperson: Louis Libin, BroadComm, Inc., Woodmere, N.Y.*

11 a.m.

### **Implementing an 8-transmitter Distributed Transmission Network**

The first Distributed Transmission (DTx) network to replace a single, high power, tall tower operation with a number of smaller transmitters includes a total of eight such transmitters. Building the DTx system presented some unique challenges related to FCC allocations, adjacent channel interference protection and system integration. A number of original solutions were developed to meet each of the challenges. These will be discussed along with the reasons for many design choices and the results achieved from operation of the system.

*S. Merrill Weiss, Merrill Weiss Group LLC, Metuchen, N.J.*

11:30 a.m.

### **Antennas for Distributed Transmission and Single Frequency Networks**

Much like traditional broadcasting, antennas deployed for distributed transmission systems are key to the success of the system. Coverage and interference are directly related to antenna parameters, with the additional issue of self-interference. Antenna arrays tailored to the network topology maximize coverage and minimize self-interference. Antenna array theory is brought to bear on the self-interference problem. Regions of sharp roll-off the azimuth patterns are discussed. Techniques are given for creating a rapid drop in amplitude over a short distance, and the pitfalls that will be encountered without measurement and validation of the array are revealed.

*Myron Fanton, Electronics Research, Inc., Chandler, Ind.*

2 p.m.

### **Evaluation of Buildings Penetration Loss for 100 Buildings in Belgium**

Building penetration loss measurements of a DVB-H signal at 602 MHz have been performed in 100 buildings in Ghent, Belgium. A classification has been made based on building type (terraced house, apartment, office building with or without coated windows, mansion, detached house), and on the number of sides of the room that are irradiated. Median values of the penetration loss, as well as standard deviation will be presented for each single category and for all data together. The distribution of the measurement data is investigated, and a comparison with existing data will be made. The results of this analysis will help enable broadcasters to design networks aimed at indoor coverage.

*David Pleys, Ghent University/IBBT, Ghent, Belgium*

2:30 p.m.

### **Vertical Polarization for UHF DTV**

Since the beginning of the DTV transition, the use of vertical or circular polarization has been considered for improvements in coverage. However, testing based on typical consumer receiving antennas has not been conclusive as to the benefits versus the additional costs for the transmitter power and antenna systems. With the introduction of mobile TV technologies, a vertically polarized component to the signal is now presenting a significant benefit. The design of broadcast antennas utilizing vertical and circular polarization for UHF DTV will be reviewed. Polarization performance, bandwidth, wind loads and costs will be compared to standard horizontally polarized antennas. System analyses showing the impact on transmitter power levels, transmission line choices and the impact on coverage for both fixed and mobile will be discussed.

*Kerry Cozad, Dielectric Communications, Raymond, Maine*

3 p.m.

### **A Mobile Television Transmitting Facility**

As part of Iowa Public Television (IPTV) digital conversion, new digital-ready analog transmitters will be installed at six UHF sites. Since all of these sites operate with a single analog transmitter, some method was needed for keeping the analog service on the air while the old integral cavity Klystron was removed. The building site prepared and the new transmitter installed, tested and proofed. This session will detail the solution, which was to install a 5 kW translator that was slated for installation at another IPTV site in a truck configured to drive and park at any of the sites, and provide a temporary service while the new transmitter is installed. Since the six sites are located all across the state of Iowa, having the temporary transmitter vehicle mounted allows for rapid and easy deployment.

*William Hayes, Iowa Public Television, Johnston, Iowa*

3:30 p.m.

### **RF Coverage and Tower Motion**

The "Structural Standards for Steel Antenna Towers and Antenna Supporting Structures" standard, TIA-222-G, includes descriptions and guidelines for controlling broadcast antenna sway. With operational wind pressure, the antenna structures atop broadcast towers deflect, altering the location of the main-beam, side-lobes, and nulls of the radiation pattern. This in turn changes the coverage and received signal strength in the broadcast population areas.

The important parameters of the problem are defined, including sway, joint rotation, deflection and beam-tilt. The relationship between the antenna electrical parameters and the structural parameters of the tower and antenna system is derived. In many broadcast structures used for TV and FM transmission, a half-degree change in the down-tilt of the main beam degrades the received signal over 10dB, potentially losing signal reception over large population areas. The focus of the additions to the structural standards is to define and place engineering parameters on the design of new structures. Improving the design of antenna and tower equipment will result in improved coverage and more reliable transmission systems.

*Myron Fanton, Electronics Research, Inc., Chandler, Ind.*

4 p.m.

### **Field Test of the Distributed Translators in Korea**

To apply distributed translators in the urban area of Seoul, three translator stations were operated and constructed as a single frequency network (SFN). One was installed on a higher mountain and another was on a midsized mountain. The other translator was installed on a building and had the smallest power among the three. Transmission timing was adjusted and TX powers were varied to find out several characteristics of test networks. The bury ratios of TXID insertion logic of each translator was also changed. Test points were decided considering each translator's coverage. In this presentation, the test results of the distributed translators with various transmission statuses are analyzed. From these results, several parameters that affect reception status in the distributed translators are found.

*Young-Woo Suh, KBS, Seoul, Korea*

## **Monitoring and Measurements in the Broadcast Plant - Radio**

*Chairperson: Talmage Ball, Bonneville International, Salt Lake City, Utah*

9 a.m.

### **Why Grounding Systems are Important and Why Testing is Invalid 95 Percent of the Time**

No one questions the fact that the grounding system for a facility is critical. Along with being critical for equipment operation and power quality, it also dissipates the electrical surges collected by the surge suppression (AC, RF, telco) and lightning protection systems. Recognizing the importance of the grounding system, this presentation will cover the basics of two common methods of testing, present a one-line electrical diagram explanation of test theory and discuss the common mistakes. Ground testing concepts and how to evaluate testing results will be emphasized.

*John Howard, Lyncole XIT Grounding, Torrance, Calif.*

9:30 a.m.

### **VSWR Measurements in Broadcast Transmission Systems**

VSWR (or return loss) measurements are important indicators of the overall health of any broadcast antenna and transmission system. While it is possible to use precision reflection measurement instruments, such as vector network analyzers, to make high quality measurements on inactive systems, the day-to-day continuous monitoring of system VSWR under operating conditions requires the careful management of specific measurement system components. Digital broadcast environments demand an even more careful approach to these measurements. In this presentation, the critical components involved in providing these measurements will be identified and the most important parameters associated with these components will be reviewed. Also, the effects of directional coupler directivity and measurement systems' dynamic range as they apply to reflectometer-based measurement systems will be analyzed, as well as the limitations of the measurements based upon critical components. Finally, some important system level considerations will be reviewed, such as antenna feed line isolation and its effect upon VSWR measurements.

