

SDR'08

Washington, D.C. Oct. 26-30
Technical Conference and Product Exposition

SDR 2.0 — ENTERING THE MAINSTREAM

Welcome to SDR'08, an innovative global conference featuring in-depth panel sessions, informative tutorials and workshops, high caliber keynote addresses, cutting-edge demonstrations and industry leading technical sessions as we explore the shift of reconfigurable radio technologies into mainstream acceptance.

"In a world of diverse and rapidly changing radio communications requirements, organizations that adopt SDR will succeed; those that neglect SDR will be left behind."

— Dr. John Chapin, Vanu

Featuring:

Keynote Speakers:

Dr. Donald H. Steinbrecher, Chief Scientist, Electromagnetic Systems Division, *Navy Undersea Warfare Center* - "One Perspective on the 40-Year Evolution of Software-Defined Radio Signals Intercept Systems"

Ari Virtanen, Executive Vice President, Wireless Solutions, *Elektrobit Corporation (EB)* - "SDR Evolution in Commercial and Dual-Use Telecom Products"

Rajendra Singh, Senior Regulatory Specialist, *World Bank* - "Technology Drive: Spectrum Access from Land to Sea"

William A. Maheu, Senior Director, *QualComm Government Technologies* - "Today's Unrealized Potential for Public Safety Communications: Voice and Data anytime, anywhere, over any device and any network"

Dr. Ron Jost, Deputy Assistant Secretary of Defense for C3, Space & Spectrum, *Office of the Assistant Secretary of Defense for Networks and Information Integration* - "The Future of SDR in Tactical Networking"

Honorary Program Chair:

Klaus Moessner, Senior Research Fellow Mobile Communications, Centre for Communication Systems Research, *University of Surrey*

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Established in 1996, the SDR Forum is a non-profit international industry association dedicated to promoting the success of next generation radio technologies. The Forum's 100-strong membership comprises world class technical, business and government leaders from EMEA, Asia and the Americas. SDR Forum is the only organization in the world dedicated to serving the industry's needs through advocacy, opportunity development, commercialization and education. For more information, please visit www.sdrforum.org.

Program at a Glance

Monday, 27 October

- 8:30 a.m. Keynote - **Dr. Donald H. Steinbrecher**, Chief Scientist, Electromagnetic Systems Division, *Navy Undersea Warfare Center* - "One Perspective on the 40-Year Evolution of Software-Defined Radio Signals Intercept Systems," *Sponsored by The MathWorks*
- 9:10 a.m. Coffee Break
- 9:20 a.m. Tutorials (see details, abstracts and room assignments on page 5) and E3 Workshop (see page 14 for details)
- 12:30 p.m. Lunch and Smart Radio Challenge '08 Awards
- 1:30 p.m. Tutorials (see details, abstracts and room assignments on page 6) and E3 Workshop (see page 14 for details)
- 5:00 p.m. Welcome reception at Mount Vernon, *Sponsored by General Dynamics*

Tuesday, 28 October

- 8:30 - 9:15 a.m. Keynote - **Ari Virtanen**, Executive Vice President, Wireless Solutions, *Elektrobit Corporation (EB)*, "SDR Evolution in Commercial and Dual-Use Telecom Products"

- 9:20 a.m. Coffee Break

	<i>Regency E</i>	<i>Potomac 3, 4</i>	<i>Regency F</i>	<i>Potomac 5, 6</i>	<i>Regency C</i>	<i>Regency D</i>
9:40 a.m.	Session 1.1 Cognitive Radio - Location Awareness	Session 2.1 RF Technology & Devices	Session 3.1 Markets Workshop - "Advancing SDR in Mainstream Markets - Opportunities and Challenges"	Session 4.1 SW Design & SCA 1 -	Session 5.1 Advanced Challenges 1	Session 6.1 Demos

- 11:50 a.m. Lunch and Exhibits, *Sponsored by Pentek*

	<i>Regency E</i>	<i>Potomac 3, 4</i>	<i>Regency F</i>	<i>Potomac 5, 6</i>	<i>Regency C</i>	<i>Regency D</i>
1:50	Session 1.2 Cognitive Radio - Spectrum Awareness	Session 2.2 Platforms 1	Session 3.2 Markets Workshop - "Advancing SDR in Mainstream Markets - Opportunities and Challenges"	Session 4.2 Frameworks & Middleware	Session 5.2 Advanced Signal Processing 1	Session 6.2 Demos

- 4:00 p.m. Coffee Break, *Sponsored by Symplicity*

- 4:15 p.m. Invited Paper and Panel - "Clean Slate Radio" - **Ronan Farrell**, Director of the Institute of Microelectronics and Wireless Systems, *National University of Ireland, Maynooth*; Panelists: John Chapin, *Vanu Technologies*; Sven Bilen, *Pennsylvania State*; Jean-Christophe Schiel, *EADS*; Philip Balister, *OpenSDR*

- 5:15 p.m. Panel - "Standards Collaboration: What is Required to Advance SDR Technologies in Mainstream Markets?" Moderated by: Lee Pucker, CEO, *SDR Forum*; Panelists: John Chapin, *Vanu* and Chair of the SDR Forum; Vishnu Sahay, *Harris Stratex*, representing *ETSI*; Kalle Kontson, *Kontson Telecommunications Consulting* and Founding Member of *IEEE SCC41*; Richard Soley, CEO, *Object Management Group*; Wolfgang Koenig, *Alcatel-Lucent Deutschland AG* and Technical Manager of the E3 Program

- 6:00 - 8:00 p.m. Evening Reception in Exhibition Hall

Program at a Glance

Workshop details can be found on pages 15 and 16.

