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IEEE

Broadcast Technology Society Newsletter

The technologies to deliver information and entertainment to audiences worldwide, at home and on the go.

From the President

William T. Hayes, President, IEEE Broadcast Society

Greetings BTS members! It has been an extremely busy time for me between my day job as Director of Engineering for Iowa Public Television and my role as President of the BTS. Over the last few months I have had an opportunity as BTS President to participate in some very exciting projects and processes. I'd like to touch on some of the highlights and share with you why I feel they are meaningful.

In January of this year I asked Christine Di Lapi to become the BTS representative on the IEEE Women in Engineering Committee which she has accepted. For me this is an extraordinarily exciting opportunity on both the professional and personal level. On the personal level, my father passed away when I was quite young (11 years old) and my mother was left alone to raise my two older sisters and me. Seeing my mother go through this process at a time when there were few opportunities afforded women in the work force and the earning potential was less because of societal barriers moved me deeply. Her determination and strength of character were inspirational to me and helped form my respect and admiration for women. On the professional level, I am excited to be part of the program to increase the awareness of engineering as a career path for women as well as creating opportunities for women to become leaders in the industries that BTS is involved in.

In April, I had the opportunity to travel to the Motorola facility in

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From the Editor

William Meintel, BT Newsletter Editor

Once again our crew here at the BTS Newsletter has put together another great issue packed with Chapter reports and news about the Society and its members plus some very interesting articles. Even if you don't care to read the further ramblings of the Editor, I encourage you to check out the other great stuff including our President's column where Bill Hayes talks about his recent BTS activities, new committee appointments and the retirement news of one of our outstanding BTS members.

Well, full service television in the U.S. has finally transitioned to all digital! Oops hold on, that's what was supposed to have happened by now but some last minute cold feet on behalf of the politicians concerned about loss of service forced a change in the long standing February 2009 deadline and so the new deadline is now 12 June 2009.

We are told that this is the final deadline and it will not be put off again although that is what was said about the previous one. I do

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Celebrating 125 Years
of Engineering the Future

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Schaumburg, IL to present Michael Needham his award for presenting the best paper at the 2008 Multimedia Symposium. Typically these awards are done at the awards ceremony held at the following year's symposium. Unfortunately, Michael's schedule did not permit him to make the trip to the 2009 Multimedia Symposium on May 13 - 15, 2009 in Bilbao Spain. I think it was an eye opening experience for both me and for the Motorola staff that attended. My presence seemed to demonstrate to Motorola the importance that BTS placed on the Multimedia Symposium and the best paper award. The attendees from Motorola demonstrated for me the high regard that they have for the IEEE and the Broadcast Technology Society. It was equally rewarding and exciting for all of us to realize the importance that we place in each other. What makes for a successful relationship is for all parties to both find value and provide value in the participation.

I have asked Eric Wandel from Wavepoint Research Inc. to become the representative for BTS on the Committee on Man and Radiation (COMAR) and he has agreed. I am certain that Eric will do an excellent job representing BTS. Eric will be replacing Jules Cohen who has announced his retirement. Jules has been our COMAR representative for many years and a long time supporter of the BTS. However, Jules' contributions to the broadcast industry involve far more than just the BTS. I first met Jules in person about ten years ago while attending my first BTS AdCom meeting. I am not one who is typically awed when I meet someone but I have to confess that I was when first talking to Jules. I had been reading his papers and seeing his work since I started working in AM radio and had learned so much from him that meeting him was very special to me. However, he was so open and willing to share his knowledge that I was completely at ease with him. A few years later he was instrumental in encouraging me to accept the nomination to become president of BTS which has been one of the most rewarding decisions I have ever made. I hope that you will join me is wishing Jules well in his retirement.

Bill Hayes
President
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believe however that the June date will hold not because of the regulators or the politician's promise but because the stations themselves will make it happen. In fact, in spite of the delay, about half of the stations have already turned off their analog signals although not all stations are on their final DTV channel since they must wait until all the analogs are shut down.

No matter when the final shutoff occurs there will be those that will not be ready. There will be various glitches, problems and some service loss but also some service gains. The delay, however, has made it possible to get converter boxes into the hands of more people as additional government money was authorized to subsidize the cost. The delay also has allowed stations more time to finalize their changes.

On the downside the delay has disrupted various schedules and budgets (stations had not planned on operating their analog transmitters for another four months) and for at least one station it means that its DTV signal can not go on the air until June. To be ready for the February deadline, this station's DTV had been shut down to modify its transmitter to its post-transition DTV channel and change out its antenna. However, the station now must wait until an analog station in the market currently operating on the new

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Newsletter Deadlines

The BTS Newsletter welcomes contributions from every member. Please forward materials you would like included to the editor at wmeintel@computer.org. Here are our deadlines for upcoming issues:

Issue	Due Date
Fall, 2009	20 July 2009
Winter, 2009	02 November 2009
Spring, 2010	20 January 2010
Summer, 2010	03 May 2010

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BTS 2009 Election Results

Bill Hayes Re-Elected for a Second Term as BTS President and Bill Meintel Re-Elected for a Second Term as BTS Vice President

The BTS AdCom is proud to announce the re-election of Bill Hayes as President and Bill Meintel as Vice President, for second two year terms which began 1 January 2009. The entire AdCom voted for their re-election by acclimation during their meeting on 14 October 2008.

The IEEE Broadcast Technology Society and its AdCom extend their thanks and deep appreciation to Bill Hayes and Bill Meintel for their dedication, time and guidance provided during the past two years, successfully advancing the IEEE BTS goals and improving services to its members.

The AdCom wishes Bill Hayes and Bill Meintel continued success during the next two years and looks forward to their continued leadership in providing new, innovative broadcast technology educational services and programs for BTS members worldwide.

BTS AdCom Members-at-Large Elected for the Term 2009–2011

The BTS Administrative Committee (AdCom) includes 15 elected voting Members-at-Large. Each year, five new AdCom members are elected for three-year terms.

The BTS extends it congratulations to and welcomes the five newly elected Members-at-Large elected for the term 2009-2011. They are as follows:

Robert W. Denny Jr
Stephen D. Dukes
Joseph Giardina
Michael Simon
Robert Surette

Brief bios of the new AdCom members are presented below.

Robert W. Denny, Jr. (S'76-M'83)

Executive Vice President, Technology and Software Development

Broadcast Management and Technology, LLC

Dallas, TX, USA

Responsibilities: Provides management consulting and technical services to the broadcast industry and develops new software technologies to enable the efficient use of spectrum.

Memberships/Offices Held: Member of IEEE and Broadcast Technology Society; served on Broadcast Symposium Committee for several years and was Symposium chairman twice. Member and past officer of Association of Federal Communications Consulting Engineers, member of National Society of Professional Engineers, and life member of American Radio Relay League.

Education: Bachelor of Science in Electrical Engineering, Drexel University, Philadelphia.

Publications/Patents/Other: Papers on FM subcarrier utilization and broadcast facility design; seven pending patent applications pertaining to spectrum management; licensed professional engineer.

Stephen D. Dukes (S '76-A'79-M '89-SM '91-F '02)

Responsibilities: Mr. Dukes is President and Chief Executive Officer responsible for management and direction of advanced technologies and strategic management group that advises companies in development and investment of existing and new technologies. The focus is on semiconductor technologies for telecommunications networks, high speed data systems, integrated voice, data and video systems, control systems, information systems, interactive television and video on demand systems, DSP software libraries, real time operating systems, middleware, applications interfaces, renewable security systems, network standards, network architecture and topologies, and rapidly developing new applications and services. Mr. Dukes serves on several boards and technical advisory boards.

Previous Work Experience: He was Vice President, Digital Broadband Technology at MediaOne responsible for broadband development and member of CableLabs' DOCSIS Certification Board. He was Vice President, Technology with TCI, including network architecture, digital settop and conditional access system requirements and developments. He was CEO of MCNS Holdings, responsible for management of the DOCSIS specifications for data over cable networks and cable modem development. Mr. Dukes was Director, Advanced Network Technologies for 3DO responsible for network interface requirements to 3DO game platforms. He was Vice President, Advanced Network Development at CableLabs responsible for network architecture, multimedia, wired telephony and wireless PCS. He was Telecom Analyst at Boeing Computer Services responsible for technical planning. Mr. Dukes held management and technical positions with GTE network engineering and planning.

Memberships/offices held: IEEE Fellow (2002); IEEE member since 1976; IEEE BTS Administrative Committee, IEEE BTS Associate Editor, IEEE CE Administrative Committee, IEEE Technical Field Award Council, Chair of IEEE Masaru Ibuka Award Committee, IEEE CE Fellow Committee, IEEE Computer Society Technical Committee on Computer Communications (TCCC), IEEE 802.14 Cable TV Protocol Study Group, IEEE Communications Society/ Society of Cable Telecommunications Engineers Technical Committee on Broadband Distribution and Access.

Education: B.S. Mathematics, University of Washington.

Publications/Patents/Other: Co-author of "Breaking the Access Barrier: Delivering Internet Connections over Cable," John Wiley & Son, along with 19 other publications.

Joseph Giardina (M'88)
CTO
DSI RF Systems, Inc.
Somerset, NJ, USA

Responsibilities: For the past 20 years, owner of DSI RF Systems, a major implementation company; designer and builder of a significant number of radio and TV transmission facilities and robotic television camera systems, and a major participant in the ongoing BAS II ENG digital relocation project.

Memberships/Offices Held: Member of IEEE and the Society of Motion Picture and Television Engineers (SMPTE), and has been certified at the level of Senior Television Broadcast Engineer by the Society of Broadcast Engineers (SBE). Has served as Co-chairman of New York SBE.

Education: Over 30 years of experience in broadcast station engineering, facilities design and construction.

Publications/Patents/Other: Numerous papers on television technology and construction and a number of broadcast-related patents; recognized as one of the preeminent RF and microwave system engineers serving broadcasters in the northeast US and particularly in New York City.

Michael Simon (AM'98-M'03)
Advanced Technologies Manager, Broadcast Division
Rohde & Schwarz
Columbia, MD, USA

Responsibilities: Mike has over 25 years broadcast engineering experience and currently is Manager Advanced Technology, Broadcast Division of Rohde & Schwarz.

Memberships/Offices Held: Active member of ATSC TSG/S4, TIA TR47, and DVB Technical Module.

Education: BSEE and Master of Science Telecommunications, University of Pittsburgh.

Publications/Patents/Other: Mike holds several patents in the area of broadcasting and has a keen interest in emerging mobile broadcast technologies.

Robert Surette (M'82-SM'01)
Director of Sales Engineering, Shively Labs
Bridgeton, ME, USA

Responsibilities: Currently Director of Sales Engineering. Mr. Surette has been with Shively Labs since 1981; prior to 1981, was employed by Dielectric Communications. Mr. Surette has been directly involved with design and development of broadcast antennas, filter systems and RF transmission components since 1974.

Memberships/Offices Held: Member of IEEE. Associate Member of the AFCCE.

Education/Credentials: BS Electrical Engineering, Lowell Technological Institute, Lowell, Massachusetts, 1973.

Publications/Patents/Other: Authored a chapter on filters and combining systems for the latest edition of the *CRC Electronics Handbook* and for the *9th Edition of the NAB Handbook.*

"The ATSC Mobile DTV Candidate Standard" Tutorial Presented by BTS at NAB 2009

By Tom Gurley, BTS Junior Past President and Kathy Colabaugh, BTS Senior Administrator

Continuing our tradition of the past fifteen years, IEEE-BTS again partnered with NAB to present a technology tutorial on a topic of current interest at the 2009 Broadcast Engineering Conference (BEC). This year's tutorial was held on Saturday morning, 18 April, from 9:00 am–12:00 noon at the Las Vegas Convention Center, room S226/227. The ATSC is developing a backward-compatible standard ("ATSC M/H") for delivery of services to mobile and handheld devices using DTV broadcast signals. The draft has been elevated to Candidate Standard and, if all goes as planned, the process will conclude with final membership approval of the Proposed Standard, which will be designated A/153, in Q3 of 2009.

This half-day tutorial session covered each of the eight parts of the specification. Each was presented by a technical expert deeply involved in its development. The session was organized by the IEEE Broadcast Technology Society, with support from the ATSC, as a follow-up to the IEEE-BTS tutorial on "Proposed ATSC Mobile/Handheld Systems" presented at NAB 2008.

The eight parts of this tutorial were presented as follows:

- "Mobile/Handheld Digital Television System" – Jerry Whitaker, VP, Standards Development, ATSC
  - An overall system description that tied the other parts together.
- "RF/Transmission System Characteristics" – Michael Bergman, VP, New Digital Technologies, Kenwood
  - This part covered the Physical Layer of the system and included the data-structure, pre-processing, post-processing, and final processing and modulation.
- "Service Multiplex and Transport Subsystem" – Richard Chernock, CTO, Triveni Digital
  - This presentation covered the management sub-layers of the system, including transport, signaling, file delivery, and streaming delivery.
- "Announcement" – Richard Chernock, CTO, Triveni Digital
  - This presentation covered the Service Guide which delivers information about the services on the broadcast channel. The ATSC M/H Service Guide is adopted from the Service Guide of the Open Mobile Alliance (OMA) BCAST specifications.
- "Application Framework" – Alan Moskowitz, MobiTV, Inc.
  - This part of the tutorial explained the need for an application framework which provides a rich JavaScript-based environment

for audio, video, graphics and interactivity and describes how it will be implemented in ATSC M/H.

- "Service Protection" – Alan Moskowitz, MobiTV, Inc.
  - This part of the system protects the service stream using the broadcast data path and optionally, a return channel. It is based on the Digital Rights Management (DRM) profile of the Open Mobile Alliance (OMA) BCAST specification for protection of files.
- "Video System Characteristics" – Brett Jenkins, VP Technology, Ion Media Networks
  - This presentation included the ATSC requirements for video coding, overviews of MPEG-AVC (H.264 Advanced Video Coding) and MPEG-SVC (Scalable Video Coding), ATSC M/H AVC and SVC coding specifications, and RTP (Real-time Transport Protocol) transport and signaling.
- "Audio System Characteristics" – Brett Jenkins, VP Technology, Ion Media Networks
  - This part of the specification covers the HE AAC v2 (High Efficiency Advanced Audio Coding) audio system. It describes the constraints on HE AAC v2 audio and defines the elementary stream packetization.