*Tim Holt, Bird Technologies Group, Solon, Ohio*

**10 a.m.**

### **The Role of the Detector in Spectrum Analyzer Measurement of Hybrid Digital Signals**

With the variety of spectrum analyzers available to broadcast engineers, there are numerous ways that spectrum analyzers acquire, process and present measurements of complex digital signals. Scan rates, bandwidths, trace averaging, video averaging, channel power utilities and other analyzer settings have an effect on the resulting measurement. Discussed in this presentation are the errors experienced by various measurement methods and a comparison of results from different methods.

*David Maxson, Broadcast Signal Lab, Medfield, Mass.*

**10:30 a.m.**

### **RF Measurement Techniques for Broadcast Engineers**

Broadcast engineers must be competent in many areas of discipline: IT, DSP, facility and power engineering. In many cases, RF technology may be a low priority for a station engineer. This session will discuss modern methods and tools for RF measurement and review passive RF measurements of transmission equipment, including impedance, return-loss, insertion-loss, VSWR, isolation, directivity and coupling. The discussion details the measuring and troubleshooting of filters, combiners, hybrids, transmission lines and antennas, as well as the vector network analyzer equipment used to perform these measurements is described, outlining modern techniques for system measurements.

Other RF measurements facing the broadcast engineer are explained, including the measurement of coverage, transmitter power output and intermodulation products. The specialized equipment and techniques involved are discussed and common mistakes are revealed.

*Myron Fanton, Electronics Research, Inc., Chandler, Ind.*

**11 a.m.**

### **RF Signal Performance Measurements of Consumer FM Receivers and Coverage Effects**

An extensive measurement program was conducted at NPR Labs in 2007 to determine the RF signal performance of consumer FM receivers. A total of 50 receivers were tested, including IBOC (HD Radio) receivers operating in analog receive mode. A variety of types, such as clock radios, automotive receivers, portables and home stereos were measured. Between 1500 and 3000 measurement points were collected per receiver, utilizing an RF test bed with custom MATLAB automation. Some unique aspects of the test bed are the instrumentation for generating three hybrid (analog+IBOC) signals and the hardware for receiver-induced IM measurements.

This study provides new insight into receiver sensitivity and interference susceptibility from co-channel, first-, second- and third-adjacent channel signals. Interference tests include both analog-to-analog and IBOC-to-analog conditions. Summary results are expressed using maps to show coverage effects with actual stations.

*John Kean, NPR Labs – National Public Radio, Washington, D.C.*

**11:30 a.m.**

### **Fiber Optic Antenna Monitoring for Computer Modeled AM Directional Arrays**

An important part of adjusting and maintaining a directional antenna system is accurately monitoring the phase and amplitude of the RF current in each directional element in the antenna array. This fiber optic monitoring system replaces the traditional coaxial sample lines with fiber optic cable and is ideal for adjusting and maintaining the new computer-modeled antenna arrays. The system uses an interface at the current sample loop on each of the antenna elements to convert the RF current sample to an optical signal.

A fiber optic cable is then used to transmit the sample information to a common antenna monitor where it is converted back to an electrical signal for appropriate phase and amplitude comparison with other elements in the antenna array. The fiber optic cable eliminates the need for decoupling at the base of each antenna element and eliminates the problem of temperature stability associated with coaxial sample lines. Installation of the small fiber optic cable is easier than coaxial cable.

*James Dalke, Dalke Broadcast Services, Inc., Bellevue, Wash.*

## Technology Luncheon

Sponsored by

**SAMSUNG**

### Keynote: Funny, You Don't Look Like Your Avatar: New Media Conquers Old Problems

In the flood of celebrity and "personalized" TV news, important science stories find difficulty making it to the airwaves. And when they do, they often become little more than sound bites. At this luncheon, keynote speaker Ira Flatow, a veteran radio and TV science journalist, describes the trials and tribulations of getting science news on the air, and how new media offer unique opportunities to reach new audiences.

### Technology Luncheon Keynote Speaker



Ira Flatow Photo Credit: Carl Flatow

National Public Radio (NPR) science correspondent and award-winning TV journalist Ira Flatow is the host of "Talk Of The Nation: Science Friday®," where he brings listeners a lively, informative discussion on science, technology, health, space and the environment. Flatow is also founder and president of TalkingScience, a 501 (c)(3) non-profit company dedicated to creating radio, TV and Internet projects that make science more user friendly.

Flatow's interest in things scientific began in boyhood — he almost burned down his mother's bathroom trying to recreate a biology class experiment. "I was the proverbial kid who spent hours in the basement experimenting with electronic gizmos, and then entering them in high school science fairs," Flatow says.

Mixing his passion for science with a tendency toward being "a bit of a ham," Flatow describes his work as the challenge "to make science and technology a topic for discussion around the dinner table."

He has shared that enthusiasm with public radio listeners for more than 35 years. As a reporter and then news director at WBFO-FM/Bufalo, New York, Flatow began reporting at the station while studying for his engineering degree at State University of New York in Buffalo. As NPR's science correspondent from 1971 to 1986, Flatow found himself reporting from the Kennedy Space Center, Three Mile Island, Antarctica and the South Pole. In one memorable NPR report, Flatow took former "All Things Considered" host Susan Stamberg into a closet to crunch Wint-O-Green Lifesavers, proving they spark in the dark.

His most recent book is "Present At The Future: From Evolution to Nanotechnology, Candid and Controversial Conversations on Science And Nature." It follows on the heels of "They All Laughed...From Light Bulbs to Lasers: The Fascinating Stories Behind the Great Inventions That Have Changed Our Lives."

On television, Flatow has discussed cutting-edge science stories on a variety of programs, including the new digital Cablevision program "Maximum Science." He is also host of the four-part PBS series "Big Ideas," produced by WNET in New York. His numerous TV credits include six years as host and writer for the Emmy Award-winning "Newton's Apple" on PBS, science

reporter for "CBS This Morning," Westinghouse and CNBC. He wrote, produced and hosted PBS' "Transistorized!," a documentary about the history of the transistor. He has talked science on many TV talk shows including "Merv Griffin," "The Today Show," "Charlie Rose," and "The Oprah Winfrey Show." He is currently exploring new and better ways of bringing science news to radio, TV and the Internet.