Wednesday, 29 October

8:30 - 9:15 a.m. Keynote - **Rajendra Singh**, Senior Regulatory Specialist, *The World Bank*, "Technology Drive: Spectrum from Land to Sea"

9:20 a.m. Coffee Break

	<i>Regency E</i>	<i>Potomac 3, 4</i>	<i>Regency F</i>	<i>Potomac 5, 6</i>	<i>Regency C</i>	<i>Regency D</i>
9:40	Session 1.3 Cognitive Radio - Sensing and Awareness	Session 2.3 Platforms 2	Session 3.3 Regulatory Workshop - "SDR 2.0 Certification and Accreditation: Do existing processes need reform"	Session 4.3 SW Design & SCA 2	Session 5.3 Advanced Signal Processing 2	Session 6.3 Demos

11:50 a.m. Lunch and Exhibits

	<i>Regency E</i>	<i>Potomac 3, 4</i>	<i>Regency F</i>	<i>Potomac 5, 6</i>	<i>Regency C</i>	<i>Regency D</i>
1:50 p.m.	Session 1.4 Cognitive Radio - Modulation Adaption	Session 2.4 Smart Antenna	Session 3.4 Regulatory Workshop - "Pointing the Finger: How Should Governments Assign Liability to Promote the Success of Next Generation Radio Technology"	Session 4.4 Certification, Validation, Tools	Session 5.4 Advanced Challenges 2	Session 6.4 Demos

4:00 p.m. Coffee Break, *Sponsored by Symplicity*

4:15 p.m. Keynote - **Bill Maheu**, Senior Director, *Qualcomm Government Technologies*, "Today's Unrealized Potential for Public Safety Communications"

5:15 p.m. Panel - "What Should the Incoming US Administration Do To Promote The Success of Next Generation Radio Technology" Moderated by: Lee Pucker, CEO, *SDR Forum*; Panelists: Bruce Oberlies, Senior Director of Advanced Technology and Strategy, *Motorola*; Jennifer Warren, Senior Director, Government & Regulatory Affairs, *Lockheed Martin Corporation*; Bernard Eydt, Chair, SDR Forum Regulatory Committee, and Associate at *Booz Allen Hamilton*; Peter Tenhula, Vice President and General Counsel, *Shared Spectrum Company*.

6:00 - 9:00 p.m. Members Reception and Annual General Meeting, *Sponsored by GE Fanuc*

Papers in each session are listed beginning on page 8.

Program at a Glance

Thursday, 30 October

8:30 - 9:15 a.m. Keynote - **Ron Jost**, Deputy Assistant Secretary of Defense for C3, Space & Spectrum, *Office of the Assistant Secretary of Defense for Networks and Information Integration*

9:20 a.m. Coffee Break

Regency E Potomac 3, 4 Regency F Potomac 5, 6 Regency C Regency D

9:40 a.m.	Session 1.5 Cognitive Radio - Policy & Language	Session 2.5 Multimode Base Stations & Terminals 1	Session 3.5 OMG Standards Track 1	Session 4.5 Architecture & Design 1	Session 5.5 Open Source HW & SW	Session 6.5 Demos
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11:50 a.m. Lunch and Forum Awards Presentation

1:50 p.m.	Session 1.6 Cognitive Radio - Resource Management	Session 2.6 Multimode Base Stations & Terminals 2	Session 3.6 OMG Standards Track 2	Session 4.6 Architecture & Design 2	Session 5.6 Civil & Gov Apps	Session 6.6 Demos
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4:00 p.m. Coffee Break

4:15 p.m. Panel - "Requirements for Test and Certification of SDR Technologies" Moderated by: Daljeet Singh, *Anritsu*, and Chair of the SDR Forum Test and Measurement Work Group; Dr. Douglas Sicker, *University of Colorado* and chair of IEEE P1900.3; Jaggi Yedetore, *Vanu*, representing commercial radio manufacturers; David Vander Staay, *Thales Communications*, representing the public safety radio manufacturers; Mark Turner, *Harris*, representing the military radio manufacturers.

5:00 - 5:45 p.m. End Note, Lee Pucker, CEO of the SDR Forum, "SDR Forum - Past, Present and Future"

CALL FOR PRESENTATIONS

2009 European Reconfigurable Radio Technologies Workshop and Product Exposition
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Join the SDR Forum for a multi-day workshop bringing together wireless telecommunications equipment manufacturers (TEMs) with their customers and suppliers to explore the evolution of reconfigurable radio over the next several years. Reconfigurable radio technologies are becoming essential to support the requirements of the wireless market. Network operators need to contain their capital and operational expenditures while supporting a proliferation of wireless standards from organizations such as IEEE and ETSI. Wireless end users, be they business travelers or first responders in a national emergency, are demanding radio technologies that allow them to communicate with whomever they need to, whenever they need to and wherever they are.



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Sunday, 26 October



1:00 - 7:00 p.m.

Showcasing some of the industry's future stars, the final judging of the **2nd Annual SDR Forum's Smart Radio Challenge**, a worldwide competition in which student engineering teams design, develop and test a software defined radio (SDR) or a cognitive radio will kick off SDR'08. This event is free of charge and optional for conference attendees.

6:00 - 8:00 p.m.

Registration

Monday, 27 October

Tutorial Abstracts — Morning Session, 9:20 a.m.

Regency E

"The SDR Forum Transceiver Facility Specification," Eric Nicolet, *Thales Communications*

The purpose of this tutorial will be to present the Transceiver Facility Specification being under development within the SDR Forum. This specification aims to provide a openly available reference (the Facility) containing generic requirements applicable to a very large of Transceiver sub-systems (I/Q base band to RF and vice-versa stage). This in support of two essential SDR industrial use cases: (i) development of highly portable Waveform Applications software, thanks to the total abstraction of the implementation the Facility is bringing, (ii) development of efficient multi-waveforms compliant flexible Transceiver Sub-system. The proposed approach of the Transceiver is translating into reference API specification which ideally complement any implementation architecture, proprietary or standard-based solutions (such as VITA 49, OBSAI, CPRI od DigRF designs), thus opening the way to dramatic cost-efficiency increases in the physical layer development area. The tutorial will exhibit a general presentation of the specification, from the industrial drivers to a accurate overview of the technical content, as well as a report on readiness in front of the Forum's objective to have one first increment of the specification released by Q1 2009.