The tutorial was open to all registrants of the NAB Broadcast Engineering Conference. Approximately 150 persons were in attendance. The presentations were compiled on a CD, and provided to all attendees.

BTS Multimedia Symposium Goes Europe!

By Pablo Angueria, Conference Co-Chair

The 2009 IEEE Broadband Multimedia Systems and Broadcasting Symposium will be held in Bilbao, Spain from 13–15 May. Past Broadband Multimedia conferences alternated between Las Vegas, NV USA and Orlando, FL USA. This change might be surprising, as this year will be the first time that a BTS conference is held outside of the USA.

Previous editions were a great success in both cities, with excellent figures regarding paper submissions, number of attendees, technical interest and industry involvement (hospitality in Nevada and Florida should not be left aside either). In just a few years, this symposium has become a reference for sharing advances in the field of multimedia broadcasting. It should also be noted that this conference has provided a link between the traditional *over the air* broadcast world with some of the new and future multimedia formats, systems and services through a variety of wired and wireless networks.

The audience of BTS conferences has become more and more international every year. As a consequence, the BTS AdCom decided in 2008 that moving the venue to different locations in the world could be a way to increase and enhance service to IEEE BTS members worldwide.

The Topics for 2009

Doctors Amaia Arrinda, Yiyan Wu and Demin Wang have carried out extraordinary work on the Technical Program Committee, coordinating the work of more than 60 experts participating in the evaluation and selection of the papers that will be presented this year. Close to 200 abstracts were received during the submission period and after a thorough evaluation process, a total of 68 oral presentations and 40 posters have been accepted. As an indication of the process, it is worth mentioning that all the papers have been reviewed at least by three different experts.

The figures associated to the origin of the papers, confirm the tendency of previous Multimedia Symposiums to attract papers from around the world. This year, speakers from Europe (68), North America (14), Asia (30), Australia (1), Africa (1) and South América (4) will be heard.

A strong concern of the IEEE BTS when organizing conferences, has been to serve industry, and provide a discussion forum appealing and useful for the broadcast industry community, not just for academia. The conference in Bilbao is keeping with this philosophy. The balance of papers coming from industry and academia is close

Bilbao River Side Walk

The Old City

Guggenheim Bilbao Museum

to the 50%, and similar audience figures are expected. Speakers from many laboratories and departments belonging to key companies in the multimedia business will attend the conference. It will be an interesting opportunity to interchange views and thoughts about the future of broadcasting and multimedia delivery.

The program is accessible on the conference website, www.ieee-bmsb2009.org/programme. Plenary Session Speakers will represent different views of multimedia standards worldwide, from North America, China, Europe and Japan.

The City and the Venue

Bilbao is located at the north of Spain, on its eastern Atlantic coast, just 80 miles away from the French Border and its present population is about 360,000. The city is conveniently connected to the rest of Spain and main cities in Europe by air, land and sea.

The precise historical origins of Bilbao have not been determined. However, a settlement had already been established and had significantly developed on both banks of the river Nervion before it officially became a city in the middle ages. It was Don Diego Lopez de Haro, lord of Bizkaia, who gave the city foundation act in the year 1300, due to its great importance as a commercial and maritime node at that time.

The city has an industrial background from the Industrial Revolution in XIX century and has undergone an important transformation in the last 40 years, thanks to new infrastructures, new underground transportation, the restoration of many buildings, the port's enlargement, the creation of new green areas, the Guggenheim Museum Bilbao, the Euskalduna Convention Centre and the Maritime Museum, while still preserving its old charm.

Today, Bilbao is the biggest city in the Basque Country and it lives from light technology companies and services. The city hosts the Guggenheim Museum Bilbao (www.guggenheim.org/bilbao) which attracts thousands of visitors to the city every year. The conference will be held at the Euskalduna Convention Centre. This venue is located in the heart of the city, on one of the river banks and in walking distance to the Guggenheim museum and the old city quarter (www.euskalduna.net).

The Basque Country: An Opportunity to Learn About An Ancient Culture

The Basque Country is a region in the north of Spain and Southern France that hosts a culture that predates the Greek and Roman civilizations. The Basques have lived uninterruptedly in this small region since the beginnings of recorded times maintaining their age-old cultural traditions, and keeping their historic identity alive, the Basques provide a link with man's distant past and, Euskara, the Basque language, is probably the oldest surviving language in Europe.

The nature and landscapes of this small area are one of the best kept secrets in Europe, with green forests, middle size rocky mountains and spectacular fishermen villages hugging the cliffs that face the gulf of Biscay.

The Basque Country is also famous for its cuisine. Basque cookers are reputed all over the world, and the quality of local fish, vegetables and meat attracts visitors to this region every year.

The Euskalduna Conference Centre

Elantxobe, a fishermen village on the coast

The organizers: BTS and University of the Basque Country (UPV/EHU)

This year's Multimedia Symposium is being organized by the Dept. of Electronics and Telecommunications of the University of the Basque Country, www.ehu.es. The members of the Signal Processing and Radiocommunications Research Lab have been working along with the BTS to ensure a successful symposium.

We are eager to welcome you to our city in May. See you soon!

The team organizing the conference at the UPV/EHU

Plans Moving Ahead for the 2009 IEEE BTS 59th Broadcast Symposium

By Tom Silliman, BTS Broadcast Symposium Co-Chair

Plans are well underway by the BTS Broadcast Symposium Committee to make the 59th IEEE Broadcast Symposium the best ever.

The 2009 Symposium will be held from 14–16 October 2009 at the new Westin Hotel in Alexandria, Virginia, USA.

Tom Silliman and Eric Wandel are Co-Chairs of the 2009 IEEE Broadcast Symposium. Tom Silliman is president of Electronics Research, Inc., and Eric Wandel is president of Wavepoint Research, Inc. The Symposium Technical Program Committee is co-chaired by Ed Williams and James Fang.

As you know, BTS has expanded our participation in hosting conferences that focus on a variety of technology areas within our field of interest. As the BTS now supports conferences such as the "IEEE International Symposium on Broadband Multimedia Systems and Broadcasting," Eric and I feel that the IEEE Broadcast Symposium should remain focused on presentations that are important to our core constituency of broadcast engineers and professionals. Our goal is to attempt to put together a program that will excite Broadcast Technology Society members with specific interest in conventional broadcasting and attract them back to our symposium. This of course does not mean focusing on "old" technology, rather leading edge technology of interest to broadcasters.

We are interested in recruiting presenters who will present on topics such as the post transition performance of digital terrestrial TV, AM and FM digital radio performance, the results of increasing the level of FM IBOC carrier levels relative to the FM analog carrier power level, predictions of FM IBOC interference to adjacent channels and observed interference to adjacent channels, point to multi point TV transmission to mobile hand held devices, distributed transmission for TV and FM, advances on the use of Longley Rice modeling to determine predicted coverage contours for radio and TV, and other topics that are relevant to the modern broadcast engineer. We are already making contact with industry leaders in the development of these technologies seeking their participation in the 2009 Broadcast Symposium.

At the back of this Newsletter, please see a full page announcement presenting a Call for Papers for the Broadcast Symposium. Abstracts are due 23 May 2009. Please email your abstracts (<500 words) to bts@ieee.org.

Keep checking the Symposium web site often at www.ieee.org/bts/symposium for the latest news and schedule of events for the 2009 IEEE Broadcast Symposium.

To obtain information about the Westin Hotel Alexandria, visit its web site at <www.Westin.com/Alexandria>

We look forward to seeing you at the 2009 59th IEEE Broadcast Symposium. If you have any questions, comments or need more information, please contact Kathy Colabaugh, BTS Senior Administrator, at bts@ieee.org.

London Calling...Important Date for Your 2009 Diaries

By Mike Bennett, IBC Partnership Board Member representing BTS AdCom

IBC2009 will take place in Amsterdam, RAI Centre from September the 10th until 15th inclusive. The Conference proceedings will start on the 10th and the Exhibition will open on Friday the 11th.

About IBC

IBC is the leading international forum for the electronic media industry, attracting visitors from more than 130 countries. It combines a highly respected and peer reviewed conference with an exhibition featuring more than 1400 exhibitors demonstrating the state of the art in media technology, from radio and television broadcasting to digital signage and 3D cinema.

Visitors can expect to learn about the developments which are shaping the industry, interact with the latest technology, experience world first demonstrations and do business in a professional and supportive environment. IBC is the event not to be missed for everyone involved in the world of content creation, management and delivery.

IBC Organizational Overview

The following groups continuously shape the organisation of IBC:

Council

The IBC Council members are specially invited senior figures from a broad spectrum of broadcast and electronic media organisations and from a wide spread of countries. The Council was created to help IBC meet the needs of the electronic media industry by addressing the issues of growth, globalisation and convergence.

Committees

Specialist committees carry out the detailed planning of the various strands of IBC. Expert volunteers from industry serve on Committees responsible for the Exhibition, Conference, Companions' Programme and Technical Resources and Events.

Partnership Board

IBC is a partnership. The partners are the six Sponsor bodies: IABM, IET (formerly IEE), IEEE, RTS, SCTE and SMPTE. Each partner has a Board member to perform the legal and contractual obligations of IBC. The Board oversees the policy, budget and general direction of IBC.

IBC Office

IBC staff specialise in providing information on the exhibition and conference, both online and print. They are also on-hand to offer further assistance in helping you prepare for your IBC2009.

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channel is shut down and to make matters worse the station's current analog is operating from a temporary location at reduced power due to the collapse of its analog tower. The result being that this station is currently providing no DTV service and very limited analog service. The delay may have helped some consumers but I expect it has had a significant economic impact on some broadcasters at a time when they really can't afford it. By the time I write my next column we should know how the transition went. But you say I said that the last time but this time I really mean it.

Now getting back to the BTS where there has been no delay with moving forward on several fronts. By the time you read this, another great tutorial (The ATSC Mobile DTV Candidate Standard) will have been presented at the 2009 NAB Engineering conference, the BTS 2009 Multimedia Symposium on 13–15 May 2009 in Bilbao Spain will be close at hand and the deadline for paper submissions for the Fall BTS Symposium will be near (15 May). If that is not enough, the BTS will also be presenting a tutorial – "Quality Issues With TV And Multimedia Over IP" at the IBC in September.

The BTS has also tapped Rich Chernock to Chair and establish a Distinguished Lecturer program. For those of you who do not know Rich, he is the Chief Technology Officer at Triveni Digital, Inc. and has himself been a frequent speaker/presenter/lecturer. Expect to hear more about this program in the near future.

I would like to take this opportunity to congratulate Bill Hayes on his reelection as BTS President and to thank him for all his hard work for our Society. Under his leadership I believe the Society has been greatly improved and now many long discussed plans are moving forward. Thanks Bill – you sure know how to get things done.

Bill Meintel
Editor
wmeintel@computer.org

ATSC Shares Emmy Award with IEEE BTS

By Ted Kuligowski

IEEE BTS, as a member of the ATSC community, was honored with an Engineering & Technology Emmy Award for ATSC DTV Standardization Work. The award was presented by the National Academy of Television Arts & Sciences at the International Consumer Electronics Show in Las Vegas on 7 January 2009.

Launched in 1948, The **Technology and Engineering Awards** honor development and innovation in broadcast technology and recognize companies, organizations and individuals for breakthroughs in technology that have a significant effect on television engineering.

Four Emmy honorees were cited for helping with the Standardization of the ATSC Digital System. The honorees are: The Advanced Television Systems Committee (ATSC), the FCC Advisory Committee on Advanced Television Service, the Advanced Television Test Center and the Advanced Television Evaluation Laboratory (CRC).

Yiyan Wu, representing the IEEE BTS serving on the ATSC Board of Directors, received on behalf of the IEEE BTS the Emmy award honoring the ATSC for ATSC DTV Standard work.

Recipients of the ATSC Technology & Engineering Emmy Award at ICES2009

In addition, Yiyan Wu, representing the Communications Research Centre Canada, received on behalf of CRC the Emmy award for CRC's Advanced Television Evaluation Laboratory contributions to the standardization of the ATSC DTV Standard.

The BTS is proud of Yiyan's professional work and his IEEE BTS support to the ATSC and also for his CRC work for the Advanced Television Test Center. It is an honor for IEEE BTS to be one of the members of the ATSC community honored with an Emmy Award.

The Advanced Television Systems Committee is an international, non-profit organization developing voluntary standards for digital television. The ATSC member organizations represent the broadcast, broadcast equipment, motion picture, consumer electronics, computer, cable, satellite, and semiconductor industries. ATSC creates and fosters implementation of voluntary Standards and Recommended Practices to advance terrestrial digital television broadcasting, and to facilitate interoperability with other media.

Four BTS Members Elevated to IEEE Fellow Grade

The BTS is proud to announce the elevation of four BTS members to the IEEE

Grade of Fellow**,** effective 1 January 2009. They are:

Francisco Ares
Universidad de Santiago de Compostela, Spain
"*for contributions to antenna array pattern synthesis*"

Nicholas Hamilton Piercy
Rogers Communications Inc, Canada
"*for leadership in development, design and implementation of modern network architecture and topologies in the cable industry*"

Ramjee Prasad
Aalborg University, Denmark
"*for leadership in developing personal wireless communications technologies*"

Thomas Silliman
Electronics Research, Inc, USA
"*for contributions to improvement of antenna and filter technology for radio and television broadcasting*"

IEEE Fellows are an elite group from around the globe. IEEE looks to the Fellows for guidance and leadership, as the world of electrical and electronic technology continues to evolve. The IEEE grade of Fellow recognizes unusual distinction in the profession and is conferred by the Board of Directors upon a person with an extraordinary record of accomplishments in any of the IEEE fields of interest. The accomplishments that are being honored shall have contributed importantly to the advancement or application of engineering, science and technology, bringing the realization of significant value to society.