On the Internet, Flatow has hosted numerous science related webcasts for Discovery Online and the American Museum of Natural History in New York. His "Science Friday" Kids' Connection Web site won the award for one of the top 500 Web sites in the country given out by Home PC Magazine. His Podcasts are among the most listened to on the Internet, frequently in the top-ten of all downloads on iTunes.

Flatow has authored articles for various magazines ranging from Woman's Day to ESPN Magazine to American Lawyer. His commentary has appeared in The Los Angeles Times and Current newspapers.

His recent honors include: National Science Teachers Association Faraday Science Communicator Award (2007), National Science Board Public Service Award (2005), World Economic Forum Media Fellowship (2005), Elizabeth Wood Writing (2002), AAAS Journalism award (2000), Brady Washburn Award (2000), the Carl Sagan Award (1999).

### Radio Engineering Achievement Award Winner



Tom Silliman is often called a renaissance man, due to his varied passions. But he is best known for his accomplishments in the field of antenna engineering for the broadcast industry as president of Electronics Research Incorporated (ERI).

Tom began his career as a consultant, working with his father in the engineering firm Silliman & Silliman. In the 1970s he developed a design for what would become the patented ROTOTILLER® antenna - a circularly polarized FM broadcast antenna. ERI, owned by the Sillimans, began manufacturing the ROTOTILLER which rapidly became a popular antenna choice for FM stations in the United States.

In-Band On-Channel (IBOC) digital broadcasting technology demanded new antenna innovations for broadcasters. Under Tom's leadership, ERI developed a dual feed antenna system designed to accommodate stations' analog and digital transmissions.

In 2003, building on the strengths of ERI, Tom led the company in its successful efforts to acquire Andrew Corporation's Broadcast Products Business. Today, ERI is considered one of the world's top suppliers of radio and television transmission components.

You will recognize Tom as the guy on a tower hundreds of feet off the ground in a variety of ERI advertisements - he's an expert climber and tower rigger. He is a friend to many broadcasters and takes the time to carefully explain complex RF issues to anyone willing to take the time to learn.

Tom's father, Robert M. Silliman won the NAB Engineering Award for Radio in 1993.



Tony Uyttendaele spent 25 years of his career with ABC, Inc., in positions of increasing responsibility. Officially retired in 2000, he continues to consult for ABC on a part-time basis. Preceding employment by ABC; he worked for Harris, RCA (several countries) and PYI Ltd., mostly making broadcast facilities become operational realities worldwide.

He graduated magna cum laude with a degree in engineering from the National Radio and Film Institute in Brussels, Belgium.

Perhaps most noteworthy of Tony's accomplishments is his pivotal and unrelenting role in making 720p a reality, from being an early supporter and promoter of progressive scan formats to final adoption by the ITU (ITU-R BT.1543) and implementation by several major broadcast networks. Prior to ABC announcing the adoption of the 720p HDTV format for production and transmission, Tony and his engineering colleagues had to convince many equipment manufacturers that they should develop 720p hardware. This they did by visiting all major Japanese broadcast equipment manufacturers as well as some consumer equipment manufacturers. In the process he made dozens of presentations positing the benefits, addressing comments from the skeptics, including convincing the Grand Alliance to change from the original 787.5 to 750 lines. At the same time he prepared, with the help of Panasonic and NTV (Japan), a draft SMPTE document for 720p. This formed the basis for what became SMPTE 296M.

Tony spent 10 years as the international chairman of the ITU-R Working Party on SNG. This Working Party developed many recommendations on uniform standards and operating procedures to make SNG practical worldwide. Tony has contributed to the industry in many other ways, as a member/participant of numerous engineering committees and organizations, including NAB, MSTV, ATSC, ATTC, FCC ACATS, FCC Advisory Committee on two-degree satellite spacing, CATS/ATRP (MIT), EIA (RS-250B), NABA, IEEE TAB NTDC (New Technology Directions Committee), ITU Task Groups, Working Parties and Study Groups.

For the ABC Television Network, Tony also developed and managed the implementation of the C-Band satellite network distribution system. He designed the uplink facility at ABC's Broadcast Centers in Manhattan and Hollywood and coordinated interference clearance with all the common carriers that share the same frequency band as a requirement to obtain an FCC license. The uplink facility at ABC's Broadcast Center in Manhattan is unique in that it is the only C-Band video uplink in Manhattan.

Tony was also the chairman of the ATSC Specialist Group on Ghost Canceling. After more than three years studying, evaluating and testing all proposed ghost canceling signals, this activity resulted in the adoption of the ghost canceling (GCR) reference signal standard, subsequently adopted by the FCC. This GCR signal has been widely adopted by countries in addition to the U.S. and is the subject of an ITU-R recommendation. This technology is still in use today in the U.S. in professional receivers for improving the quality of NTSC translators and repeaters.

Wednesday, April 16, 2008 • 2 – 5:30 p.m.  
Las Vegas Convention Center • Room S228

## Radio RF and Transmission Systems

*Chairperson: Gary Kline, Cumulus Media, Atlanta, Ga.*

**2 p.m.**

### Save That Tower!

Exploring hidden risks and how to overcome them – a tower may have weathered many storms, but age other factors could mean the tower is closer to a catastrophic failure than imagined. Based on research for Current, an insiders' guide to the events surrounding two recent publicizing tower collapses, is provided and the broader implications and lessons learned for keeping towers standing tall are discussed.

*Anne Gabriel, Current: The Newspaper about Public TV & Radio, Forest Lake, Minn.*

**2:30 p.m.**

### AM Co-location: Money on the Table?

With the improvement in technology and the ever-decreasing ability to build new towers, cellular, wireless and PC providers are looking for vertical real estate. There are many AM broadcast towers in prime locations that can be used to host these carrier's antennas, which will provide a new revenue stream for the radio station, without interfering with the operation of the station. An overview of AM-colocation, its pitfalls, benefits and the ways to implement are given in this presentation.