Potomac 3, 4

"Developing SDR with Agility," T. McClean, *Zeligsoft*

The development of SDR systems, as with many other complex embedded systems, requires frequent modifications to system design and implementation because of requirement changes caused by a number of factors including evolution of hardware and platform technologies, discovery of conflicting requirements, and refinement of non-functional requirements. To cope with frequently changing requirements, developers need the agility to test frequently

to discover problems early in the process and to be able to modify the different design and implementation artifacts. In order to be able to increase system quality, frequent execution starting from early iterations on host and target platform is a necessity. Similarly, automated and incremental test generation, execution and analysis are essential for satisfying both functional and non-functional requirements. Often a system has several variations, known as a product line, where multiple applications or waveforms are targeted at multiple different platforms. The aforementioned factors drive the desire for agility in the development of SDR. Two technologies that can be used to increase agility are Model Driven Development (MDD) and Model Driven Testing (MDT). MDD provides a means to build several layers of differing degrees of abstraction, for example a software layer that is platform independent and a logical platform that abstracts the hardware layer. The software layer is mapped to the logical platform layer, and using this mapping, an automatic code generator can generate the platform specific aspects of the system. For example, in the mapping of application to platform, connections between software elements are mapped to a communication transport indicating how they will communicate. The transport selection is then used to generate the code necessary for the elements to communicate. This decoupling and mapping enables the user to easily change platforms. With MDT, scenario models can describe unit tests for a particular piece of functionality in the application/waveform or they can be used to describe system level tests. Furthermore, we are able to build the system testing incrementally by growing subsets of the functionality (and stubs), starting with sub-systems and stubs, and finishing with the complete functionality of the application/waveform. Since these models are independent of any platform — the platform is chosen and software mapped to the platform — we are able to start testing on a host platform and

Monday, 27 October

Tutorial Abstracts — Morning Session, 9:20 a.m. (continued)

systematically migrating to the target platform. By adding non-functional property annotations to the scenarios (application/waveform and platform) we are able to integrate system aspects into the generated tests and test suites. For example, the latency of a connection between two devices or nodes in the platform is annotated in the model. This latency annotation can be used to generate “delays” in the behavior of a generated stub. This is the focus of this tutorial. This tutorial will show the participant how Model Driven Development (MDD) and Model Driven Testing (MDT) can enable agility in the development of SDR applications. The tutorial leader will model part of an SDR system, and show how this can be done with agility. The tutorial leader will generate application code and execute it on a host platform as well as an embedded platform. While building the model the leader will continually be able to generate test suites, analyze non-functional constraints and re-target the model to different platforms. This tutorial will show in detail how SDR can be developed with agility.

Regency F

“Signal Processing Techniques for Spectrum Sensing and Communication in Cognitive Radio Networks,” Behrouz Farhang-Boroujeny, University of Utah

As the vast majority of the available spectral resources have already been licensed, it appears that there is little or no room to add any new services, unless some of the existing licenses are discontinued. On the other hand, studies have shown that vast portions of the licensed spectra are rarely used. This has initiated the idea of Cognitive Radios (CR) where secondary (i.e. unlicensed) users are allowed to transmit and receive data over portions of spectra when primary (i.e. licensed) users are inactive. This should be done

in a way that the secondary users (SU) are invisible to the primary users (PU). The FCC Spectrum Policy Task force has already set the rules for the operation of CR networks. Standards working groups, e.g. IEEE802.22, have already been formed and are already working on relevant documents or have finalized the standards. This tutorial after presenting a review of the state of the art in cognitive radios, addresses a range of signal processing tools that are available for both spectral sensing and communications. In particular, the limitations of OFDM in cognitive radio settings are emphasized and less traditional multi-carrier techniques are emphasized.

Regency D

“The Analysis of Cognitive Radio Networks,” Jody Neel, Cognitive Radio Technologies LLC

This tutorial presents techniques for analyzing the behavior of cognitive radio networks as most frequently encountered in today’s cognitive radio literature. The subject matter will cover material such as traditional engineering analysis techniques, basic game theoretic concepts, and more esoteric material typically covered in graduate game theory courses, but which are critical to understanding state-of-the-art dynamic spectrum access networks. This tutorial will also illustrate how concepts from game theory are being used to shape the design of dynamic spectrum access networks to yield powerful lowcomplexity cognitive radio algorithms. To provide a more familiar learning environment and an appreciation of how game theory applies to cognitive radio, all concepts in this tutorial will be illustrated with examples frequently encountered in the cognitive radio literature – e.g., power control, dynamic frequency selection, spectrum trading, sensor network formation, routing, and node participation.

Tutorial Abstracts — Afternoon Session, 1:30 p.m.**Regency E**

“Antennas for Agile and Cognitive Radio,” Marshall W. Cross, MegaWave Corporation

Antennas are important components in any radio system. Proposed frequency agile and cognitive radio systems place unique and difficult-to-achieve demands on the bandwidth, radiation patterns, efficiency, physical construction and cost of antennas suitable for the VHF through SHF bands: 30 MHz to 30 GHz. A brief summary of RF channel characteristics (signal, noise and interference) is discussed for this frequency range, followed by examples of contemporary antennas and their performance. Emerging and esoteric antenna techniques and actual designs suitable for supporting agile and cognitive radio systems will be presented. The examples will include antennas suitable for: fixed, vehicular and body worn applications.

Potomac 3, 4

“OFDM Systems,” fred harris, San Deigo State University

Orthogonal Frequency Division Multiplexing (OFDM) has become the modulation method of choice for many fielded and developing wireless communication systems. These systems include including Digital Audio Broadcasting (DAB), Digital Video Broadcasting (DVB), various Local Area Networks (LAN) based communication systems such as 802.11a, 802.11g, 802.11n, the ultra-wide band 802.15, and wire-line systems such as Asynchronous Digital Subscriber Line (ADSL), as well as various Multiple-Input, Multiple-Output (MIMO) systems. OFDM has been selected as the modulation process for these diverse applications because of its high tolerance for induced distortion and for its very efficient use of bandwidth. We will review the structure and performance parameters of standard OFDM

Tuesday, 28 October

Tutorial Abstracts — Afternoon Session, 1:30 p.m. (continued)

signaling schemes including modulation and demodulation, carrier, timing, and sampling clock synchronization, peak to average ratio (PAR) system considerations and control techniques. We will also examine several alternate developing OFDM based structures.

Regency F**“WiMAX Deployment and Applications with Software Defined Radio Technologies,” Robert Forget, *Vecima Networks, Inc.***

WiMAX has the potential to provide broadband connectivity anywhere, anytime, for any WiMAX compliant device. As a new advanced wireless technology, WiMAX implementation in the “real world” has its technical and market challenges. This tutorial will look at how software defined radio technologies can help enable WiMAX transitioning from fixed to mobile for various applications. The tutorial will also explore the complexities of the international market, network ecosystem and various market segments for WiMAX.