The IEEE Broadcast Technology Society extends its congratulations to the BTS members elected to IEEE Fellow Class of 2009. Following are backgrounds of the 2009 BTS Fellows.

Francisco J. Ares-Pena

Francisco Ares-Pena earned his B.S., M.S., and Ph. D. degrees in Physics from the University of Santiago de Compostela, Spain, in 1986, 1987 and 1993, respectively.

He worked as a Research Scholar in the Department of Electrical Engineering at the University of California, Los Angeles, for two quarters in 1990 and 1991, where he developed the main topic of his Ph. D. thesis.

He is currently an Associate Professor in the Department of Applied Physics at the University of Santiago de Compostela, Spain. Dr. Ares has authored approximately 280 papers for journals, conferences and collaborative volumes. His general research interests include numerical methods in solving electromagnetic problems and antenna array pattern synthesis.

Dr. Ares, in addition to being a Fellow of IEEE, he is a Fellow of the Electromagnetics Academy. He received the Outstanding Ph. D. Award from the Physics Faculty, University of Santiago de Compostela, in 1994 and awarded the teaching innovation prize of the University of Santiago de Compostela, in 2006.

Nick Hamilton-Piercy

Nick Hamilton-Piercy has now retired from industry employment. Most recently, until mid 2008, he was retained as Senior Technology Advisor for Rogers Communications Inc. where he was responsible for advising the corporation on broadband and video related technology directions and programs as well as developing technology strategies for future growth in broadband and wireless.

He continues to assist several other high technology corporations as a member of their Technical Advisory Boards or as Technology Advisor or as a Board Member.

Nick has been in the telecommunications industry since 1954 and with Rogers Communications Inc., for over 34 years where he served as Chief Technology Officer heading up the Rogers Engineering corporate technology group. At Rogers he was instrumental in introducing the broadband industry to ringed fibre networks for metro environments, launching digital video satellite distribution, interactive television technology and high speed cable modem services, wireless microcell extender technology and many other Industry leading technologies.

Before joining Rogers in 1974 , Nick was with the Canadian Marconi Company for 12 years and before this was with Marconi-Elliot UK for 6 years and a member of the engineering consulting team for 1 year at Spembly Limited a hi-tech consulting company based in Chatham UK.

Nick graduated as a Chartered Engineer Light Electrical from the Medway College of Technology in Chatham, England, during 1961 where he specialized in electrical and electronic engineering.

He is a member of the Association of Professional Engineers of Ontario (APEO); a Fellow of the Institute of Electrical and Electronic Engineers (IEEE); a Senior Member of the Society of Cable Television Engineers (SCTE); a member of the SCTE Engineering Committee; a Member several Technology Advisory Boards including Arris; Aurora Networks; Broadcom; NTG Clarity and TeraSpan Networks.

He also is a past Chairman of the Technical Advisory Committee (TAC) of Cable Television Laboratories, Inc. a previous recipient of the National Cable Television Association's Vanguard Award for Science and Technology, recipient of the Canadian Cable Telecommunications Association's E.R. Jarmain Award for Innovation in Cable Engineering and a member of the SCTE cable technology Hall of Fame. He has been recognized as a Cable TV Pioneer in 2002 and part of the SCTE Circle of Eagles. He is a Frequent Guest speaker for NCTA, SCTE, Government Groups and Investor Groups.

Ramjee Prasad

Professor Ramjee Prasad is currently the Director of Center for Teleinfrastruktur (CTIF), and holds the chair of wireless information and multimedia communications. He is coordinator of European Commission Sixth Framework Integrated Project MAGNET Beyond (His personal Adaptive Global NET Beyond). He was involved in the European ACTS project FRAMES (Future Radio Wideband Multiple Access Systems) as a project leader.

He is a project leader of several international, industrially funded projects. Dr. Prasad has published over 700 technical papers, contributed to several books, and has authored, coauthored, and edited twenty books. His latest book is *"Introduction to Ultra Wideband for Wireless Communications"*.

Prof. Prasad has served as a member of the advisory and program committees of several IEEE international conferences. He has also presented keynote speeches, and delivered papers and tutorials on WPMC at various universities, technical institutions, and IEEE conferences. He was also a member of the European cooperation in the scientific and technical research (COST-231) project dealing with the evolution of land mobile radio (including personal) communications as an expert for The Netherlands, and he was a member of the COST-259 project.

Prof. Prasad was the founder and chairman of the IEEE Vehicular Technology/Communications Society Joint Chapter, Benelux Section, and is now the honorary chairman. In addition, Prof. Prasad is the founder of the IEEE Symposium on Communications and Vehicular Technology (SCVT) in the Benelux, and he was the symposium chairman of SCVT'93. Presently, he is the Chairman of IEEE Vehicular Technology/Communications/Information Theory/Aerospace and Electronics Systems/Society Joint Chapter, Denmark Section.

In addition, Prof. Prasad is the coordinating editor and editor-in-chief of

the *Springer International Journal on Wireless Personal Communications*. He was the technical program chairman of the PIMRC'94 International Symposium held in The Hague, The Netherlands, from September 19–23, 1994 and also of the Third Communication Theory Mini-Conference in Conjunction with GLOBECOM'94, held in San Francisco, California, from November 27–30, 1994. He was the conference chairman of the fiftieth IEEE Vehicular Technology Conference and the steering committee chairman of the second International Symposium WPMC, both held in Amsterdam, The Netherlands, from September 19–23, 1999. He was the general chairman of WPMC'01 which was held in Aalborg, Denmark, from September 9–12, 2001, and of the first International Wireless Summit (IWS 2005) held also in Aalborg, Denmark on September 17–22, 2005.

He is the General Chair of the First International Conference on Wireless Communication, Vehicular Technology, Information Theory and Aerospace & Electronic Systems Technology (Wireless VITAE) to be held on May 17–20, 2009 in Aalborg.

Prof. Prasad was also the founding chairman of the European Center of Excellence in Telecommunications, known as HERMES and now he is the honorary chairman. In addition to being a Fellow of the IEEE, Prof. Prasad is fellow of IETE, a fellow of IEE, a member of The Netherlands Electronics and Radio Society (NERG), and a member of IDA (Engineering Society in Denmark). Prof. Prasad is advisor to several multinational companies. He has received several international awards; the latest being the "Telenor Nordic 2005 Research Prize" (website: http://www.telenor.no/om/).

Thomas Boughton Silliman

Tom Silliman is currently the President and CEO of Electronics Research, Inc. He joined the company in 1969 as a project engineer. He maintains a close interaction with all aspects of the business, including product design, manufacturing, test, and installation.

In the past, Mr. Silliman designed the ERI antenna test range and antenna matching routine for calculating slug matching used on all ERI products. Mr. Silliman designed and patented the ERI Rototiller FM antenna in 1975, and his side mount FM antenna is still considered one of the best FM side mount antennas available on the market.

Mr. Silliman was the recipient of the National Association of Broadcasters Radio Engineering Achievement Award in 2008. Mr. Silliman earned a Bachelor of Electrical Engineering, Cornell University in 1969 (five year degree) and a Master of Engineering (Electrical), Cornell University 1970. His professional licenses include Registered Professional Engineer in the states of Indiana, Minnesota, and Maryland. His professional affiliations include Association of Federal Communications Consulting Engineers (AFCCE), Full Member and past President.

Before elevation to IEEE fellow, Tom was a Senior Member of the IEEE, IEEE Broadcast Technology Society member and Secretary of the Administrative Committee. Tom also serves as a volunteer on the Board of Directors of WNIN-TV/FM, the local public radio (NPR) and local public television (PBS) station licensed to Evansville, Indiana.

BTS Argentina Chapter Elects Officers for 2009

By Valentino Trainotti

The following IEEE BTS Argentina Chapter members were elected in December 2008 to serve as BTS Chapter Officers during 2009.

Chair:
Valentino Trainotti
Electronic Engineer
Full Professor Electromagnetic Radiation and Radiating Systems
Faculty of Engineering, Secretary of Research and PHD.
University of Buenos Aires

Vice Chair:
Walter Gustavo Fano
PHD in Electrical Engineering
Associated Professor
Faculty of Engineering
University of Buenos Aires

Secretary:
Gerardo Demarco
Electronic Engineer
CEO of SERSAT Co
Buenos Aires, Argentina

Treasurer:
Héctor Vila
Electronic Engineer
Chief Engineer Channel 3
and AM Broadcasting Station
Rosario, Argentina

The IEEE BTS Argentina Chapter looks forward to a very productive and active year in the coming months during 2009.

BTS Beijing Chapter Report

By Jian Song, Chair

2008 was a busy, fruitful, and memorable year for BTS Beijing Chapter. The highlight was the ICC2008 which was held in China for the first time and many BTS members have devoted their time and energy in organizing the workshop in broadcasting area.

When ICC2008 announced its call for proposals for the workshops, BTS Beijing Chapter responded quickly and submitted the workshop proposal of "Digital Television and Mobile Multimedia Broadcasting". Dr. Yiyan WU (from CRC, Canada) and Prof. Jian SONG (from Tsinghua University, also the chairman of Beijing Chapter) serve as the workshop co-chairs. Our proposal was one of the eight approved out of the fifteen submissions. With the excellent work by our workshop TPC members (all are experts in Broadcasting area and many of them are IEEE BTS members), 6 papers were accepted, covering quite dynamic and exciting topics in broadcasting area. The authors are coming from different continents, including Asia, Europe and America.

The workshop on morning of 23 May turned out to be very successful. Besides six regular presentations, there were two invited talks, one entitled "Recent and Future Developments in Digital Television and Mobile" by Dr. WU, the other was the Review of FP6 Project "Multi-standard integrated network convergence for global mobile and broadcast technologies", by Prof. Jianwei ZHANG from University of Hamburg, Germany. More than 30 people attended the workshop. Numerous off-line discussions occurred which provided a good opportunity for the people to share their visions and exchange their ideas for future research and applications in this area.

BTS Beijing Chapter also organized eight seminars in 2008 with many students presenting their latest research results. From the detailed agenda information presented below, it can be seen that the topics are quite comprehensive in the DTV broadcasting area with a focus on the physical layer transmission technologies.

Looking forward, with the announcement of DVB-T2 as well as DVB-C2 in 2008 and ATSC M/H on the horizon, there will surely be many new standards and cutting-edge technologies proposed in the future. BTS Beijing Chapter will work closely with our sister chapters to create a more harmonized society and make technical contributions in DTV area.

Time & Place	Speaker	No. of Attendants	Title
13 March 2008 FIT 1-312	Weiliang Zhang	20	All digital time domain parallel receiver algorithm design
	Zaichu Yang		Sampling rate conversion design for all digital time domain parallel receivers
21 March 2008 FIT 4-302	Dengbao Du	30	Research on synchronization and channel estimation for MIMO TDS-OFDM systems
11 April 2008 FIT 3-125	Wei Li	18	Synchronization scheme for TDS-OFDM system with large carrier frequency offset
	Huilin Zhu		Multi-Rate Quasi-Cyclic LDPC Codes at Short Block Lengths
	Haining Liu		Quasi real-time data collection and replay system for field channel
24 April 2008 FIT 1-312	Xue Dong	20	Configurable system bandwidth modulation method using virtual sub-carriers
	Yingying Lu		Low complexity modulator with configurable bandwidth
	Aolin Xu		Receiver synchronization method using the cyclic property in time domain
21 May 2008 FIT 3-125	Fang Yang	25	Channel Estimation for the Chinese DTTB System Based on Novel PN sequence Reconstruction
	Qiuliang Xie		A Fast and Efficient Encoding Structure for QC-LDPC Codes
	Weimin Leng		A Modified Gardner Detector for Multilevel PAM/QAM system
22 May 2008 FIT 1-315	Yiyan Wu (Professor)	50	Recent and Future Developments in Digital Television and Mobile Multimedia Broadcasting
25 Sep 2008 FIT 1-312	Qiuliang Xie	15	Research on coded modulation with high spectrum efficiency
	Qicun Shi		Research on key techniques of hoping OFDM faced to cognitive radio
6 Sep 2008 FIT 1-312	Chen Chi	16	Research on key techniques of wireless scalable video transmission
	Zhigang Li		Research on key techniques of 1.2 Gbps parallel demodulation
06 Nov 2008 FIT 1-312	Linqi Song	18	A normalized LLR soft information demapping method in DTMB system
	Xiaoqing Wang		Shaping gain for LDPC-coded system with non-uniform constellation over AWGN channel
	Qicun Shi		All digital baseband frequency hopping OFDM system
	Wei Li		Joint synchronization for TDS block transmission with scalable guard interval padding
	Linglong Dai		A new frequency synchronization algorithm in TDS-OFDM system

BTS Japan Chapter Report

By Shuji Hirakawa, Chair

BTS Japan Chapter had one joint meeting with the Institute of Image Information and Television Engineers (ITE) during October 2008 to January 2009. A technical meeting was held on 22–23 January 2009, at Fukuoka University, Fukuoka, Japan. There were 24 technical presentations on general topics, for example,

- Study on propagation characteristics with SFN-GF link
- Development and operation of low delay wireless camera including 17 presentations by young students, for example,
- Study on improving link budget for Ka band multibeam satellite broadcasting
- Study on simulating bit error for satellite communication depend on fluctuation of receiving signal level
- On hand-over between mobile terminals under cell structure electromagnetic environment
- Simulation for radiowave propagation along random rough surface by Discrete Ray-Tracing Method
- Diffraction of electromagnetic wave by two horizontal edges which have different heights and angles
- Scattering of electromagnetic wave by square structure which has a circular protuberance on its wall
- Numerical analysis on electromagnetic wave by perfect conductors
- Indoor electrical field distribution within concrete walls depends on the number of persons present in the room
- "Measurement for permittivity of metal coated material using standing wave in cylindrical space
- Analysis on circular polarized microstrip antenna for three frequencies
- Study on antenna for collecting GPS data on radio-controlled plane
- RFID dual frequency reader antenna for mobile terminal
- Numerical analysis on receiving antenna for DTTB. and one special topic for "My 50 Years attracted by Development of Line Antennas" by Prof, Takehiko Tsukiji (Fukuoka University).