*Lawrence Behr, LBA Group, Greenville, N.C.*

**3 p.m.**

### Radio Transmitter Maintenance "Back to Basics"

These days, data management at the transmitter site is key in being able to recognize trends in equipment performance and predicting potential problems before they become real ones. Several methods and systems put into place at five radio transmitter facilities in Boston are demonstrated, which help keep the plants running efficiently with minimum down time. These systems help keep track of transmitter parameters and other logged items, and will flag trends that may require attention. In addition, helpful common sense preventive maintenance tips will be given.

*Paul Shulins, Greater Media, Boston, Mass.*

**3:30 p.m.**

### Implications of IBOC Injection Levels above -20 dB

The movement to increase IBOC injection to improve overall coverage and building penetration is gaining momentum. A general assessment of the impact of higher IBOC injection on the broadcast signal is discussed. The implications of changing existing broadcast infrastructure and an update on new installation recommendations will be presented. Specifically, information will be provided on transmitter performance along with possibilities for performance enhancement through peak-to-average ratio reduction, pre-correction and combining techniques.

*Gary Liebisch, Nautel, Bangor, Maine*

4 p.m.

### **FM IBOC Building Penetration Tests at Elevated Digital Subcarrier Levels**

CBS Radio conducted a study of HD Radio penetration in the Los Angeles radio market. Ten buildings differing in construction type and usage were identified. The buildings ranged from a residential dwelling to an office building in downtown Los Angeles.

Measurements were made inside and outside of each building to gauge the building's attenuation. Tests were then conducted to determine the extent of HD reception at the authorized -20 dBc digital power level and at an experimental -10 dBc digital power level. In addition, recordings were made of the analog signal quality at the Point of Failure (POF) for each digital power levels.

*E. Glynn Walden, CBS Radio, New York, N.Y.*

4:30 p.m.

### **Linear Effects of AM Narrow Band Antenna Systems: Characterization by Direct Measurement and Transmitter Based Equalization**

Much work has been done within the AM broadcasting technical community to improve the bandwidth of AM antenna systems for IBOC, as well as to understand and mitigate the effects of narrow impedance bandwidth on transmitter linearity. The spectrum analyzer has been heavily relied upon to verify antenna response as well as transmitter out-of-band emissions. However, there have been problems reported when relating spectrum measurements at the transmitter output to far field measurements. Additionally, the spectrum analyzer cannot directly measure the antenna system response. Until now, little has been published on the mitigation of linear bandwidth effects in the AM antenna system through the use of correction in the transmitter.

In this presentation the following areas are explored: the use of a directional coupler to improve the accuracy of spectrum verification at the transmitter output in the presence of VSWR; the discussion of the limitations of a spectrum-only measurement technique; the introduction of the use of subcarrier demodulation techniques to verify antenna system response; the discussion of the use of equalization in the transmitter to mitigate antenna bandwidth limitations; and the effect of antenna bandwidth on the received signal and receiver performance. Real world measurements of receiver acquisition time and coverage with and without antenna equalization will be presented.

*Ben Dawson, Hatfield and Dawson*

*Tim Hardy, Nautel, Halifax, Canada*

5 p.m.

### **Free Software Tools for Design of AM Antennas**

Many engineers employed in AM stations never get to design an antenna system, but are expected to maintain the system. Discussed in this presentation are a set of software tools that may help station engineers understand the effect that any changes to components in the system may make. This software is available to all NAB attendees free of charge from the RadioTab FTP site. Details on how to do this are given at the end of this presentation.

*Van Richards-Smith, RadioTab Network, Brisbane, Australia*

Wednesday, April 16, 2008 • 6 – 8:00 p.m.  
Las Vegas Hilton Ballroom B

### **Amateur Radio Operator's Reception**

Always one of the most popular events at the convention, this reception draws hundreds of broadcasting's best and brightest, from company CEOs to shop technicians, for a relaxed evening talking shop, enjoying the fellowship of the radio amateur community and winning fabulous door prizes.

Sponsored by



Thursday, April 17, 2008 • 9 a.m. – noon  
Las Vegas Convention Center • Room S226/227

### **Codecs, Compression Systems and Scaling for Video**

*Chairperson: Graham Jones, NAB, Washington, D.C.*

9 a.m.

### **10-bit High Quality MPEG-4 AVC Video Compression**

HD MPEG-4 AVC is a standard that has been well established in the broadcast industry for over three years. It offers premium compression performance at significantly lower bit rates than MPEG-2. However, there are still aspects of the H.264 AVC toolset that are not widely used, in particular High 10 Profile (Hi10P) that supports full resolution 10-bit video encoding. From content distribution (C&D) to satellite direct-to-home, there are applications for Hi10P operation that can enhance performance.

Direct-to-home broadcasters are competing with the HD-DVD market and therefore require optimum compression performance. In particular, areas for improvement include plain backgrounds, which can suffer from color contouring. This is also becoming increasingly relevant as consumer displays migrate to 10-bit technologies, therefore there will be a demand for ultimate dynamic range. Likewise, C&D markets desire 10-bit HD video through the entire broadcast production chain, and this can be achieved in addition to 4:2:2 color processing with the H.264 AVC High 4:2:2 Profile (Hi422P).

Discussed in this presentation are the advantages and disadvantages of HD MPEG-4 10-bit encoding at a variety of bit rates on different types of content. Comparisons are made at the different operating points, demonstrating where gains may be achieved.

*Matthew Compton, Tandberg Television, Southampton, UK*

**9:30 a.m.**

### **Practical Applications of Compression Standards**

Discussed in this presentation are some of the advantages and tradeoffs of the growing list of available compression standards. A general overview of current and proposed standards, which will delve into the application of suitable compression standards within the broadcast workflow, will be provided. Compression format tradeoffs such as data-rate and image quality, compression and decompression complexity, license structure, open and propriety standards, and hardware and software implementations will be compared. Also examined will be the impact of GOP structures, color space depth and associated audio formats upon broadcasters' workflows.

The generalization of requirements in the areas of production, contribution and distribution in terms of quality and data-rate will help broadcasters rationalize requirements and select appropriate media compression formats. This presentation will provide both a primer and keys for success. A matrix overview will include: MPEG-1, MPEG-2, IMX, XDCam/XDCamHD, HDCam, MPEG-4, H.264 (AVC), DV25/50/100 and DVCAM, JPEG2000, VC-1 (WM10), DnX and DnXHD, AVS, Dolby E and AC3, AAC and MP3.