Potomac 5, 6**“SCA Based Component and Waveform Development: A Hands on Tutorial,” Carl Dietrich, *Virginia Tech***

This tutorial is for anyone interested in gaining hands-on experience developing waveform applications and components with an SCABased software radio framework, or in bringing such experiences into software defined radio (SDR) or communications education, training, or research. Based on experience with similar workshops, it is anticipated that some participants will be able to develop SCA receiver applications and use them with RF hardware to receive radio signals within the workshop time frame. The session begins with a brief overview of software defined radio including basic concepts, education, research topics, and the Software Communications Architecture (SCA), the basis of the U.S. military’s Joint Tactical Radio System (JTRS). OSSIE, Virginia Tech’s open source implementation of the SCA, is introduced through hands-on laboratory activities developed by the Naval Postgraduate School and Virginia Tech. Lab materials as well as the OSSIE core framework and associated rapid development and application software are provided to participants and are also available for free download.

Regency D**“Policy Based Control of Cognitive Radios: Methods and Tools,” Mieczyslaw M. Kokar, *Northeastern University***

This tutorial will cover both theoretical and practical aspects of policy based control of cognitive radios. First, a motivational example will be given to demonstrate the importance of policies and their role in cognitive radios.

This will be followed by a presentation of some methodological techniques and some technologies that are needed for establishing an ontological approach to policy based control. The notion of ontology will be introduced in theoretical, computational and practical terms. Examples of specific ontologies will be discussed using both a graphical representation and an evolving standard language used for communicating ontologies and annotations as well as for the interpretation of semantic annotations (OWL - Web Ontology Language). An overview of OWL constructs will be provided using Protégé, the most popular and freely available tool for editing ontologies and some graphical plugins. Other publicly available tools will also be demonstrated in the context of a methodology for ontology engineering. Policy based control will be discussed using illustrative examples.

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Tuesday, 28 October

Paper Listing, Tuesday morning

Session 1.1: Cognitive Radio Location Awareness (Chaired by Allison Brown), Regency E

- 1.1-1 **Alper Ucar, Ediz Cetin, Izzet Kale**, *University of Westminster* - "A Reconfigurable SDR Receiver for Multi-Mode GNSS Applications"
- 1.1-2 **Arash Farhang, Neal Patwari**, *University of Utah* - "Cognitive Geolocation: Learning Location by Listening to the Radio"
- 1.1-3 **Alison Brown, Ben Mathews**, *NAVSYS* - "Indoor Navigation using a Software Defined Radio"
- 1.1-4 **Andrew Macdonald**, *General Motors* - "The Implications of .7 GHz to 3 GHz Terrestrial Band Characterization on Vehicular SDR Design"

Session 2.1: RF Technology and Devices (Chaired by Mohammed Ismail), Potomac 3, 4

- 2.1-1 **François Rivet, Yann Deval, Dominique Dallet, Jean-Baptiste Bégueret, Didier Belot**, *IMS* - "A 65NM CMOS RF Front End Dedicated to Software Radio"
- 2.1-2 **S.M. Hasan, S.W. Ellingson**, *Virginia Tech* - "Multiband Multimode Public Safety Radio Using a Multiband RFIC with a RF Multiplexer"
- 2.1-3 **Amneh Akour, Mohammed Ismail, Roberto-Teran Rojas**, *Ohio State University* - "Design of Manufacturable 60GHz CMOS LNAs"
- 2.1-4 **Amneh Akour, Sheung Yan Ng, S. Rodriguez**, *Ohio State University* - "Digital-Self calibration of CMOS Mixers"
- 2.1-5 **Chowdhury Shahriar, Bashirul A. Polash, Chris Anderson**, *Virginia Tech* - "Jitter Analysis of Time Interleaved ADC/DAC Systems"

Session 4.1: SW Design and SCA 1 (Chaired by Fredrich Jondral), Potomac 5, 6

- 4.1-1 **Toby McClean, Mark Hermeling, Francis Bordeleau**, *Zeligsoft* - "Model Driven Testing and the SCA"
- 4.1-2 **Shaw Ping Lee, Mark Hermeling**, *Thales* - "An SCA Waveform Development Process Integrating Waveform Modelling and Component Development with UML"
- 4.1-3 **Fabio Casalino, Dominick Paniscotti**, *Selex* - "Experience report on the use of CORBA as the sole middleware solution in SCA-based SDR environments"
- 4.1-4 **Adem Zumbul**, *Tubitak* - "Applying Design Patterns to SCA Implementations"

Session 5.1: Advanced Challenges 1 (Chaired by Eric Nicollet), Regency C

- 5.1-1 **Rainer Storn**, *Rohde & Schwarz* - "Throughput-Enhancement for CSMA-based Mobile Ad Hoc Networks"
- 5.1-2 **Ajay Kr.Singh, G. Singh and DS Chauhan**, *Jaypee University* - "Software Defined Radio in Wireless Ad-hoc Network"
- 5.1-3 **Ling Gao, Ronan Farrell**, *NUI Maynooth* - "Using SDR to Embed WiMAX Channels Within the Tetra Framework"
- 5.1-4 **Andres Marquez, Wilfrido Moreno, Huseyin Arslan**, *University of South Florida* - "Vertical Handoff in Wireless Overlapping Networks"

Session 6.1: Demos, Regency D

- 6.1-1 **Paul Sutton**, *CTVR* - "A Dynamic Spectrum Access Network Using Cyclostationary Signatures for Network Formation, Network Rendezvous and Link Maintenance"
- 6.1-2 **Mark McHenry, Sal D Itri**, *Shared Spectrum* - "Dynamic Spectrum Access Demo"

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 - SCA code validation, correction, and conversion
 - Eclipse 3.3

See Spectra 2.1 at PrismTech's booth #40

Tuesday, 28 October

Paper Listing, Tuesday afternoon

Session 1.2: Cognitive Radio - Spectrum Awareness (Chaired by Charles Clancy), Regency E