The BTS Japan Chapter is planning to have two joint meetings below with the Institute of Image Information and Television Engineers (ITE).

12 February 2009 at NHK Hiroshima Station, Hiroshima, Japan.

27–28 February 2009 at Wago Kaikan, Yamanouchi machi, Nagano, Japan.

Ottawa Joint ComSoc and BTS Chapter Report

By Wahab Almuhtadi, Chair

The IEEE Ottawa Joint Chapter of Communications Society and Broadcast Technology Society (ComSoc/BTS) organized the following technical seminars:

1. **Watch this White Space: Leveraging the Latest License-free Spectrum** by Stephen Rayment, Chief Technology Officer, BelAir Networks, Ottawa, Canada on 26 January 2009.
2. **Overview of the Self-healing Autonomous Sensor Network (SASNet) Project** by Louise Lamont, Research Manager, Mobile Ad hoc and Sensor Network Systems, Communications Research Centre, Industry Canada on 2 December 2008.
3. **Impacts of the Sun on Satellite Communications Systems** by Dr. Andy D Kucar, radio4u.com, Ottawa, Canada on 22 September 2008.

For more information about the above seminars or about the upcoming events, please visit: http://ottawa.ieee.ca/comsoc

2008 Report of IEEE Russia Northwest BTS, CES and COMSOC Joint Chapter (IEEE Russia Northwest Section)

By Dmitry Tkachenko, Chair

1. The Chapter participated in the 10th International Conference CSTB 2008 in the framework of the exhibition CSTB 2008 (Moscow, Exhibition Center "Crocus Expo", 4–6 February 2008). The conference was organized by MIDEXPO company and Cable TV Association of Russia in association with International Broadcasting Convention (IBC), International Association of Broadcasting Manufacturers (IABM), Ministry of the Russian Federation for Culture and Mass Communications. 118 papers were delivered at the conference.
2. The Chapter took part in organizing the workshop "Transition from Telecommunications to Infocommunications" in the framework of Exhibition NORWECOM-NEXT (St. Petersburg, Exhibition Center "Lenexpo", 20 February 2008). 7 papers were delivered at the workshop.
3. Seminar "NGN Network Planning" was organized by a member of the Chapter Prof. Nikolay Sokolov in St.Petersburg State University of Telecommunications on 20 March 2008.
4. Lecture "Digital Storage in Consumer Electronics" was delivered by Dr. Thomas Coughlin in St.Petersburg University of Film and Television on 12 May 2008 in the framework of Distinguished Lecturer Tour organized by IEEE Consumer Electronics Society. The event was organized jointly with IEEE Student Branch of the University of Film and Television. About 60 students and members of the Chapter attended this lecture.
5. The Chapter was a technical co-sponsor for 15th International Conference on Telecommunications (ICT 2008) that was held in St.Petersburg on 16–19 June 2008. 96 papers from 21 countries were delivered at the conference including several keynotes and invited papers from the world's leading experts.
6. International Workshop on Multiple Access Communications (MACOM 2008) was held on 16–17 June 2008 in St.Petersburg along with ICT 2008 conference. 26 papers were delivered at the workshop.
7. The Chapter took part in organizing the 8th International Conference on Next Generation Teletraffic and Wired/Wireless Advanced Networking NEW2AN 2008 (St. Petersburg, 3–4 September 2008). The conference was organized by Tampere University of Technology (Finland) and BalticIT (Russia) in cooperation with ITC (International Teletraffic Congress), Popov Society, COST 290 and support of NOKIA. 21 papers were delivered at the conference.
8. The Chapter took part in organizing the 1st Conference on Smart Spaces ruSMART 2008 that was held in St.Petersburg on 5 September 2008 in conjunction with NEW2AN 2008 conference. Approximately 90 participants attended the conference, and 11 papers were delivered at the conference.

ATSC Mobile DTV Effort Moves Forward

By Jerry Whitaker, VP of Standards Development, ATSC

The work to develop a comprehensive standard for mobile and handheld services – known as *ATSC Mobile DTV* – has reached a milestone with publication of the A/153 Candidate Standard document set. ATSC Mobile DTV is being developed to support a variety of services including free (advertiser-supported) television and interactive services delivered in real-time, subscription-based TV, and file-based content download for playback at a later time. The standard can also be used for transmission of new data broadcasting services.

ATSC Mobile DTV is built around a highly robust transmission system based on vestigial sideband (VSB) modulation coupled with a flexible and extensible Internet Protocol (IP) based transport system, efficient MPEG AVC (ISO/IEC 14496-10 or ITU H.264) video, and HE AAC v2 audio (ISO/IEC 14496-3) coding. The ATSC Mobile DTV Candidate Standard (document A/153) describes the methodology for new services to be carried in digital broadcast channels along with current DTV services without any adverse impact on legacy receiving equipment.

In addition to live television, the ATSC Mobile DTV system provides a flexible application framework to enable new receiver capabilities. Receivers that make use of an optional Internet connection will enable new interactive television services, ranging from simple audience voting to the integration of Internet-based applications and transactions with television content.

ATSC Mobile DTV at CES

The Consumer Electronics Show (CES), held 8–11 January in Las Vegas, was the site of a major announcement regarding the planned roll-out of ATSC Mobile DTV services in the U.S. The Open Mobile Video Coalition (OMVC), an alliance of U.S. broadcasters dedicated to accelerating the development of mobile digital television, announced the first wave of broadcasters that have committed to launching mobile DTV services later

this year. Major broadcasters declared their intention to launch services across 63 stations in 22 markets, covering 35 percent of U.S. television households. The 63 stations break down as follows:

Fourteen NBC affiliates
Nine ABC affiliates
Nine CBS affiliates
Five FOX affiliates
Nine ION Television affiliates
Four CW affiliates
Four MyNetworkTV affiliates

In addition, nine PBS stations are in discussions with the OMVC to join the 2009 launch.

To showcase the consumer experience of ATSC Mobile DTV and the technical feasibility of the A/153 Candidate Standard, the OMVC conducted a live demonstration on the opening day of CES 2009. The demo involved multiple Las Vegas-based television stations broadcasting local and national TV programs, music videos, local sports, and public affairs programming to compliant devices produced by LG Electronics, Samsung Electronics, and Kenwood. Transmission equipment was provided by Harris Corporation.

ATSC Mobile DTV-enabled portable DVD player. Courtesy of LG

The ATSC Mobile DTV Candidate Standard

Development of the ATSC Mobile DTV system was based on a strategic plan approved by the ATSC Board of Directors in October 2006. ATSC subsequently developed detailed system requirements and issued a request for Proposals (RFP) in May 2007. Work on the ATSC Mobile DTV system has been done within the Specialist Group on ATSC-Mobile/Handheld (TSG/S4), which is led by Mark Aitken of Sinclair Broadcast Group as Chair and Dan Borowicz of Ion Media as Vice-Chair. On 25 November the Technology and Standards Group (TSG) approved publication as a Candidate Standard.

A Candidate Standard (CS) is a specification that has received significant review within an ATSC specialist group. Advancement of a document to Candidate Standard is an explicit call to those outside of the related specialist group for implementation and technical feedback. This is the phase at which the specialist group is responsible for formally acquiring that experience or at least defining the expectations of implementation. The parent technology group (TSG) must approve advancement of a document to Candidate Standard status; this done by a ballot of voting members of the group.

Because the Candidate Standard phase is intended to gain real-world implementation experience, ATSC member companies are already working to make sure the ATSC Mobile DTV system functions as intended, and to identify any elements that might require additional work. Suggested laboratory tests and field tests on the system during the CS phase are documented in test plans developed by ATSC. Testing organizations can request these plans from ATSC or develop their own. The OMVC has announced plans to conduct field trials of the ATSC Mobile DTV system. Rounding out the ecosystem for ATSC Mobile DTV devices and services, the Consumer Electronics Association has launched a complementary Special Interest Group for manufacturers interested in building products to the Candidate Standard.

Schedule

The current work plan for ATSC Mobile DTV meets the often-stated U.S. broadcaster need to announce the availability of future mobile/portable/handheld services in the first quarter of 2009. If all goes as planned, TSG will be asked to approve a ballot on the ATSC Mobile DTV Proposed Standard in May 2009, with the ATSC process ending with final membership approval in Q3 of 2009.

Work within ATSC is open to all organizations with a direct and material interest. If you would like to be involved in this ongoing work, please contact the author, jwhitaker@atsc.org

The ATSC Mobile DTV Candidate Standard document set can be downloaded from the Candidate Standard page on the ATSC Web site: http://www.atsc.org.

Longley-Rice's Faulty Subroutines, Part 1: Z1SQ1

By Sid Shumate, Givens & Bell

In the last article of my Longley-Rice series, I ended with: "the computation of delta-h relies on calls to the **z1sq1** subroutine to determine straight lines representing the average height and slope of terrain along a selected path range. And subroutine **zlsq1** has problems; one of which causes its calculations to go wrong. It explains why the better a database used, with larger and larger numbers of terrain samples, the worse the Longley-Rice results that are obtained. I will discuss subroutine **zlsq1**, this error, and a set of fixes for subroutine **zlsq1**, in the next article".

The Delta-H subroutine, **dlthx**, selects a starting point and an ending point along a radial line. It then calls subroutine **z1sq1** with these two points as input. It does this twice.

Z1sq1, (Z-one-SQ-one, or "The Least-Squares Line fit to the function Z" subroutine, is supposed to take the start point and end point of a set of interval points along a line (in this case, a radial of a terrain database), and use a standard "Linear Least-Squares Fit" method of line-fitting to create an average terrain height line. It then computes and sends back to the Delta-H subroutine the heights of the beginning and end points of this line. While discussing the Linear Least Squares Fit (LLSQF) solution, I will refer to the equations in Chapter 15.2, *Fitting Data to a Straight Line*, of "*Numerical Recipes in C, Second Edition*" ©Cambridge University Press (Numerical Recipes).

The Linear Least Squares Fit

The LLSQF part of this subroutine uses a mathematical procedure for finding the best-fitting curve (in this case, simplified to a straight line) to a given set of points by minimizing the sum of the squares of the offsets ("the residuals") of the points from the curve. LLSQF is the simplest and most commonly applied form of linear regression. LLSQF finds the best fitting line through a set of points. The LLSQF proceeds by finding the sum of the squares of the vertical (y-axis) deviations of the function values (in this case, elevations) from a straight line, along the x-axis from the start point to the end point. In the c++ source code, this is computed in a **for** loop. The square deviations from each elevation point are therefore summed and the resulting residual is then minimized to find the best-fit line. When used in a simple mode, to find the best fitting straight line through a set of points, the process provides a solution for a, an intercept value, and b, the slope value, in the standard straight line equation $y = a + b*x$.

In the original Longley-Rice Tech Note 101(TN101), this equation becomes:

$$h(x) = \bar{h} + m(X - x) \qquad (5.15a)$$

Where the h(x) term (height of a point on the line) replaces the y, $\bar{h}$ (the average height of the line) replaces the intercept variable a, and the m (slope of the line) replaces the b slope variable. To simplify the process, the subroutine considers the reference horizontal location to be exactly halfway between the start point and the end point.

The full LLSQF formula in Numerical Recipes can be simplified. Since here we are dealing with an even number of equal-width intervals, and we assume that the line will be a good fit with equal errors of measurement for each terrain height, then, solving for "a" at the midpoint of the values of "x" along the x axis (the section of the path considered), the Chapter 15.2.18 formula for "a", simplifies to:

$$a = Sy/S$$

where:

Sy = sum (Σ) of elevation values from each terrain point from –x to x,

S = number of terrain data points (the sum of 1 for each terrain point)

In ***z1sq1***, first the elevation values of the start and end points are added and divided by 2, to provide an average value for the two end points if the distance between them is too small to compute terrain data points between them. A **for** loop then sums the elevation values that lie between the start and end points.

For one interval, there are two terrain data points; for two intervals, there are three terrain data points. The number of intervals, argument xa in the c++ source code, is one less than the number of terrain data points. In the subroutine, the sum of the y values, Sy, is divided by xa, the number of intervals, instead of by S = xa + 1, the number of terrain data points, but this provides the correct result for a because the end point elevation values were divided by 2. The value of "a" at this point, represents the intercept value at the midpoint between the start and end points. This is how both the ITM FORTRAN and NTIA c++ source codes correctly determine the value of the intercept point "a".

For the slope value "b", starting with:

$$b = \frac{S*Sxy - Sx*Sy}{Delta} = \frac{S*Sxy - Sx*Sy}{S*(Sxx) - (Sx)^2} \quad (15.2.6, \text{Numerical Recipes})$$

If the same preconditions used for "a" are used to simplify "b", and when the middle of a set of terrain interval points is at the midpoint of the path considered, then the sum of the negative terms in the x equidistant function cancel out the positive terms as x progresses from −x, to x, and the Sx term equals zero. The S term then cancels out, and the "b" formula simplifies to: b = Sxy/Sxx, where:

Sxy is the sum of : (each individual elevation value times the x value at that location).

Sxx is the sum of the squares of the x values at each location.

The Bad Longley-Rice Shortcut

However, this is not quite what the ITS **z1sq1** subroutine does. In the ITS c++ source code, before the ***for*** loop occurs, a partial term for the numerator of the b formula is computed as: b = 0.5*(z[ja + 2] − z[jb + 2])*x; this takes half of the height difference between the end points, and multiplies it by the value of x at the start point. The argument xa is the number of intervals from the start point to the end point. The argument x is first set to be equal to –0.5xa, so x is here equal to minus one-half of the number of intervals. If the distance between the start and end points is only one interval width, xa = 1, x = −.5, so the value of argument *b* at this point is equal to one-quarter of the height difference between the start and end points.