*Todd Roth, Harris, Mason, Ohio*

**10 a.m.**

### **Providing Spatial Scalability Using Scalable Video Coding to Mobile Broadcasting**

Terrestrial mobile broadcasting – called Digital Multimedia Broadcasting (DMB) – has been on air since 2005 in Korea. The video resolution of DMB is 320x240 pixels for handheld devices. In mobile broadcasting, higher resolution for better video quality is needed in some cases, like in cars. Scalable Video Coding (SVC) can be applied in the mobile broadcasting environment due to the flexibility of spatial, temporal and quality scalability. Recently, SVC technology rapidly matured, but its reference SW encoder isn't optimized yet. Therefore, Korean Broadcasting System (KBS) has developed a real-time SW SVC encoder for broadcasting. Shown in this presentation is an SVC encoder that can provide two spatial layers: QVGA (320x240) and VGA (640x480). The base layer can be fully compatible with H.264/AVC. KBS' encoder performs real-time operation on a normal PC by optimizing SVC algorithm.

*InJoon Cho, Korean Broadcasting System, Seoul, Korea*

**10:30 a.m.**

### **Scalable Video Coding (SVC) and Broadcast Delivery of 1080P High Definition**

The new 1080p high resolution format is gaining momentum in production environments and consumer applications. Broadcast deliveries of these formats pose challenges for service provider infrastructures. With 1080p infrastructure equipment still in its infancy, how can an operator plan to broadcast this rich content? Millions of set-top boxes are deployed and designed for specific codecs, but what are the strategies to maintain continuity with the deployed base? Discussed in this presentation are the challenges faced by broadcasters and operators related to bandwidth constraints and the set-top installed base, compression strategies for SVC and solutions available to deliver new video formats using the current service broadcast model.

*Elie Sader, Harmonic Inc, Sunnyvale, Calif.*

**11 a.m.**

### **Understanding and Implementing JPEG 2000 Compression for Long-form EFP Acquisition**

For documentary and drama producers, picture quality and workflow efficiencies finally come together. The true open compression standard JPEG 2000 (J2K), widely accepted as the standard for digital cinema, is now also available for (long-form) EFP productions.

JPEG2000 is a wavelet compression scheme, so it completely eliminates the blocking artifacts which are a blight in all MPEG and DV (DCT-based) compression schemes. More subtly, JPEG2000 also eliminates harsh edges on color transitions, making chromakeying smoother and more natural. Most importantly, it is an open standard which is available to all without payment.

However, developing products that use JPEG2000 has been seen as a challenge, as the codec is processor-hungry. Proven acquisition and craft editing products are now available though, and it is time to raise the profile of this high quality workflow. In this presentation, the issues in shooting and posting JPEG2000 high definition content and the real benefits that will flow from its wide take-up are considered.

*John Naylor, Thomson, Beaverton, Ore.*

**11:30 a.m.**

### **Bridging the Gap with HD Transcoding**

With the variety of content coming into the home today from cable, satellite and Internet services, the need arises for a versatile platform that can transcode MPEG-2 and H.264 content from a variety of resolutions ranging from HD to QVGA, and be able to do this seamlessly and in real time without any additional storage requirements or off-line processing. Maintaining the quality during the transcode operation is critical so that the consumer does not sense degradation in the content. Addressed in this presentation is how transcoding HD/SD content can be done in a single silicon device without having to go through a complete brute force transcode operation by a STB and re-encoded by another expensive H.264 HD encoder, which would be cost prohibitive.

Coupling the decoder and encoder in an MPEG-2 to H.264 and H.264 to MPEG-2 transcoder is critical to arriving at the best possible quality during the transcode operation. An example and demo of HD to HD transcoding will be provided to illustrate how critical motion vector information, frame type and macroblock modes are preserved during the handoff of the decoder to encoder, so that the overall quality is maintained or even exceeded while being able to drop the bit rate in the process. In addition, a demo will be provided where this same transcoder will scale the content in order to allow less capable devices, such as cell phones, to view it in their own native format.

*Tim Simerly, Texas Instruments, Huntsville, Ala.*

## Technology Innovations

*Chairperson: Charles Jablonski, Redwood City, Calif.*

**9 a.m.**

### **Super Hi-Vision Transmission Experiment in the 21 GHz Band**

NHK is studying an ultrahigh-definition video system called “Super Hi-Vision” as the next-generation broadcasting system, aiming to be the ultimate broadcasting system with a heightened sensation of reality. It has 16 times the amount of information of the current HDTV system and provides an overwhelmingly realistic viewing sensation with more than 4000 scanning lines. NHK has developed Super Hi-Vision cameras, projectors, disk recorders and audio equipment, which were demonstrated at NAB2006 and NAB2007.

NHK is investigating a step toward the practical use of Super Hi-Vision in broadcasting. The 21 GHz band satellite broadcasting system is under development as a promising transmission channel to deliver Super Hi-Vision to individual homes because it has a wide RF channel bandwidth of 600 MHz. This time NHK has developed prototypes of a 300 MHz wideband modulator and a demodulator and carried out an indoor Super Hi-Vision transmission experiment through the 21 GHz band experimental transponder via a single carrier to verify performance of the hardware and evaluate the wide-band transmission characteristic. Shown in this presentation are the results of the experiment and the possibility of the Super Hi-Vision broadcasting via a 21 GHz band satellite.

*Hisashi Sujikai, NHK, Tokyo, Japan*

**9:30 a.m.**

### **HDMI as Television Application Platform for Interactive and More**

HDMI has become the ubiquitous connection for television. To date, the CEC bus has been only lightly leveraged for system control. But new extensions can enable a wide range of television applications for professional system needs as well as interactive television. This system can be leveraged for unprecedented levels of control and interaction, giving ad hoc installations a degree of integration previously only available in professional installations. A case study of building, deploying and programming an interactive application will be presented along with possible additional future applications.

*Rainer Zwing, Thomson, Villingen-Schwenningen, Germany*

*Scott Francis, Thomson, Villingen-Schwenningen, Germany*

**10 a.m.**

### **11.88 Gb/s – SDI Continuing the Evolution of SDI**

With the advent of large-scale deployments of high definition television and future migration to higher bandwidth 1080p50/60 transmission, the video industry will need to reduce the number of physical links, both electrical and optical, between facilities, equipment racks and outside broadcast vehicles. This requirement will extend within large pieces of equipment, such as serial video routers, to reduce the size and complexity of high-speed interconnect. By combining multiple HD signals, up to 1080p50/60, into a single optical fiber or coaxial cable link, the cost of installations can be significantly reduced, reducing the number of fiber runs and providing a more efficient use of cabling resources.