- 1.2-1 **W. Sabrina Lin, K.J. Ray Liu, T. Clancy, University of Maryland** - "Modulation Forensics for Space Time Coding in Wireless Communications"
- 1.2-2 **Frank Brickle, ACPT, Inc.** - "Robust Signal Classification Using the Wavelet Transform for Feature Extraction"
- 1.2-3 **Barathram Ramkumar, Miloje S. Radenkovic, Tamal Bose, Virginia Tech** - "Combined Blind Equalization and Automatic Modulation Classification for Cognitive MIMO"
- 1.2-4 **Keith E. Nolan, CTVR at Trinity College Dublin** - "700MHz Band Spectrum-Usage Measurements From Denver To Washington DC During November 2007 And Their Value In Helping Software-Defined Radio Enter The Mainstream"
- 1.2-5 **Christopher R. Anderson, Charles B. Cameron, USNA** - "Low-Power Spectrum Survey Measurements for Cognitive Radio Applications"

Session 2.2: Platforms 1 (Chaired by John Kleider), Potomac 3, 4

- 2.2-1 **Robert. Normoyle, Paul Mesibov, DRS Signal Solutions** - "The VITA Radio Transport as a Framework for Software Definable Radio Architectures"
- 2.2-2 **Álvaro Palomo Navarro, Rudi Villing, Ronan Farrell, NUI Maynooth** - "Software Defined Radio Architectures Evaluation"
- 2.2-3 **Sabih Guzelgoz, Ahmed Hesham, Omar Zakaria, Huseyin Arslan, University of South Florida** - "An SDR based Wireless Laboratory: Introducing Multi-Dimensional Signal Analysis"
- 2.2-4 **Christophe MOY, Amor Nafka, Pierre LeRoy, Julien Delorme, Jacques Palicot, Dominique Nussbaum, Karim Kalfallah, Hervé Callewaert, Jérôme Martin, Fabien Clermidy, Bertrand Mercier, Renaud Pacalet, Supelec** - "IDROMel: an Open Platform Addressing Advanced SDR Challenges"

Session 4.2: Frameworks and Middleware (Chaired by M.S. Mora), Potomac 5, 6

- 4.2-1 **John Bradley, Karl Wagner, MITRE** - "Automating FPGA-Based System Implementation with Common Interfacing"
- 4.2-2 **Vuk Marojevic, Ismael Gomez, José Salazar, A. Gelonch, Universitat Politècnica de Catalunya** - "Dynamic Mapping of Waveforms within the PHAL Execution Environment"
- 4.2-3 **Karl Wagner, MITRE** - "Bridging Design Stages of an FPGA-based System with a Structured Abstraction Methodology"
- 4.2-4 **Frédéric LeRoy, Gaël Abgrall, Jean-Philippe Delahaye, Jean-Philippe Diguët, Guy Gogniat, Ensieta** - "Comparative study of two Software Defined Radio Environments"

Session 5.2: Advanced Signal Processing 1 (Chaired by Joe Mitola), Regency C

- 5.2-1 **Rodger Hosking, Pentek** - "Digital Down Converter Implementation, FPGAs Offer New Possibilities"
- 5.2-2 **Kiarash Amiri, Chris Dick, Raghu Rao, Joseph R. Cavallaro, Rice University** - "FlexSphere: An FPGA Configurable K-best Sphere Detector for SDM/SDMA Wireless Systems"
- 5.2-3 **Stefan Nagel, Dennis Epple, Friedrich K. Jondral, Univ Karlsruhe** - "Implementing the TETRA physical layer on Lyrtech's SFF SDR Development Platform"
- 5.2-4 **Randall Flint, Behrouz Farhang-Boroujeny, University of Utah** - "Line Enhancer Methods for Carrier Tracking in QAM/PSK Data Signals"

Session 6.2: Demos, Regency D

- 6.2-1 **Phillip Balister, OpenSDR** - "The Beagle Board: A platform for open source software defined radio"
- 6.2-2 **Peter Andreadis, Luca Pascale, CRC** - "Software Defined Wideband Receiver for Real Time Detection Modulation Recognition: from a Component Based Development Perspective"

Please refer to the DVD in provided in your complimentary attendee bag for the full Conference Proceedings.

Wednesday, 29 October

Paper Listing, Wednesday Morning

Session 1.3: Cognitive Radio Sensing and Awareness (Chaired by Klaus Moessner), Regency E

- 1.3-1 **Jorge A. Surís, Adolfo Recio, Peter Athanas, Virginia Tech** - "Rapid Radio: Human-Assisted Signal Classification and Receiver Implementation"
- 1.3-2 **L. Bixio, G. Oliveri, M. Ottonello, M. Raffetto, C. S. Regazzoni, University of Genoa** - "Signal Interception with Multiple Antennas for Cognitive Radio"
- 1.3-3 **D.Thilakawardana, S. Thilakawardana, K.Moessner, University of Surrey** - "Spectrum Occupancy Detection for Cognitive Radios Using Wavelet Transform Analysis"
- 1.3-4 **Hiroyuki Shiba, Munehiro Matsui, Kazunori Akabane, Kazuhiro Uehara, NTT** - "Performance Evaluation of Cooperative Sensing for Cognitive Radio"
- 1.3-5 **Pooyan Amini, Arash Farhang, Daryl Wasden, Ehsan Azarnasab, Peiman Amini, Salam Akoum, Behrouz Farhang-Boroujeny, University of Utah** - "Cognitive Spectrum Assignment"
- 1.3-6 **Mai Ohta, Takeo Fujii, Kanashi Muraoka, Masayuki Ariyoshi, U of Electro-Communication** - "An OFDM based Sensing Information Exchange for Cooperative Sensing in Cognitive Radio"

Session 2.3: Platforms 2 (Chaired by John Glossner), Potomac 3, 4

- 2.3-1 **Clark Pope, Mike Kessler, DRS Signal Solutions** - "Picoceptor, Advanced Architecture for Miniature Software Definable Radio Systems"
- 2.3-2 **M.S. AlJerjawi, Y.S. Xu, Chahe Nerguizian, Christopher Caloz, Ke Wu, R.G. Bosisio, University of Montreal** - "UWB Wave-Radio"
- 2.3-3 **Okhtay Azarmanesh and Sven G. Bilén, Penn State** - "Use of Legacy Components in an SDR Rapid Prototyping Development Environment"
- 2.3-4 **Carlos R. Aguayo Gonzalez, Carl Dietrich, Jeffrey H. Reed, Virginia Tech** - "Distributed SDR Applications for Distance Learning"
- 2.3-5 **Ketan Mandke, Robert C. Daniels, Scott M. Nettles, Robert W. Heath, Jr., University of Texas** - "On the Challenges of Building Multi-antenna Software Defined Packet Radio"