Then a ***for*** loop is used to sum: b+ = z[ja + 2]*x; which multiplies the individual terrain point elevation heights, z[ja + 2], (as they are incremented from the first location past the start point to the last location before the end point), by the value of x at each terrain location. The value of argument x is increased by 1 at the start of each loop, so, for example, if xa = 10, x, as used in the loop, starts at –4 and ends at 4 in the last cycle of the ***for*** loop. Note that the loop performs 9 cycles, as x = 0 for one of the cycles; including the two end points, a total of 11 elevations are considered for a path with ten intervals.

Here is where the subroutine deviates from the standard theoretical formula. Instead of using the ***for*** loop to compute the Sxx term (the sum of the squares of the x values), the ITM uses an alternate method. After the ***for*** loop has completed, the value of b is recomputed as: b = b*12.0/((xa*xa + 2.0)*xa).

So the formula actually used for b for between the end points, is:

b = 12*(sum of: (x*y) for each x from –x to x.)/(xa*xa + 2.0)*xa

where:

xa is the number of intervals between the start and end points.

(x*y) is the elevation height, y, in meters, times the distance x, in intervals from the midpoint.

The formula 12/(xa*xa + 2.0)*xa attempts to duplicate the 1/Sxx term. How well does this work? To find out, I duplicated the ITM subroutine calculations on a worksheet, and compared them to worksheet calculations based on the simplified standard slope formula. The first test starts with a straight line set of data test, with an elevation of 20 meters at the start point, zero meters at the end point, and 11 elevation points (10 intervals). The standard slope formula produces a slope of –2 meters/interval, a difference of elevation of 20 meters, divided by a horizontal distance of 10 intervals, sloped negatively (downhill) from the start point. The ITM subroutine also produces an answer of –2 meters/interval.

Studying the worksheet, however, reveals a weakness in the ITM computation. The standard slope formula computation produces a sum of 220 for the value of Sxy, and a value of 110 for the value of Sxx; the equivalent of dividing each element of Sxy evenly by 110. The ITM computation relies on the number of intervals, not the number of terrain data points. As a result, the computation of 12/((10*10) + 2)*10 results in the equivalent of dividing the sum of the y*x elements between the end points by 85, and the sum of the y*x elements by 170, improperly overweighting the contribution of the middle elements, and underweighting the contribution of the end points. Other simple test waveforms, used with 10 interval distances, such as a symmetrical parabola created with $y = 10x - x^2$, and one with $y = 5x - x^2$, produce correct slope values of 0 and −5.

But these are simple tests. For the third test, we make the data unsymmetrical with respect to both the x and y axis by using the same 10 interval length, and a set of elevations approximating a simple irregular terrain, created by the formula: $y = 10x - x^2 + 20x^3$. For a length of 10 intervals, this formula produces zero values at the endpoints. And under these more realistic conditions, the ITM method starts to fail, producing a slope result of −.47, which can be compared to the slope of −.36 produced by the standard slope formula.

Is this significant? Tests on the ITM show that correct operation of the ***z1sq1*** subroutine is critical to the correct determination of the terrain roughness delta-h coordinate. Tests with a version of the ITM modified to allow the delta-h value to be printed on the output reports showed the delta-h value often starting at reasonable values (5 to 100 meters) for the first few kilometers, but increasing to over 5,000 meters on some 50-kilometer paths using a three-arc second database; the overweighting of the middle values increases the errors as the numbers of intervals increase. For a given path, the number of intervals increases as the resolution of the terrain database increases, from 30 arc-sec to 3 arc-sec and better. So the higher the resolution of the terrain database, the worse the results.

The fix to correctly implement the standard slope regression formula and even out the weighting is not difficult, and allows the ITM to work much better with databases with resolution as fine as 3-arc-sec. Add an additional argument such as bn (b numerator) to the end of the double declaration line, making it double xn, xa, xb, x, a, b, bn; then remove the 0.5* from the line: b = 0.5*(z[ja + 2] − z[jb + 2])*x; and insert as the next line: bn=2*(x*x);. In the ***for*** loop, after the line b+ = z[ja + 2]*x; insert the line: bn+ = (x*x);. Finally, replace the line b = b*12.0/((xa*xa + 2.0)*xa); with b = b/bn; and recompile the executable.

There is another fix required to get good results with a one arc second database; I will discuss it in the next article.

Reginald Fessenden's Antenna Designs

By James E. O'Neal, Technology Editor, TV Technology and BTS AdCom Member

Radio has its roots intertwined very deeply with the experiments performed by Heinrich Hertz in 1887. He was apparently the first experimenter to grasp the concept of the antenna in the transmission and reception chain.

Hertz's transmitting antenna was a plain and simple dipole placed at the focus of a parabolic reflector. The receiving antenna was equally simple – a loop of stiff wire with ball electrodes for the received energy to identify itself with a snap and bit of bluish light.

A few years later when the world got serious about radio, the transmitting antenna was still recognized as very important, but had morphed into anything but a simple dipole and reflector as operating frequencies dropped into low end of the spectrum.

Most early transmitting antennas could be characterized by "getting as much wire up as high as possible and tuning for maximum current (or spark)."

With slight refinements, this concept held as radio broadcasting established itself in the 1920s. Most stations used a "flattop," "cage," or "tee" antenna, or some variation of these as a way of coupling their RF to free space. It was not uncommon to see self-supporting towers with station call signs emblazoned on them perched atop hotels, office buildings and other established structures in metropolitan areas. As operating wavelengths dictated fairly substantial horizontal dimensions, it was sometimes necessary to secure a lease on two buildings and cross the city streets below with the multiple wire harnesses, dropping the center-connected feedline down to a transmitter location somewhere below (commonly a shack on the rooftop). If broadcasters chose their buildings wisely, they might be able to bond to the building's steel frame and use this as a ground system (counterpoise). If the building with the transmitter were not steel-framed, then some other type of counterpoise system had to be devised. Users of such antenna systems met with varying degrees of success. However, in at least one situation, the requisite homework was not done and the building height (length of the steelwork to ground) was very nearly one quarter of a wavelength, with the resulting extremely poor signal propagation remaining a mystery until someone "did the numbers."

As the "roaring twenties" gave way to the next decade, medium wave antenna design was approached a bit more scientifically, and it was realized that the vertical feeder was doing most of the radiation, with the flattop above serving basically as a means of suspending the feedline and as a system for increasing capacitance to ground (top loading). Work by C. Stuart Ballantine and others during the 1920s gave rise to the concept of the insulated base, (or series-fed) vertical radiator (free standing or guyed), that remains to this day the medium wave antenna of choice worldwide. In the early 1930s when MW vertical radiators first began to be taken seriously, others worked out the best counterpoise or grounding system – a number of conductors (ideally 120), each ½ wavelength or more, radiating away from the base of the vertical radiator in a horizontal plane.

The Grandaddy of All Insulated Base Vertical Radiators

It all seems simple now, but the overall concept of the modern MW antenna system took years to develop.

However, in retrospective, it shouldn't have taken this long. The model for the series-fed vertical radiator was there in a 1905 patent issued to radio pioneer Reginald A. Fessenden.

In examining his patent, it appears that Fessenden quite accurately captured the essence of an antenna system that would not come into widespread use for another 25 years or so.

Fessenden actually had two such antennas constructed the year his patent was issued. One was located at his fabled Brant Rock, Mass. station some 35 miles from Boston. An identical antenna was erected at his company's (National Electric Signaling Company - NESCO) operation in Macrihanish, Scotland. The idea was to establish reliable wireless service between the continents. (Something no one else – Marconi included – was doing at that time.)

Both NESCO stations were equipped with state-of-the-art rotary gap spark transmitters (although Fessenden was working in the background on another project to break with the damped oscillations and "spread spectrum" transmissions produced by spark transmitters).

Reginald A. Fessenden ***(Photo Courtesy of the Office of Archives and History. Raleigh, North Carolina)***

From a point of view more than 100 years in the future, it's interesting to examine Fessenden's patent and his actual antenna system implementation at the two stations. It's also interesting to speculate why it took so long for broadcasters to "get on board" and embrace the vertical radiator.

Fessenden's U.S. patent # 793,651 (issued on July 4, 1905) for his vertical radiator embodies a number of principles that were "discovered" by others more than two decades later.

In his preamble, Fessenden states a truth that is still with us today:

"Heretofore in the transmission of power by electromagnetic waves great difficulty has been met in providing a suitable antenna, especially in obtaining one of suitable height with suitable mechanical and electrical strength."

His 1905 design addresses movement of tall antennas in the wind, the necessity for a proper base insulator, and also the principle of top loading:

"As it is preferred that the aerial or antenna should have some freedom of movement independent of the foundation, a ball-and-socket or rocking joint is provided at the lower end of the lowest section."

He adds that the "cup-shaped" lower member of this ball-and-socket support be secured in the upper section of the base – in this case, two concrete slabs electrically isolated from each other and the ground, by interposing a "suitable insulating material." Fessenden designed his "base insulator" as a series of cone-shaped structures, "formed of porcelain or other suitable insulating material."

Figure # 3 clearly reveals this ball-and-socket joint and the stacked layers of small insulators. The basic difference between the modern series-fed vertical radiator today is in the base insulator, which is now a single unit instead of multiple small insulators, and which incorporates a ball-type of support to allow limited movement of the mast.

Figure # 4 is a photograph of what remains today of the base insulation system installed in connection with the vertical radiator erected at Fessenden's Brant Rock, Mass. operation. (The antenna itself was toppled sometime in the mid-1910s.)

It should be noted that when Fessenden's antennas were constructed the prefabricated triangular tower sections we take for granted nowadays were not available. Fessenden hit upon the idea of bringing in a company experienced in the construction of tall smokestacks to erect his radio towers. What was created were two identical three-foot diameter, 420-foot tall, hollow steel tubes. The basic difference between an ordinary smokestack installation and the radio towers was the addition of the base insulator and the breaking up of guy lines by the insertion of suitable insulators. Another difference was an access door or panel near the base and the addition of handholds *inside* the tube, so that it could be climbed from within to gain access to the top of the structure,

The Concept of Top-Loading

The top loading mechanism for Fessenden's 1905 antenna is clearly seen in the patent drawing and also in postcard views of the large Brant Rock antenna, which became something of a tourist attraction after its erection.

While Fessenden does not really describe the purpose of the top loading system in his patent, he does offer insight into its construction.

"…the aerial is formed of a number of sections…and provided at the top with a crown or collection of wires 2, radiating from the aerial at points near the top of same and having their ends connected to a hoop 3, which is supported by gaffs 4." (The numbers correspond to locations shown on Fessenden's patent and are visible in Fig. 1.)

It is conjectured that the top loading mechanism was added to the original antenna construction as an afterthought and was included in the patent application to protect the top loading principle. Writings by Samuel Kintner – a long time associate of Fessenden, and later Westinghouse vice president – provide evidence to support this.

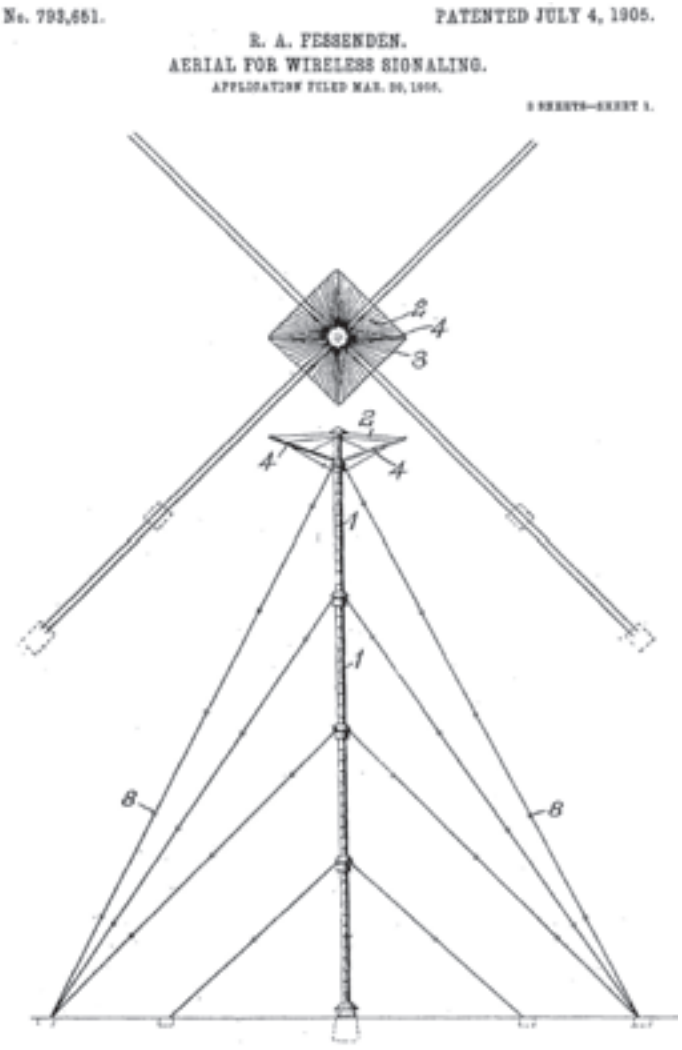


Fig. 1 – These drawings from Fessenden's 1905 antenna patent clearly show several concepts embodied in modern MW antennas: uniform cross section, an insulated base and guy lines broken up by insulators. The structure shown above the antenna is top loading array

Fig. 2 – This photograph shows one of the two antennas erected by Fessenden in 1905 for the purpose of establishing a reliable transatlantic radio communications link. The installation in Scotland was destroyed in late 1906 by failure of a guy line. Insulators used to break up the guy lines can be plainly seen, as can the top loading "umbrella." (Photo courtesy of the Office of Archives and History. Raleigh, North Carolina)