In addition, the definition of higher bandwidth video formats, such as Ultra High Definition Television (UHDTV), requires interface capacities for the carriage of such formats to scale accordingly. UHDTV image formats require

interface capacities ranging from 7.5 Gb/s, up to 72 Gb/s. Using current HD-SDI interfaces, operating at 1.485 Gb/s, UHDTV requires multiple links, from eight to more than 48, depending on the image format and sampling structure. This is a costly and technically challenging solution. The real estate required for all the HD-SDI connectors is considerable, leading to increased system costs, and the cost and complexity of cabling is significant. By utilizing a serial digital interface operating at 11.88 Gb/s, one can define the video data mapping protocol, the carriage of ancillary data, coding and physical interface characteristics.

*Gareth Heywood, Gennum Corporation, Burlington, Ontario, Canada*

*Ryan Latchman, Gennum Corporation, Burlington, Ontario, Canada*

**10:30 a.m.**

### **Audio Mixing Requirements in Next Generation Broadcast Receivers for Audio Description and Other Enhanced Features**

The deployment of next generation broadcast platforms for HDTV and IPTV offers the opportunity to utilize advanced video and audio codecs, as permitted by recent revisions to ETSI specifications TS 101154 and TS 102005. In addition to bandwidth savings, new audio codecs for these applications will likely need to support additional features within their platform lifetimes, including 7.1-channel surround sound and improved provision for the visually impaired. Support for the latter feature is increasingly being mandated by broadcast regulators in Europe and elsewhere.

Discussed in this presentation are the requirements for audio mixing features within next generation broadcast audio codecs. Audio mixing enables enhanced services, such as audio description for the visually impaired or director commentaries, to be offered at efficient total data rates. This can be achieved by transmitting an additional bit rate-efficient channel of commentary, which is mixed dynamically with the main program audio within the audio decoder of a standard home set-top box. It is concluded that mixing audio streams in the coded domain within a single standard audio decoder offers significant advantages over other approaches. These include simplicity of implementation, improved audio quality and connectivity to home audio equipment. The importance of implementing metadata control of the mixing feature is highlighted, and requirements for appropriate production and encoding tools are discussed.

*Roland Vlaicu, Dolby Laboratories, San Francisco, Calif.*

**11 a.m.**

### **HDTV System Onboard the Lunar Explorer Kaguya (SELENE)**

The lunar explorer Kaguya (SELENE) of the Japan Aerospace Exploration Agency (JAXA) was launched on September 14, 2007. This lunar explorer is equipped with 15 observation instruments and will orbit the moon for one year to perform scientific research on subjects such as the moon's origin. As part of this mission, NHK developed a high definition camera system (HDTV) to take high definition still and moving images of the earth rising from the moon. This system enables the compression of images shot using a small 2.2 million-pixel high definition camera, and can record moving images of a maximum of one minute on a 1GB memory.

To enhance reliability, each instrument was duplicated and underwent various tests to ensure that it can operate under severe space conditions. For example, vibration tests under the vibration conditions incurred during a rocket launch, which is 17 Gs, were performed. The test results were then used to make various adjustments, such as strengthening the camera boards or CCDs. The preparation process took about seven years to complete and the large-scale project of taking images of a “beautiful earthrise from the surface of the moon” was finally achieved.

*Seiji Mitsuhashi, NHK, Tokyo, Japan*

**PRESENTER INDEX**

|                              |                |
|------------------------------|----------------|
| <b>A</b>                     |                |
| Aitken, Mark .....           | 15             |
| Allard, Frédéric .....       | 27             |
| Anderson, Timothy B .....    | 33             |
| <b>B</b>                     |                |
| Babbitt Michael, .....       | 48             |
| Bachofen Ralph, .....        | 47             |
| Ball, Talmage .....          | 45, 51         |
| Band, Bob .....              | 32             |
| Behr, Lawrence .....         | 57             |
| Bishop, Mark .....           | 19             |
| Bisset, John .....           | 28             |
| Bower, Andy .....            | 46             |
| Brett, Wayne .....           | 15             |
| Briscoe, Paul .....          | 48             |
| <b>C</b>                     |                |
| Campana, David .....         | 15             |
| Caron, Bernard .....         | 46             |
| Casaccia, Ed .....           | 31             |
| Castro, Michael .....        | 18             |
| Chernock, Rich .....         | 38             |
| Cho, Injoon .....            | 60             |
| Church, Steve .....          | 46             |
| Citta, Richard .....         | 15             |
| Claudy, Lynn .....           | 16             |
| Compton, Matthew .....       | 59             |
| Converse, Dave .....         | 16             |
| Costa, Acacio Luiz .....     | 26             |
| Cozad, Kerry .....           | 49             |
| Czarnecki, Edward .....      | 46             |
| <b>D</b>                     |                |
| Dalke, James .....           | 53             |
| Daniels, Simon .....         | 25             |
| Dawson, Benjamin .....       | 58             |
| Driscoll, Melinda .....      | 23             |
| <b>E</b>                     |                |
| Estrada, Luis .....          | 42             |
| Evain, Jean-Pierre .....     | 29             |
| <b>F</b>                     |                |
| Fabiano, Joe .....           | 14             |
| Fannechere Nicolas, .....    | 20             |
| Fanton, Myron .....          | 36, 49, 50, 52 |
| Felts, Boris .....           | 21             |
| Flatow, Ira .....            | 54             |
| Fluker, Steve .....          | 43             |
| Footen, John .....           | 13             |
| Fourcher, Fred .....         | 42             |
| Francis, Scott .....         | 62             |
| Feinwald, Clay .....         | 46             |
| <b>G</b>                     |                |
| Gabriel, Anne .....          | 57             |
| Gampell, Guy .....           | 32             |
| Gao, Wen .....               | 15             |
| Gardina, Mick .....          | 30             |
| Gleason, Frederick, Jr. .... | 23             |
| Glenn, Dave .....            | 16             |
| Godfrey, John .....          | 16             |
| Goldfarb, Robert .....       | 31             |
| Grossniklaus, Al .....       | 27             |
| Guel, Sid .....              | 42             |
| Gurley, Tom .....            | 15             |
| <b>H</b>                     |                |
| Hardy, Tim .....             | 58             |
| Hayes, William .....         | 50             |
| Heywood, Gareth M .....      | 63             |
| Holt, Tim .....              | 51             |
| Howard, John .....           | 51             |
| <b>I</b>                     |                |
| Illgner, Klaus .....         | 46             |
| Isreal, David .....          | 28             |