Session 4.3: SW Design & SCA (Chaired by Steve Bernier), Potomac 5, 6

- 4.3-1 **Steve Bernier, Charles Auger; Hugues Latour, CRC** - "The deployment of software components into heterogeneous SCA platforms"
- 4.3-2 **Shahzad Aslam-Mir, Wallace Davis, DataSoft** - "The application of SCA in the design of high data rate (HDR) JTRS radios and waveforms"
- 4.3-3 **Rafael Aguado Munoz, Indra** - "Is SCA Alligned? Business Approach to SDR Development"
- 4.3-4 **Peter Andreadis, Robin Addison, Paolo Mancini, Giovanni Scialanca, LOG.IN** - "SCA Compatible Software Defined Wideband Receiver for Real-Time Energy Detection and Modulation Recognition"

Visit us @ booth #30

Multi-Mode Basestation

Software Defined Radio

Common Platform

What's in a name?
Flexibility defined...

October 30th
Session 2.5-2

XILINX

Wednesday, 29 October

Paper Listing, Wednesday Morning (continued)

Session 5.3: Advanced Signal Processing 2 (Chaired by Chris Dick), Regency C

- 5.3-1 **fred harris, Chris Dick, SDSU** - "On Trading Excess Bandwidth for Reduced Peak to Average Power Ratio in Single Carrier Shaped Dirichlet Kernel OFDM"
- 5.3-2 **John E. Kleider, Tony Smith, Xiaoli Ma, General Dynamics** - "Transmitter and Receiver Performance Improvements for Small Form Factor SDR Hand-Held Radios"
- 5.3-3 **Chiyong Ahn, Hakmin Kim, Jaeho Chung, Seungwon Choi, Hanyang University** - "Implementation of Advanced Two-Dimensional Interpolation-Based Channel Estimation for OFDM Systems"
- 5.3-4 **Barathram Ramkumar, Tamal Bose, Miloje S. Radenkovic, Virginia Tech** - "Recursive Blind Equalization of MIMO Channels"
- 5.3-5 **Ambrose Slone, Wil Myrick, Joe Hecker, SAIC** - "Polyphase Channelization utilizing General-Purpose Computing on a GPU"

Session 6.3: Demos, Regency D

- 6.3-1 **Amor Nafkha, Supelec** - "FPGA Dynamic Partial Reconfiguration for very high Speed - RealTime 4G baseband Modem Based on a Network on Chip Architecture"
- 6.3-2 **Angsuman Rudra, D-TA Systems Inc.** - "Ultimate SDR Platform: Ether to Ethernet"

Paper Listing, Wednesday Afternoon

Session 1.4: Cognitive Radio - Modulation Adaption (Chaired by fred harris), Regency E

- 1.4-1 **Chris Dick, fred harris, Xilinx** - "OFDM Modulation Using Square-Root Nyquist Time Domain Kernels To Obtain Reduced Peak-to-Average Power Ratio"
- 1.4-2 **Terence W. Barrett, fred harris, Dragan Vuletic, Wade Lowdermilk, SDSU** - "Modulation with Spectrally Efficient Prolate Spheroidal Wave Functions Overlaid on a Conventional Polyphase Channelizer"
- 1.4-3 **James Schreuder, Schreuder Engineering** - "QAM Carrier Tracking for Software Defined Radio"
- 1.4-4 **Ying Wang, Alex Young, Qinqin Chen, Sujit Nair, Charles W. Bostian, Virginia Tech** - "OFDM Signal Classification and Synchronization for Cognitive Radio Systems"
- 1.4-5 **Okhtay Azarmanesh and Sven G. Bilén, Penn State** - "A Modulation Classification Technique for Software-Defined Radio Using Inphase-Quadrature Diagrams"

Session 2.4: Smart Antenna (Chaired by Seungwon Choi), Potomac 3, 4

- 2.4-1 **Huijing Qiang, Omar Granados; Jean Andrian; Jun Luo; Matthew Woolley, Florida International University** - "Implementation of a WLAN Waveform Under Cost-Effective Novel Software and Hardware Architecture"
- 2.4-2 **Mijin Baek, Seungheon Hyeon, Seungwon Choi, Hanyang University** - "Development of Waveform Component for SDR System Supporting Mobile WIMAX"
- 2.4-3 **Chang-eui Shin, Yusuk Yun, Seungwon Choi, Hanyang University** - "A Beamforming Algorithm for Collaborative MIMO System with Array Antenna"
- 2.4-4 **Yongjin Jo, Taeyoul Oh, Seungwon Choi, Hanyang University** - "An Adaptive Beamforming Technique for OFDM-Based Smart Antenna System in a Multipath Fading Channel"
- 2.4-5 **June Kim, Seungheon Hyeon, Seungwon Choi, Hanyang University** - "Design and Implementation of high-speed data transfer protocol in CORBA environment"
- 2.4-6 **Changhoon Lee, Jun Kim, Seungheon Hyeon, Seungwon Choi, Hanyang University** - "FPGA Design for Supporting CORBA Component"

Session 4.4: Certification Validation and Tools (Chaired by Doug Jaeger), Potomac 5, 6

- 4.4-1 **Stefan Nagel, Volker Blaschke, Jens Elsne, Friedrich K. Jondral, Dimitrios Symeonidis, Univ Karlsruhe** - "Certification of ESRA-compliant software defined radios"
- 4.4-2 **Jeroen Declerck, Erik Umans, Antoine Dejonghe, Martin Trautmann, Miguel Glasse, Liesbet Van der Perre, IMEC** - "A Software Development and Validation Framework for SDR Platforms"
- 4.4-3 **James Neel, Shareef Sayed, Mathew Carrick, Carl Dietrich, Jeff Reed, Cognitive Radio Technologies LLC** - "PCET: A Tool for Rapidly Estimating Statistics of Waveform Components Implemented on Digital Signal Processors"
- 4.4-4 **Richard Overdorf, Agilent** - "Error budget Analysis of a software defined radio - predicting BER and improving interoperability"