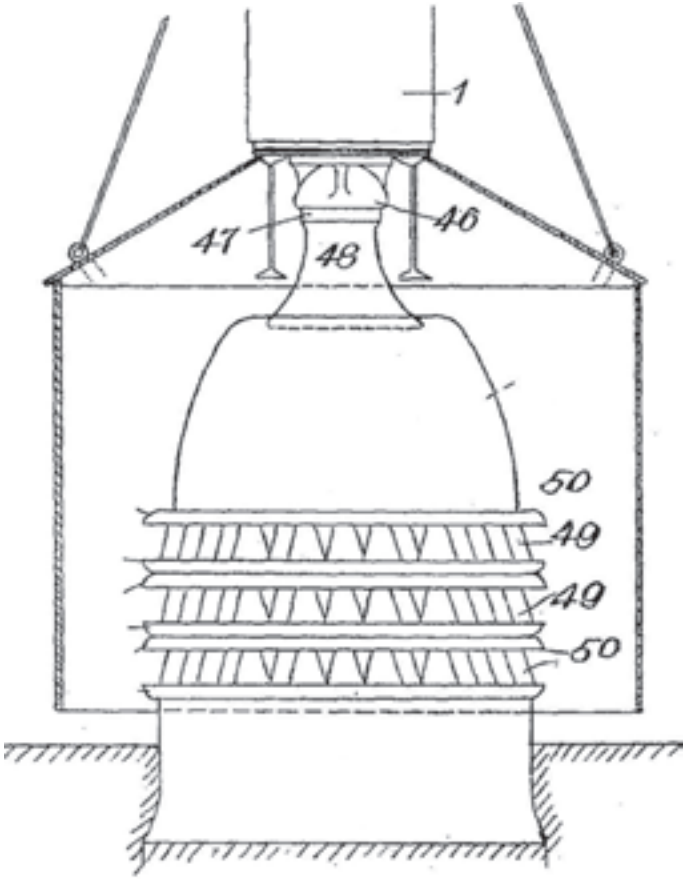


Fig. 3 – This patent drawing details the insulated base mount for Fessenden's vertical antenna. It features a ball-and-socket joint to accommodate antenna sway, and alternating layers of insulating plates and small cone-shaped insulator supports

Fig. 4 – All that remains today of Fessenden's Brant Rock, Mass. 420-foot vertical radiator is this base unit. The lower portion of the ball-and-socket joint and the stacked insulating plates, along with some of the small cone-shaped insulators are visible in this photograph. The former NESCO laboratory site is now a park for house trailers and recreational vehicles. *(Photo courtesy of Jay Ballard)*

"The antenna systems consisted of a single straight tube, 36 inches outside diameter and 420 feet long. This was built in eight-foot sections bolted together.…At first the tube along constituted all of the antenna. Later, a form of umbrella structure carrying an additional spread of wires at the top of the tube was added."[1]

Kintner stated that Fessenden used a 35 kW spark transmitter to excite his antenna. It is assumed that the capacitive top loading array or "umbrella" was created to reduce a problem with corona discharge when operating with this RF source.

Fessenden's patent is quite detailed, even addressing proper guy line tensioning. (The patent drawings shows small dynamometers permanently installed in each of the lines.)

The only missing element in Fessenden's precursor for the modern insulated base vertical radiator is the 120 radial ground system. This seems to have been left for RCA engineers George Brown, Bob Lewis and David Epstein to invent sometime later.[2]

There is no mention in the patent of any sort of grounding system to be used in conjunction with Fessenden's 1905 antenna. However, the state of the art then consisted of little more than a ground rod, or grouping of ground rods tied together. One expert in the field characterized early antenna ground systems then as being in the "black-magic stage."[3] Really efficient grounding systems (radial arrays of one-half wavelength long conductors) weren't to be realized for at least another quarter century or so.

It was not uncommon for the early simple ground systems to cause problems. Heavy RF return currents flowing in the antenna's near field could cause an occasional grass fire.

And while on the topic of RF currents, Fessenden's widow, Helen, in her 1940 account of the scientist's life provides a

graphic description of those associated with the Brant Rock tower when the rotary spark rig was in operation.

"Another stunt, this exclusively for men, was to be in the tower when sending was going on and it was functioning as an antenna. I recall seeing Mr. Bennett standing inside the tower holding in his hand a lamp bulb. On extending his arm through the manhole the lamp filament glowed brightly."[4]

Did Fessenden Invent the Franklin Too?

One curious feature of Fessenden's vertical radiator patent is the separation of the tower (smokestack) sections by insulating materials.

His patent states that the antenna can be constructed with or without insulating material between the cylindrical steel sections. If they are suitably insulated, Fessenden states that LC networks can be used to interconnect the isolated sections to enhance performance. There is, however, no evidence that he integrated this nuance into the NESCO antennas constructed at Brant Rock and Machrihanish. If this concept is carried to the logical extreme of isolating a full wave vertical radiator halfway up and inserting a phase shifting network to bring the upper and lower half currents (and voltages) into a reinforcing, rather than a canceling configuration. This was, of course, the idea behind the vertical dipole antenna patented by Charles S. Franklin in the mid-1920s.

Obvious too for the frequencies at which radiotelegraphy was being conducted (500 kHz and downward), such a full wavelength structure would have been ponderously tall.

In a well documented demonstration of radiotelephony (and the first demonstration of the broadcasting of speech and music) on Friday Dec. 21, 1906, Fessenden excited his 420-foot vertical with RF energy modulated by the simple inclusion of a carbon microphone in series with the antenna feed. A copy of an engineering report prepared by a telephone company engineer invited to witness this seminal accomplishment stated that Fessenden's alternator operated at 50 kHz and could deliver 36 watts at this frequency. The mic dissipated 24 watts, leaving 12 to feed the antenna. Even though the 420-foot antenna was really a behemoth for its time, the numbers show that at this frequency it amounted to only around 1/47th of a wavelength. Further handicapping Fessenden's attempt at AM broadcasting was a stated depth of modulation of only five percent. However, the record shows that his signal was successfully picked up at a receive site located some 10 miles distant. (Surviving photos show a vertical antenna was used at the receive site, but it's apparent it was nowhere near the 420-foot antenna height of the NESCO Brant Rock facility.)

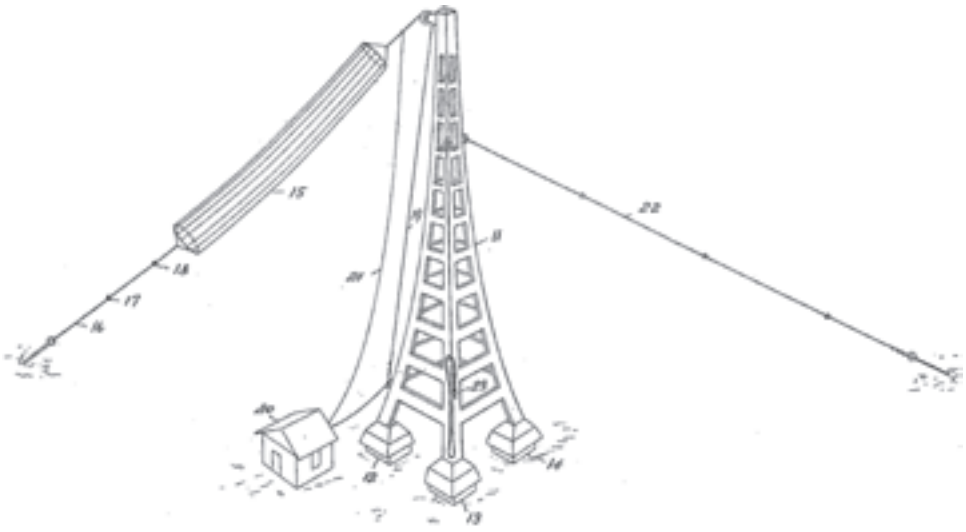


Fig. 5 – This drawing from a 1911 patent shows a cage type of antenna, supported by a tower structure with "feet" insulated in a similar manner to the vertical radiator described in Fessenden's 1905 patent. It appears from the drawing that Insulators are used to break up steel guy lines, but no claim is made for this type of construction. The patent claims that the guy lines can be "temporary" additions "…in the case of anticipated hurricanes of abnormal severity."

A Return to Multiple Wires

In examining other of Fessenden's patents dealing with antennas (he was quite a prolific thinker and designer), he doesn't seem to have been totally married to the concept of an insulated base vertical radiator. The antenna shown in fig. 5 appears on a patent granted in 1911 and is plainly recognizable as a cage. However, in fairness, the patent is really aimed at the tower supporting the antenna. Fessenden embodies some of the same principles in this structure as were included in his vertical radiator from 1905 – insulated base and guy lines broken up by insulators. The unusual element in the patent is the construction of the tower itself – concrete reinforced with iron and steel rods (rebar).

Another multiple wire antenna is included as an illustration in a second 1911 Fessenden antenna patent. (Fig. 6) Fessenden again relies on "ferro-concrete" (steel reinforced concrete) tower structures. The main thrust of this patent, however, seems to be the creation of a directional antenna structure. "An antenna for wireless telegraphy, comprising a series of wires lying in an oblique position with respect to the horizontal and having a horizontal component extending in the direction of propagation, said antenna being connected at the forward end to the telegraph instruments [*transmitter*] and being supported at the rear end by a ferro-concrete tower…"

In both of these 1911 patents, Fessenden's choice of reinforced concrete for the support towers was based on the belief that they would not absorb RF to the degree that a supporting structure fabricated of steel would.

There is no evidence that Fessenden constructed full scale models of either of these antennas at the NESCO Brant Rock Facility.

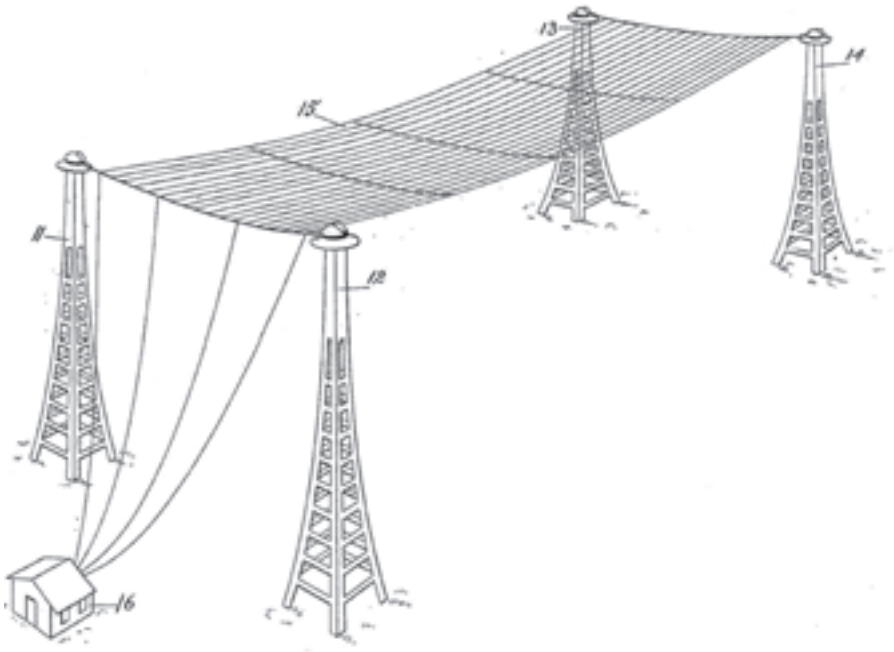


Fig. 6 – This multiple horizontal wire antenna was the subject of another of Fessenden's patents. The patent emphasized the reinforced concrete tower structures more than it did the radiating elements

Another Type of Vertical Radiator

Another antenna patent worthy of examining was awarded to Fessenden in 1915. (The application was submitted eight years prior to the award.) It is shown Fig. 7 for an insulated base vertical radiator with multiple guys. The thrust of this design was to reduce construction costs associated with his earlier "smokestack" steel cylinder vertical radiator antenna. Fessenden claimed that a 400-foot "stick" fabricated of 2.5-inch diameter pipe could be built for less than $2,500 1907 dollars. For comparison purposes, he stated that a three-foot diameter (smokestack) radiator of this height would cost more than $30,000.

A similarly constructed antenna was placed into service by commercial radio stations beginning in the 1930s. It's referred to as a "flagpole" radiator by RCA's George Brown in his autobiography and Brown leaves his readers with the impression that it was an RCA invention.[5]

(Fessenden's design for this "skinny-minnie" antenna appears to be extremely conservative. He calls for the use of between 300 and 400 guy lines. The "flagpole" antennas erected in the 1930s were engineered with an appreciably smaller number.)

One Antenna that Probably Didn't Work So Well

Probably the strangest of Fessenden's antenna designs is the one described in patent no. 956,489, which was awarded on April 26, 1910.

This construction of this device is revealed in the drawings accompanying the patent (Fig. 8).

On first glance, it's difficult to recognize the device as an antenna at all. The drawing illustrates a box on wheels with what appears to be brick walls inside.

However after reading the patent, that's exactly what Fessenden was describing; but, there are not some additional nuances that are not readily apparent from studying the drawing. The strangest of these is that the brick-walled structure is coated (Fessenden says "soaked) in "asphaltum" to make it liquid tight. Further, Fessenden has incorporated a liner of porcelain into this liquid-holding brick enclosure "for the purpose of preventing contamination." Additionally, *"the whole tank is preferably inclosed [*sic*] in a house or box [detail] 15 preferably constructed of asbestos or well varnished wood."*

According to Fessenden, the bottom of this antenna structure is to be constructed of sheet tin or zinc.

Another feature not readily apparent in the drawings is the inclusion of a series of pipes – detail 16 – carrying a "hot or cold mixture" needed to maintain the tank at a constant temperature.

The RF-radiating part of this unusual antenna is the structure identified as detail 6 in the drawing. It is readily apparent that it is coupled to a source of RF through an air core transformer installed below (and out of contact with the liquid surrounding) the radiating element, which appears to be a flat plate in the side view, but is seen as a cylinder in the top elevation. Also visible in this view is detail 5, a parabolic reflector. Detail 17 in the drawing is explained as a lens. However, Fessenden states that the wall of the tank itself could be given a lenticular shape for focusing purposes.