|                            |            |
|----------------------------|------------|
| <b>J</b>                   |            |
| Jablonski, Charles .....   | 62         |
| Janitschek, Andrew P. .... | 36         |
| Jensen, Laura .....        | 23         |
| Jones, Graham .....        | 59         |
| <b>K</b>                   |            |
| Kean John, .....           | 26, 44, 53 |
| Kelley, Don .....          | 28         |
| Kelly, Charles W. ....     | 33         |
| Kereakos, Nick .....       | 23         |
| Kim, Junius .....          | 43         |
| Kline, Gary .....          | 28, 57     |
| Knee, Mike .....           | 39         |
| Korte, Olaf .....          | 33         |
| Kovalick, Al .....         | 12, 13     |
| Kube, Wayne .....          | 28         |
| <b>L</b>                   |            |
| Latchman, Ryan .....       | 63         |
| Lattie, Tom .....          | 40         |
| LeBow, Gerald .....        | 46         |
| Lee, Joonsoo .....         | 15         |
| Lee, Junehee .....         | 15         |
| Lemer, Robert .....        | 38         |
| Lennon, Chris .....        | 13, 39     |
| Lhermitte, Richard .....   | 18         |
| Libin, Louis .....         | 48         |
| Luff, John .....           | 13         |
| Luplow, Wayne .....        | 16         |
| Lyons, Christopher .....   | 27         |
| <b>M</b>                   |            |
| Macher, Jean .....         | 17         |
| Mailhot, John .....        | 15         |
| Mansergh, Daniel .....     | 22         |
| Marie, Pascal .....        | 41         |
| Maxson, David .....        | 52         |
| Meintel, William .....     | 27         |
| Merrill, John .....        | 47         |
| Mikkelsen, Tom .....       | 12         |
| Mitsuhashi, Seiji .....    | 63         |
| Morello, Alberto .....     | 46         |
| <b>N</b>                   |            |
| Naylor, John .....         | 61         |
| Neugeboren, Harlan .....   | 12         |
| Nobbs, Andy .....          | 37         |
| <b>O</b>                   |            |
| O'Brien, Jim .....         | 12         |
| Ogonowski, Greg .....      | 24         |
| Okano, Masahiro .....      | 20         |
| Overmeire, Luk .....       | 39         |
| <b>P</b>                   |            |
| Pallett, John .....        | 17         |
| Parker, Darryl .....       | 46         |
| Paulausky, Larry .....     | 43         |
| Paulsen, Karl .....        | 29         |
| Pelkey Gary .....          | 23         |
| Peterle, Tony .....        | 27         |
| Plets, David .....         | 49         |
| Porter, Marshall .....     | 19         |
| Poray, John .....          | 12         |
| <b>R</b>                   |            |
| Richards-Smith, Van .....  | 58         |
| Richer, Mark .....         | 16         |
| Rietschel, Johannes .....  | 44, 45     |
| Robidoux, Pierre .....     | 45         |
| Roth, Todd .....           | 60         |
| Rucktenwald, Tom .....     | 22         |
| <b>S</b>                   |            |
| Sader, Elie .....          | 60         |
| Sang-Hun, Kim .....        | 25         |
| Santos, Ernesto .....      | 40         |
| Scherer, Chriss .....      | 28         |
| Schmid, Philipp .....      | 25         |

|                          |            |
|--------------------------|------------|
| Schwartz, Robert.....    | 16         |
| Sheffield, Eilyn G.....  | 44         |
| Shulins Paul.....        | 22, 32, 57 |
| Shumate, Sid.....        | 24         |
| Sidas, Walter.....       | 31         |
| Silliman, Tom.....       | 55         |
| Simerly, Tim.....        | 61         |
| Smith, Milford.....      | 23         |
| Socketk, Pete.....       | 17         |
| Sujikai, Hisashi.....    | 62         |
| Suh, Young-Woo.....      | 50         |
| Swanton, Ken.....        | 30         |
| <b>T</b>                 |            |
| Tanioka, K.....          | 46         |
| Tanner, Craig.....       | 37         |
| Tawil, Victor.....       | 48         |
| Thaler, Larry.....       | 41         |
| Thomas, Barry.....       | 33         |
| Thomas, Peter.....       | 37         |
| Tinkle Paul.....         | 28         |
| Tomiyaama, Kimihiro..... | 29         |
| Turner, John.....        | 37         |
| <b>U</b>                 |            |
| Uyttendaele, Tony.....   | 56         |
| <b>V</b>                 |            |
| Virag, David.....        | 16         |
| Vlaicu, Roland.....      | 63         |
| <b>W</b>                 |            |
| Wadle, John.....         | 14         |
| Walden, E. Glynn.....    | 58         |
| Wallace, Dennis.....     | 28         |
| Warren, Diane.....       | 16         |
| Wellings, Michael.....   | 13         |
| Weiss, S. Merrill.....   | 48         |
| Whitbread, Colin.....    | 46         |
| Wiler, Eric.....         | 23         |
| Wilhite, Joel.....       | 29         |
| Wilson, Dave.....        | 22         |
| Wood, David.....         | 46         |
| <b>Z</b>                 |            |
| Zager, Lewis.....        | 12         |
| Zink, Alexander.....     | 44         |
| Zwiebel Rob.....         | 47         |
| Zwing, Rainer.....       | 62         |