Wednesday, 29 October**Paper Listing, Wednesday Afternoon (Continued)****Session 5.4: Advanced Challenges 2 (Chaired by Mark Buckner), Regency C**

- 5.4-1 **Michael Furman**, *Furman LLC* - "Global Frequency Management Using Cognitive Radio"
- 5.4-2 **Ajay Kr. Singh, Ankita Taneja, Ved. P. Mishra, Ajay Kr. Singh, G. Singh, S.P. Ghrera**, *Jaypee University* - "Security Architecture for SDR System Using OTA Download Sequence"
- 5.4-3 **Mieczyslaw M. Kokar, Leszek Lechowic**, *Northeastern University* - "Verification of Equivalence of Policy-selected Software Components in a Cognitive Radio"
- 5.4-4 **Feng Ge, Alex Young, Terry Brisebois, Qinqin Chen, Charles W. Bostian**, *Virginia Tech* - "Software Defined Radio Execution Latency"

Session 6.4: Demos, Regency D

- 6.4-1 **Newman, Chen, Datla, Vollos, Dietrick, Bose, Reed**, *Virginia Tech* - "VT-Cornet: Cognitive Radio Mesh and Dynamic Spectrum Allocation Demonstration"
- 6.4-2 **Ray Munden**, *Anritsu* - "Summary of Planned UCS Demo"

Thursday, 30 October**Paper Listing, Thursday Morning****Session 1.5: Cognitive Radio - Policy and Language (Chaired by Charles Bostian), Regency E**

- 1.5-1 **Didier Bourse, Wolfgang Koenig, Michael Doubrava, J.M. Temerson, Klaus Nolte, Kari Kalliojarvi, Enrico Buracchin, David Bateman**, *Motorola* - "FP7 E3 Project: Technical, Business, Standardization and Regulatory Perspectives"
- 1.5-2 **Lynn Grande**, *General Dynamics* - "A Policy Strategy for the Software Defined Radio Enabling Cognitive Radio Technology within the Tactical Network"
- 1.5-3 **Shujun Li, Mieczyslaw M. Kokar**, *Northeastern University* - "Ontology-Based Radio for Public Safety Use Cases"
- 1.5-4 **Todor Cooklev, Mark Cummings**, *Purdue* - "Networking Descriptoin Language for Ubiquitous Cognitive Networking"
- 1.5-5 **Mark Cummings, Bruce Fette, Mitch Kokar, Shujun Li**, *envia* - "Activities of SDR Forum MLM Working Group on a Language for Advanced Communication Systems Applications"

Session 2.5: Multimode Base Stations and Terminals 1 (Chaired by Robert Normoyle), Potomac 3, 4

- 2.5-1 **John Chapin**, *Vanu* - "Teledensity Growth in the Developing World through SDR Technology"
- 2.5-2 **Manuel Uhm**, *Xilinx* - "Multi-Mode Basestation Common Platform Software Defined Radio: Whats In A Name"
- 2.5-3 **John Glossner, Mayan Moudgill, Sitij Agarwal, Gary Nacer**, *Sandbridge* - "The sb3500 Processor Implementation"
- 2.5-4 **Mark A. Buckner, Jacob Barhen, Ryan Kerekes**, *Oak Ridge National Labs* - "Multi-Core and Optical Processor Related Applications Research at Oak Ridge National Laboratory"
- 2.5-5 **Benjamin Egg, Chris Dick, Todd Thornton, fred harris, Mike Rugar, Ivan Corretjer**, *Aethercomm, Inc.* - "Multi Giga-hertz Software Defined Ratio Platform for Modular DSP Architectures"

Session 3.5: OMG Standards Track 1 (Chaired by Kevin Richardson), Regency F

- 3.5-1 **Kevin Richardson**, *MITRE* - "OMG Introduction"
- 3.5-2 **Mark Scoville**, *L-3 Comm* - "The SDR Forum and The OMG: Working Together"
- 3.5-3 **Jerry Bickle**, *PrismTech* - "SW Radio Specification Overview"

Session 4.5: Architecture and Design 1 (Chaired by Christophe Moy), Potomac 5, 6

- 4.5-1 **Jorn Janneck, Chris Dick**, *Xilinx* - "Dataflow programming: Building Portable and Efficient Designs in Heterogeneous Programmable Platforms"
- 4.5-2 **Annalies Squires**, *Etherstack* - "Techniques for Commercial SDR Waveform Development"

Thursday, 30 October

Paper Listing, Thursday Morning (continued)

- 4.5-3 **Frank Ditore, David Leiss, Greg Jue, Agilent** - "An RF "aware" Software Defined Radio Design and Verification Methodology"
- 4.5-4 **Yuji Ikeda, Kosuke Yamazaki, Toshiyuki Maeyama, Yoshio Takeuchi, KDDI** - "Proposal for an Efficient Software Optimization Method for Software Defined Radio"

Session 5.5: Open Source Hardware and Software (Chaired by Matt Ettus), Regency C

- 5.5-1 **Carl Dietrich, Dileep Kumaraswamy, Sahana B. Raghunandan., Lillian Le, Jeffrey H. Reed, Virginia Tech** - "OpenSpaceRadio: An Open Source Implementation of STRS 1.01"
- 5.5-2 **Jason Snyder, Stephen H. Edwards, Carl B. Dietrich, Virginia Tech** - "Development of an Open-Source Integrated Development Environment for SCA-based Components and Waveforms"
- 5.5-3 **Thomas W. Rondeau, Matt Ettus, Robert W. McGwier, Trinity College** - "Open Source Transparency for OFDM Synchronization Experimentation"
- 5.5-4 **Michael L. Dickens, Brian P. Dunn, and J. Nicholas Laneman, Notre Dame University** - "Design and Implementation of a Portable Software Radio"
- 5.5-5 **Eric Blossom, Blossom Research** - "gcell - The GNU SPE Scheduler and Asynchronous RPC Mechanism"

Session 6.5: Demos, Regency D

- 6.5-1 **Bram van den Ende, TNOWINTSEC** - "WP8: SDR Demonstrator"
- 6.5-2 **Raul Sierra, Rhode & Schwarz** - "Challenges Testing SDRs"

Paper Listing, Thursday Afternoon

Session 1.6: Cognitive Radio - Resource Management (Chaired by Wolfgang Koenig), Regency E