The principle behind this rather radical antenna structure was based on Fessenden's belief that if the radiating element were directly coupled to a suitable liquid dielectric material, then the size (length) of the element could be reduced by an appreciable amount.

In Fessenden's words:

*"As the specific inductive capacity of the medium, distilled water, is approximately 80, the wave length outside the medium will be approximately 27 feet. To obtain the same ratio between the dimensions of the reflector and the wave length in air would require that the reflector be 810 ft. diameter from which the advantages of this construction will be apparent. In addition, since the specific inductive capacity of the dielectric is 80, the energy emitted by the sending conductor [*detail*] 6, although it is only 6 inches long will be the same in amount as that emitted by a sending conductor 40 ft. high in air."*

In other words, by immersing the radiating element in distilled water, Fessenden's design makes a ½-foot radiator the equivalent of a 40-foot element in free space.

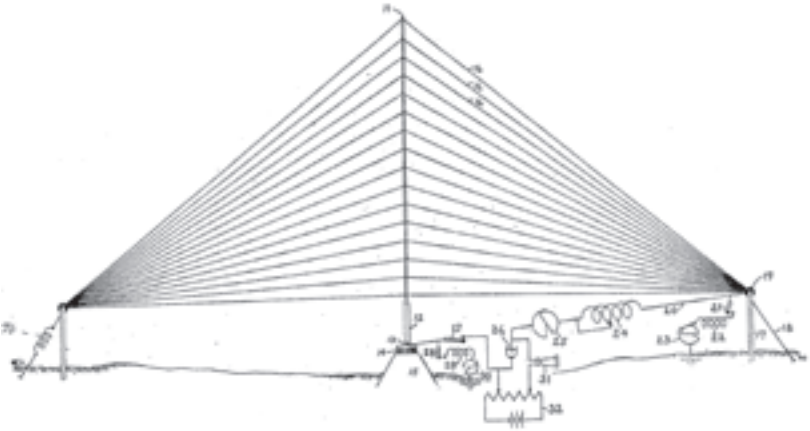
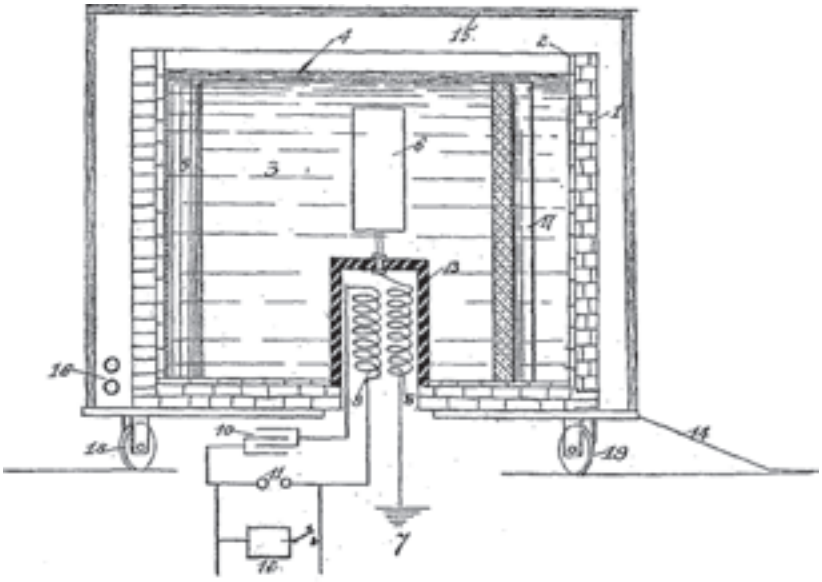


Fig. 7 – Patent drawing showing Fessenden's concept for constructing a vertical antenna from fairly small (2.5-inch o.d.) pipe sections. This construction was later adopted by some MW stations and was known as a "flagpole" type of radiator



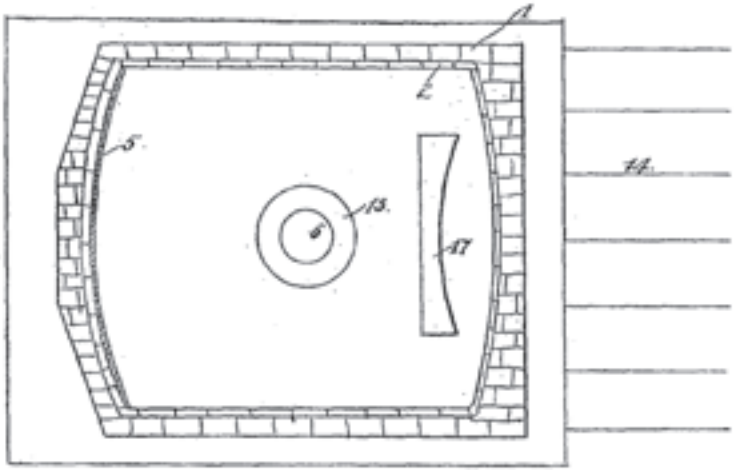


Fig. 8 – This most unusual antenna patented by Fessenden was supposed to have included brick, asphalt, porcelain, zinc sheeting and distilled water in its construction

(The author recalls high fidelity loud speaker designer, Paul Klipsch's occasional references to "a miniature 32-foot wavelength" in describing exaggerated specs for physically small speakers. If Fessenden's design and claims for this particular antenna are extrapolated into the field of audio, he seems to have foretold what was yet to come in the speaker design arena too.)

Recognizing Fessenden's Contributions

Although Reginald Fessenden may not be remembered for his pioneering antenna work, he certainly deserves credit for visualizing what we know today as the series-fed, insulated base vertical radiator. It's educational to perform a patent search by entering his name and "antenna" in the search engine. Not only is Fessenden's name on numerous patents dealing with antenna design and theory, it's remarkable to see how many patents issued to others long after Fessenden's death in 1932 cite prior art work by Fessenden. Among his many other accomplishments, he should be properly recognized as the father of AM radio broadcasting, the inventor of the principle of heterodyning of electrical signals (he coined the term "heterodyne"), *and* the originator of the insulated base vertical radiator used for virtually all medium wave broadcasting today.

Acknowledgement

James E. O'Neal is technology editor at the TV Technology magazine. He is a member of the IEEE, SMPTE and SBE, and is a graduate of the University of Arkansas.

This article has been peer reviewed.

[1] Kintner, S. M., "Pittsburgh's Contributions to Radio," Proceedings of the Institute of Radio Engineers, vol. 20, no. 12, pp. 1840–1862; Dec. 1932.

[2] Brown, G.H., Lewis, R.F., Epstein, J. "Ground Systems as a Factor in Antenna Efficiency," Proceedings of the Institute of Radio Engineers, vol. 35, no. 6, pp. 753–787; June 1937.

[3] Laport, Edmund A., "Radio Antenna Engineering," p. 77; McGraw-Hill Book Co., New York, 1952.

[4] Fessenden, Helen M., "Fessenden – Builder of Tomorrows." p. 141; Coward-McCann Inc., New York, 1940.

[5] Brown, G.H., "and part of which I was – Recollections of a Research Engineer," p. 175; Angus Culpar Publishers, Princeton, N.J., 1982.

Delivery of Academic Lectures Through DVB-T and MHP Applications

By M. Baldi, E. Gambi, S. Spinsante, Polytechnic University of Marche, Italy

Digital Terrestrial Television is currently the fastest growing digital television platform in Europe. Since the first launch in the United Kingdom, in 1998, an increasing number of Countries have experienced operational transmissions, or are currently running service trials. With specific reference to the Italian scenario, the number of DVB-T receivers, sold or rent, is approaching 4,000,000 and ranks third behind UK and Germany.

In the wide spectrum of possible applications of the Digital Video Broadcasting – Terrestrial (DVB-T) technology, a promising role is played by the so-called learning services, i.e. services that are provided in order to support continuous, lifelong learning to remote users. TV based interactive learning (also known as T-learning) represents the convergence between services (interactive digital TV and E-learning), technologies (TV and computer), and platforms (broadcast transmission, Internet Protocol), in such a way as to be a real cross media application. The European Commission is heavily engaged in promoting research initiatives related to the development of new learning platforms. The most recent example is provided by the Enhanced Learning Unlimited project, whose objective is to look on how interactive digital TV can be used to increase learning opportunities at home, office and school. In fact, current ICT initiatives are not effectively widening participation, particularly among those who are not actively engaged in learning; in this sense, looking towards solutions and devices that people are familiar with, and feel comfortable in using, both in their own homes and on the move, can give a strong contribution to overcome the so called "digital divide."

Interactive digital television combines the appeal and mass audience of traditional TV with interactive features, such those usually available on the Web. In this context, a key role is played by the Multimedia Home Platform (MHP) standard, that enables T-learning services, as it makes possible to enrich the video content by adding animations or text based materials (hypertext), and, most of all, it provides interactivity through the management of the return channel, which is physically supported by the user's Set Top Box (STB). The presence of a return channel opens new perspectives in the framework of learning services: interaction between home students and a remote teacher, or among students themselves, allows the real-time emulation of a traditional live lesson. Each student acts individually at home, but also may join virtual groups with other students, through the interactive TV. Moreover, connectivity ensured by the return channel makes it possible to overcome many of the potential limits of a broadcast T-learning model, which are mainly due to the absence of a live interaction between students and with the teacher. Another key point to consider is the possibility of providing different assessment options, more similar to the traditional ones, again thanks to the connection ensured by the STB: not only self-assessment tests, but also interactive question-and-answer sessions.

According with the scenario described above, we present a particular application for the delivery of learning contents (more specifically academic lectures), that is based on digital television and integrates videoconference technology: the former acts as a primary platform for content distribution and interactivity support, the latter allows a low cost production and transmission of the video content. At the authors' best knowledge, this is the only example, at least in the Italian context, of such integration between communication technologies involving DVB-T for learning purposes. The application, and the T-learning service that can be provided by means of it, have been adopted by the Faculty of Economics of the Polytechnic University of Marche (Italy) for the home delivery of academic lectures of its satellite School of Economics, Markets and Business Administration (located in a different town) to subscribed undergraduate students. This allows the academic institution to get a very thorough presence in the local educational framework, and, at the same time, it is a concrete answer to the problem of accessibility and digital divide, which strongly affects rural areas.

The service is provided through a technological platform integrating videoconference systems, DVB-T broadcast and interactive applications, as shown in Fig. 1.

The videoconference links (ISDN and ADSL link) connect the Academic classroom to a Multimedia Control Unit

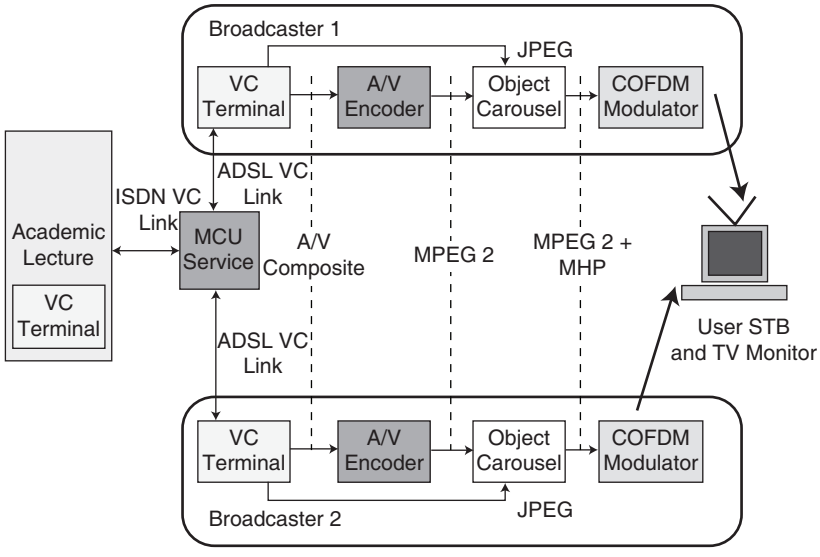


Fig. 1 – Technological infrastructure for the considered T-learning system

(MCU service), that retransmits the received traffic to the broadcaster's sites. The usage of an MCU is necessary if the same A/V content is to be delivered to different local broadcasters (more than one), characterized by different coverage areas. Moreover, the MCU may implement, if necessary, a transmission protocol conversion. This feature is usefully employed in our system, because the videoconference link towards the MCU uses one, or more, ISDN channels, that guarantee a fixed bandwidth, while the downlink flow of ADSL links is used for the retransmission to the broadcasters. At the broadcaster's site, the A/V content received by the videoconference terminal is MPEG2-encoded, and organized in a proper transport stream. The videoconference terminal outputs the lecture slides too, in JPEG format. Together with the MHP interactive application, they are inserted in the transport stream and, finally, modulated to be transmitted over a UHF link and received by the user STB.

The MHP application designed for the T-learning service makes available to the user a number of functions focused on typical student needs:

– Options for slide management: remote synchronization by the lecturer during the lesson, or off-line browsing by the user;
– Assessment facilities: interactive sessions with the lecturer (chat line, message service) or off-line self assessment tests;
– Availability of additional information through the return channel.

The main feature of the proposed T-learning application is the possibility of performing a live update of the contents shown on the DTT channel, according with the lecturer's actions. Every time a new slide is captured in the form of a still frame by the VC terminal located in the classroom, and used by the teacher, it is transferred to the companion VC terminal at the broadcaster's side, and uploaded to the Object Carousel generator, in a specified folder. A software tool, running on the Object Carousel generator server, monitors such a folder, and launches a proper script every time a change in a file is revealed. Such a script acts to rebuild the transport stream "on-the-fly" without stopping the streaming from the Object Carousel generator. This is done by changing and updating the version number parameters of the Application Information Table (AIT) and Digital Storage Media - Control and Command (DSM-CC) object. This way, the MHP application running on the STB is notified of the change, thanks to the functionalities of the DSM-CC paradigm, and can grab the new content on-air, without being reloaded. As a result, the students see the content displayed on their screens automatically updated with the new slide. Fig. 2 shows a screenshot of the application page where the slides are displayed, together with the video of the live lesson remotely held.