## COMPANY INDEX

|   |        |
|---|--------|
| <b>A</b>  |        |
| ABC/Disney Television Group.....                | 16     |
| Advanced Television Systems Committee.....      | 16     |
| American Public Media.....                      | 23     |
| APT.....  | 25, 32 |
| Association for Maximum Service Television..... | 48     |
| Audemat.....                                    | 27     |
| Avid Technology.....                            | 12, 13 |
| AZCAR Technologies.....                         | 29     |
| <b>B</b>  |        |
| Barix AG.....                                   | 44, 45 |
| BBC.....  | 46     |
| Belo Corporation.....                           | 28     |
| Bird Technologies Group.....                    | 51     |
| Bitcentral.....                                 | 42     |
| Blue Order Solutions AG.....                    | 37     |
| Blue Sky Holdings, LLC.....                     | 14     |
| Bonneville International.....                   | 45, 51 |
| Broadcast Automation Consulting.....            | 42     |
| Broadcast Electronics.....                      | 28     |
| Broadcast Pix.....                              | 30     |
| Broadcast Signal Lab, LLP.....                  | 52     |
| BroadComm Inc.....                              | 48     |
| Building4Media.....                             | 12     |

|   |                        |
|---|------------------------|
| <b>C</b>                                      |                        |
| CBC/Radio Canada.....                         | 45                     |
| CBS Broadcast Inc.....                        | 31                     |
| CBS Radio.....                                | 58                     |
| CBS 5 KPHO-TV.....                            | 47                     |
| Communications Research Centre.....           | 46                     |
| Consumer Electronics Association.....         | 22                     |
| Consumer Electronics Retailers Coalition..... | 16                     |
| Cox Radio/Orlando.....                        | 43                     |
| Cumulus Media.....                            | 28, 57                 |
| Current.....                                  | 57                     |
| <b>D</b>                                      |                        |
| Dalke Broadcast Services Inc.....             | 53                     |
| Dielectric Communications.....                | 49                     |
| Digital Fountain.....                         | 19                     |
| Dolby Laboratories.....                       | 48, 63                 |
| <b>E</b>                                      |                        |
| EBU.....                                      | 46                     |
| Electronics Research, Inc.....                | 36, 49, 50, 52         |
| ENENSYS Technologies.....                     | 18, 20                 |
| Entercom.....                                 | 46                     |
| Envivio Inc.....                              | 21                     |
| European Broadcasting Union.....              | 29                     |
| <b>F</b>                                      |                        |
| FCC.....                                      | 46                     |
| Fraunhofer IIS.....                           | 33, 44                 |
| <b>G</b>                                      |                        |
| Gefen.....                                    | 38                     |
| Gennum Corporation.....                       | 63                     |
| Ghent University.....                         | 49                     |
| Gilmer & Associates, Inc.....                 | 12                     |
| Givens & Bell, Inc.....                       | 24                     |
| Greater Media.....                            | 22, 23, 28, 32, 43, 57 |
| <b>H</b>                                      |                        |
| Harmonic Inc.....                             | 29, 40, 60             |
| Harris.....                                   | 32, 33, 39, 60         |
| Harris Broadcast Communications.....          | 13, 15, 43, 47, 48     |
| Hatfield & Dawson.....                        | 58                     |
| HD Digital Radio Alliance.....                | 16                     |
| <b>I</b>                                      |                        |
| IBM.....                                      | 42                     |
| iDirect Technologies.....                     | 30                     |
| IEEE Broadcast Technology Society.....        | 15                     |
| Ion Media TV.....                             | 16                     |
| Iowa Public Television.....                   | 50                     |
| IRT.....                                      | 46                     |
| <b>J</b>                                      |                        |
| Jones Radio Networks.....                     | 23                     |
| <b>K</b>                                      |                        |
| KBS.....                                      | 25                     |
| Korean Broadcasting System.....               | 60                     |
| KQED Public Radio.....                        | 22                     |
| <b>L</b>                                      |                        |
| LBA Group, Inc.....                           | 57                     |
| Lincoln Financial Media.....                  | 33                     |
| Linx Electronics.....                         | 15                     |
| Lyncole XIT Grounding.....                    | 51                     |
| <b>M</b>                                      |                        |
| MediaFLO Inc.....                             | 12                     |
| Meintel, Sgrignoli & Wallace.....             | 27, 28                 |
| Merrill Weiss Group LLC.....                  | 48                     |
| Mix TV Network.....                           | 26                     |
| MOG Solutions.....                            | 40                     |
| <b>N</b>                                      |                        |
| NAB.....                                      | 16, 59                 |
| National Geographic Television.....           | 18                     |
| National TeleConsultants.....                 | 13                     |
| Nautel, Inc.....                              | 25, 33, 57, 58         |
| NBC-Universal.....                            | 31, 41                 |
| NDS.....                                      | 22                     |
| NHK (Japan Broadcasting Corporation).....     | 20, 29, 46, 62, 63     |
| National Public Radio.....                    | 44                     |

|  |                            |
|--|----------------------------|
| National Public Radio (NPR).....           | 23, 53                     |
| NPR Labs.....                              | 26, 44                     |
| <b>O</b>                                   |                            |
| OmniBus Systems Inc.....                   | 14                         |
| Orban/CRL Systems, Inc.....                | 24                         |
| <b>P</b>                                   |                            |
| Paravel Systems LLC.....                   | 23                         |
| <b>R</b>                                   |                            |
| Radio Free Asia.....                       | 36                         |
| <i>Radio</i> magazine.....                 | 28                         |
| Radio TAB Network.....                     | 59                         |
| RAI.....                                   | 46                         |
| ResearchChannel.....                       | 13                         |
| <b>S</b>                                   |                            |
| Sage Alerting Systems.....                 | 46                         |
| Samsung.....                               | 15, 16                     |
| Shure Incorporated.....                    | 27                         |
| Sinclair Broadcast Group.....              | 15                         |
| Snell & Wilcox Ltd.....                    | 39                         |
| Society of Broadcast Engineers.....        | 12                         |
| SpectraRep.....                            | 46                         |
| <b>T</b>                                   |                            |
| Tandberg Television.....                   | 59                         |
| Telestream, Inc.....                       | 17                         |
| Teletrax.....                              | 37                         |
| Telos Systems.....                         | 46                         |
| Texas Instruments.....                     | 61                         |
| TFT Inc.....                               | 46                         |
| The Workflow and Technology Group LLC..... | 12                         |
| Thomson.....                               | 15, 16, 19, 31, 41, 61, 62 |
| Thomson Grass Valley.....                  | 17                         |
| Thunderbolt Broadcasting Company.....      | 28                         |
| Triveni Digital.....                       | 38, 47                     |
| Turner Engineering.....                    | 37                         |
| <b>V</b>                                   |                            |
| VRT Medialab.....                          | 39                         |
| <b>W</b>                                   |                            |
| WEGENER.....                               | 23                         |
| WFYV-FM/WMXQ-FM.....                       | 28                         |
| WTHR NBC13.....                            | 27                         |
| WRAL TV.....                               | 17                         |
| <b>Z</b>                                   |                            |
| Zenith/LG Electronics.....                 | 15, 16                     |