Besides the functionalities described above, the proposed T-learning application can make available a number of enhanced options, varying from the possibility of setting up a "conversation" between the user and the teacher, through an instant messaging service (chat line), to the availability

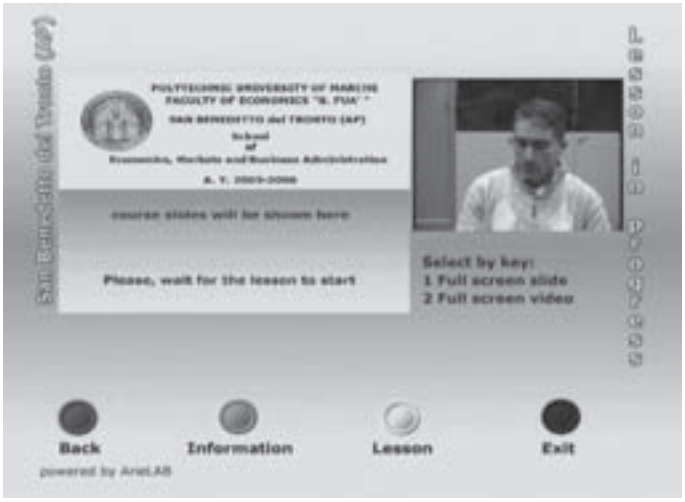


Fig. 2 – Slide and live lesson displayed by the MHP application

of a message delivery service, similar to an e-mail facility, to the accessibility of web contents, properly modified for delivery in a TV context. These features have already been tested with positive outcomes in a trial run, but, at present, are not fully delivered to home users, basically for the scarce availability of a return channel connection at user's premises.

The system herein presented has been tested to evaluate the effects of the bandwidth available in the VC link to provide, at the user side, a sufficient video quality. Because of the usage of 2 ISDN channels, for a total capacity of 256 kbit/s, the overall quality strongly depends on the quality of the video signal at the output of the VC chain. In addition, multiple encoding processes of the same video signal may degrade the final video quality. In this case, two encoders are present: the H.264 coder, operating at a low bit rate within the VC system, and the MPEG2 coder at the broadcaster's site. The bandwidth assigned to the H.264 coder plays the major role in affecting the final quality, with respect to the MPEG2 coder bandwidth. H.264, being the encoding process that acts first on the video signal, determines the main compression and loss contribution. It should be considered that the video signal associated to an academic lecture usually has very low motion, so a moderate low bit rate is sufficient to reach good quality levels.

The performance of the live update process in the real implementation is, on average, less than 30 seconds for the whole process to be completed, and a reduction of this value can be obtained by increasing the bandwidth dedicated to the application within the stream, and the rate at which the Carousel injects the MHP content into the stream itself.

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59th Annual IEEE Broadcast Symposium

SAVE THE DATE!

14 -16 October 2009 – Alexandria, VA USA

Please mark your calendar to attend the 59th Annual IEEE Broadcast Symposium to be held at the Westin Hotel in Alexandria, Virginia on 14-16 October 2009.

The IEEE Broadcast Symposium is focused on technical areas important to broadcast engineers and professionals with an emphasis on leading edge technology of interest to broadcasters.

Topic Areas:

Presentations are being scheduled who will present on topics such as the post transition performance of digital terrestrial TV, AM and FM digital radio performance, the results of increasing the level of FM IBOC carrier levels relative to the FM analog carrier power level, predictions of FM IBOC interference to adjacent channels and observed interference to adjacent channels, point to multi point TV transmission to mobile hand held devices, distributed transmission for TV and FM, advances on the use of Longley Rice modeling to determine predicted coverage contours for radio and TV, and other topics that are relevant to the modern broadcast engineer.

This event will now offer Continuing Educations Units (CEUs) for attending the technical sessions. Most consultants and PE's know that those are often required to maintain professional engineer licenses. Please feel free to request the CEU accreditation when you register for the conference.

Potential presenters are still invited to submit abstracts for proposed papers on advances in broadcast technology, including presentations in the following topic areas: 1) Technical issues associated with the termination of analog television broadcasting, 2) Repurposing of analog television broadcast transmitters, 3) Digital radio and television systems: terrestrial, cable, satellite, Internet, wireless, 4) Streaming, IPTV, VoIP, VoD, Mobile TV, Wireless Multimedia, 5) Wireless Broadband Networks; e.g., IEEE 802.22 Wireless Regional Area Networks ("WRANs"), 6) Transmission, propagation, reception, re-distribution of broadcast signals.

Prospective authors are invited to submit extended abstracts of 500-1000 words by e-mail to bts@ieee.org. Please indicate that the abstract is submitted to the 2009 Annual IEEE Broadcast Symposium, and include the corresponding author's full name and contact information including: Affiliation, address, e-mail, and phone number. Abstracts must be submitted by May 31, 2009 for consideration to be included in the 2009 Symposium technical program.

For details visit the Broadcast Symposium web site: www.ieee.org/bts/symposium

IEEE International Symposium on Broadband Multimedia Systems and Broadcasting


Call for Papers

24-26 March 2010 – Shanghai, China


The IEEE International Symposium on Broadband Multimedia Systems and Broadcasting 2010, the fifth in the series, will be held in Shanghai, China (http://www.ieee-bmsb2010.org). The symposium will be a premier forum for the presentation and exchange of technical advances in the rapidly converging areas of multimedia broadcasting, telecommunications, consumer electronics, and networking technologies.

The symposium seeks technical papers on the following topics:

1. ***Multimedia systems and services***
   - 1.1 Mobile TV
   - 1.2 IPTV & Internet TV
   - 1.3 DTV and broadband multimedia systems
   - 1.4 VoD, interactivity, datacasting
   - 1.5 Field trials and test results
   - 1.6 Content management
   - 1.7 Service deployments
2. ***Multimedia devices***
   - 2.1. Display technology
   - 2.2. Acquisition technology
   - 2.3. Set-top box and home networking
   - 2.4. Mobile, portable, and handheld devices
   - 2.5. Program guides and navigation
3. ***Multimedia quality: Performance evaluation***
   - 3.1 Performance evaluation
   - 3.2 Objective evaluation techniques
   - 3.3 Subjective evaluation techniques
4. ***Multimedia processing***
   - 4.1. Audio technology
   - 4.2. Video coding and processing
   - 4.3. Content adaptation and scaling
   - 4.4. Error resilient and concealment
   - 4.5. Rate control
   - 4.6. Retrieval and indexing
   - 4.7. 3-D and multi-view video
   - 4.8. Content protection and watermarking
5. ***Transmission and networking***
   - 5.1. Channel modeling and simulation
   - 5.2. Channel coding, modulation, multiplexing
   - 5.3. Signal processing for transmission
   - 5.4. Propagation and coverage
   - 5.5. Congestion control
   - 5.6. Traffic and performance monitoring
   - 5.7. Networking and QoS

Call for Tutorials: Proposals for half-day tutorials are also solicited based on the topics listed above.

Call for Panels: Proposals are solicited for panels on technology, application, business, and policy-related issues and opportunities for multimedia and broadcasting industry.

Prospective authors are invited to submit extended abstracts of about 1000 words by e-mail to **bts@ieee.org.** Each abstract must include at least two ***key words*** chosen from the topics mentioned above. **Please indicate that the abstract is submitted to the *IEEE International Symposium on Broadband Multimedia Systems and Broadcasting 2010*,** and includes the corresponding author's full name and contact information including: Affiliation, address, e-mail, and phone number.

Important dates:

Submission of extended abstracts:	**23 September 2009**
Notification of acceptance:	**28 November 2009**
Submission of full papers:	**27 February 2010**






January 9–13, 2010
Las Vegas, USA
http://www.icce.org

IEEE CONSUMER ELECTRONICS SOCIETY

CALL FOR PAPERS



28TH INTERNATIONAL CONFERENCE ON CONSUMER ELECTRONICS 2010

Conference Theme: Green Consumer Electronics Technologies

The International Conference on Consumer Electronics (ICCE) is soliciting technical papers for oral and poster presentation at ICCE 2010. Now in its 28th year, ICCE has a strong conference history coupled with a tradition of attracting leading authors and delegates from around the world. Papers reporting new developments in all areas of consumer electronics are invited, including but not limited to those listed below. Student papers and papers of a tutorial nature are particularly encouraged. This year, papers relating to Green Consumer Electronic Technologies are particularly sought for a special session.

Tutorials are scheduled during the Conference. Brief proposals should be submitted by June 1st, to Atul Batra at abatra@marvell.com. Proposals must include title, abstract, detailed outline, as well as bio and contact information for the presenter.

TOPICS

HOME ENTERTAINMENT
Home Gateway, DTV, Home Theater, PVR, Interconnects, Game Systems, Interactive and Directed Programming, Internet Integration, Advanced DVD and CD, Displays

MOBILE COMPUTING & COMMUNICATION
Mobile Broadband, Handheld & Wearable Computers, Personal Multimedia Devices, Next Generation Cellular, AV Streaming to Handheld Devices

A/V TECHNOLOGY
Still & Video Cameras, Analog and Digital Audio, 3D Video, Recording, Storage, Compression, Transcoding, Applied Signal Processing, Content Indexing, Networked A/V, Video Enhancement, Visual Quality Assessment, Emerging VOD and Non-Real-Time (NRT) Services & Standards

RF & WIRELESS
Antennas, Acquisition, Equalization, Spectrum Usage, Software Radio, Wireless LAN, 802.11 Standards, Bluetooth, RFID, WPAN

CONSUMER NETWORKS
Wired & Wireless Multimedia, QoS, Security, Peer-to-Peer, Internet Appliances, Home Control, Bridges, Interoperability, Application Control, Home Architecture, Healthcare Applications and Energy Management.

AUTOMOTIVE ENTERTAINMENT & INFORMATION
Navigation, A/V Systems, Driver Assistance, Networks, Communication Aspects, Sensors and Control

SECURITY & RIGHTS MANAGEMENT
Copy and Redistribution Protection, Payments, Trusted Computing, Parental Controls, Legal and Regulatory Issues, Biometrics, Privacy, Encryption

ENABLING TECHNOLOGY
Advanced Semiconductors, High Speed Signals & Interconnects, Algorithms, O/S, Development Tools, Test Equipment, Advanced Displays, Power and Conventional Batteries, Small Fuel Cells, Standards, Intellectual Property, Cost Reduction, Compliance Testing, Human-Computer Interface, Special-Needs/Assistive Technology, Recyclable / Green Engineering

CO-LOCATED WITH THE INTERNATIONAL CONSUMER ELECTRONICS SHOW

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Charlotte Kobert

AUTHOR'S INFORMATION

Deadline for Paper Submission: June 19, 2009

Notification of Acceptance: September 7, 2009

Camera-Ready Paper Due: October 2, 2009

ICCE is Now Accepting Sponsorships

Authors are invited to submit a 2-page summary according to the posted submission guidelines. Only electronic submissions will be accepted via the web at http://www.icce.org.

At least one author of each paper MUST pre-register for the conference by October 16, 2009 for papers to be included in the program.

For further information or questions, please visitwww.icce.org or contact us at icce@ieee.org

Announcing a Special Issue of the

IEEE/OSA Journal of Display Technology on

LCOS Technology

□□ Submission Deadline: 31 DECEMBER 2009 □□

The *IEEE/OSA Journal of Display Technology* (JDT) invites submission of manuscripts for a special issue. The purpose of this special issue is to document the current status of the Liquid Crystal on Silicon (LCOS) technology through a collection of original papers. Contributed papers on all aspects of this technology are welcome; from issues concerning the drivers and electronic interface, signal processing aspects, chip design, design of the liquid crystal pixels, modeling, development of special materials, associated optical systems to applications in projection displays, pico-projectors, diffractive displays, holograms and communication devices.

The Primary Guest Editors for this issue are **Dr F. Anibal Fernandez and Dr Sally E. Day**, University College London, London, UK. Associate Guest Editors are **Dr Mike Robinson**, RealD, USA, **Dr Herbert de Smet**, IMEC and University of Ghent, Ghent, Belgium and **Dr Atsutaka Manabe**, Merck KGaA, Darmstadt, Germany.

The deadline for submission of manuscripts is **31 December 2009** and publication is tentatively scheduled for the **September 2010** issue. Manuscripts should conform to requirements for regular papers (up to 8 double-column, single-spaced journal pages in length, keywords, biographies, etc.). All submissions will be reviewed in accordance with the normal procedures of the Journal.
The IEEE Copyright Form should be submitted after acceptance. The form will appear online in the Author Center in Manuscript Central after an acceptance decision has been rendered.

For all papers published in JDT, there are voluntary page charges of $110.00 per page for each page up to eight pages. Invited papers can be twelve pages in length before mandatory overlength page charges of $220.00 per page are levied. The length of each paper is estimated when it is received. Authors of papers that appear to be overlength are notified and given the option to shorten the paper.

Authors may opt to have figures displayed in color on IEEE Xplore at no extra cost, even if they are printed in black and white in the hardcopy edition. Additional charges will apply if figures appear in color in the hardcopy edition of the Journal.

Manuscripts should be submitted electronically through IEEE's Manuscript Central:
http://mc.manuscriptcentral.com/jdt-ieee. Be sure to select **"2010 LCOS Technology Special Issue"** as the Manuscript Type, rather than "Original Paper." This will ensure that your paper is directed to the special issue editors. IEEE Tools for Authors are available online at:
http://www.ieee.org/organizations/pubs/transactions/information.htm

Inquiries can be directed to Lisa Jess, Publications Administrative Assistant, IEEE Photonics Society Editorial Office, l.jess@ieee.org (phone +1-732-465-6617; fax +1 732 981 1138).

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