- 1.6-1 **Soamsiri Chantaraskul, Klaus Moessner, Univ Surrey** - "Opportunistic RADIO for multi-channel usage in WLAN Ad hoc networks"
- 1.6-2 **Ari Ahtiainen, Kees van Berkel, David van Kampen, Orlando Moreira, Antti Piipponen, Tommi Zetterman, Nokia** - "Multi-radio Scheduling and Resource Sharing on a Software Defined Radio Computing Platform"
- 1.6-3 **Qinqin Chen, Charles W. Bostian, Virginia Tech** - "Cognitive Gateway Design to Promote Universal Interoperability"
- 1.6-4 **Tulin Mangir, Mukul Khairatkar, California State Univ** - "Network Access Security Policies for Cognitive radio"
- 1.6-5 **Saleh Faruque, University of North Dakota** - "Energy Efficient Cognitive Radio"

Session 2.6: Multiode Base Stations and Terminals 2 (Chaired by Aditya Kaul), Potomac 3, 4

- 2.6-1 **Steve Jennis, PrismTech** - "What Does the 'Mainstream' Need to Adopt 'True' Software Defined Radio?"
- 2.6-2 **Erik L. Org, Russell J. Cyr, Geoff Dawe, John Kilpatrick, BitWave** - "Programmable RF Transceivers for Femtocells"
- 2.6-3 **Aggelos Saatsakis, Panagiotis Demestichas, Siegfried Walter, Thomas Loewel, Ferenc Noack, Klaus Nolte, Wolfgang Koenig, University of Piraeus** - "Flexible Base Stations and Associated Management Functionality in the B3G World"

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Thursday, 30 October

Paper Listing, Thursday Afternoon (continued)

- 2.6-4 **Khalid Eltahir Mohamed, Borhanuddin Mohd. Ali, S.S. Januar, Sabira Khatun, Alyani Ismail, University Putra Malaysia** - "Design and Implementation of the SDR Digital Control System (SDR-DCS) for the Baseband of a Multi Standard Handset Transceiver"

Session 3.6: OMG Standards Track 2 (Chaired by Mark Scoville), Regency F

- 3.6-1 **Vince Kovarik, Harris** - "Modeling the SDR: A Single Integrated Model for a Communication System"
 3.6-2 **Jim Kulp, Mercury** - "Application of OMG Technologies within DoD Products"
 3.6-3 **Hans-Peter Hoffmann, Telelogic** - "Harmony/SE - Model-Based Systems Engineering Using SysML"
 3.6-4 **Richard C. Reinhart, NASA** - "Case Study: Using the OMG UML Profile for Software Radio on NASA's Space Telecommunications Radio System (STRS)"
 3.6-5 **Jennifer Nappier, Joseph Downey, NASA** - "STRS Compliant FPGA Waveform Development"

Session 4.6: Architecture and Design 2 (Chaired by Thomas Rondeau), Potomac 5, 6

- 4.6-1 **James Rodenkirch, Bill Bolick, Diversified Technology** - "Systems Architecting and Engineering Processes and Methodologies: Essential Enablers for the Acceptance of SDR into the "Mainstream." "
 4.6-2 **Mark A. Buckner, Brian Kaldenbach, Oak Ridge National Lab** - "From Requirements Capture to Silicon: A Model-Driven Systems Engineering Approach to Rapid Design Prototyping and Development Used in the Oak Ridge National Laboratory's Cognitive Radio Program"
 4.6-3 **Min Li, David Novo, Bruno Bougard, Liesbet Van Der Perre, Francky Catthoor, IMEC** - "Algorithm-Architecture Co-Design for Energy Efficient Software Defined Radio Baseband"
 4.6-4 **M.S. Mora, Gerry Corley, Jorg Lotze, Ronan Farrell, CTVR, National University of Ireland** - "Experiences in the Co-Design of Software and Hardware Elements in a SDR Platform"
 4.6-5 **T. Kempf, E. M. Witte, V. Ramakrishnan, G. Ascheid, M. Adrat, M. Antweiler, Aachen Univ** - "A Practical View of SDR Baseband Processing Portability"

Session 5.6: Civil and Government Applications (Chaired by Stephen Nagel), Regency C

- 5.6-1 **Sarvpreet Singh, M. Adrat, S. Couturier, M. Antweiler Martin Phisel, Steve Bernier, Research Establishment for Applied Science (FGAN)** - "SCA-Based Implementation of Stanag 4285 in a Joint Effort Under the NATO RTO/IST Panel"
 5.6-2 **David Murotake, Antonio Martin, SCA Technica, Inc** - "Development Approaches for an International Tactical Radio Cryptographic API"
 5.6-3 **Shyamalie Thilakawardana, Klaus Moessner, University of Surrey** - "Spectrum Management in Public and Government Security (P&GS) Systems; Making use of 'Quiet' times"
 5.6-4 **Ahmed Bakraiba, Chong Jin Hui, Sabira Khatun, UPM** - "Intelligent Traffic Management System Using Software Defined Radio (SDR) Technique"

Session 6.6: Demos, Regency D

- 6.6-1 **ahee, Sundance DSP** - "PARS - Parallel Application from Rapid Simulation for SDR"
 6.6-2 **Jerry Bickle, PrismTech** - "SCA Compliance, Waveform Portability AND High Performance using DSPs for Today's Software Defined Radios"

Workshops

Tuesday, October 28: E3-SDR Forum Join Workshop (Regency C)

Led by Wolfgang Koenig, Alcatel-Lucent

The End-to-End Efficiency (E3) FP7 project sponsored by the European Commission, and the Software Defined Radio Forum (SDR Forum) will host a joint workshop on Monday 27.10.08 in Washington during the SDR Forum Technical Conference. E3 is aiming at integrating cognitive

wireless systems in the Beyond 3G (B3G) world, evolving current and future heterogeneous wireless system infrastructures into an integrated, scalable and efficiently managed B3G cognitive system framework from a technical, regulatory, standardization and business perspective.

Workshops

Tuesday, Oct. 28: Advancing SDR in Mainstream Markets – Opportunities and Challenges (Regency F)

Led by Manuel Uhm, chair of the SDR Forum Markets Committee

SDR has begun to move beyond the innovators and early adopters as defined by Geoffrey Moore in “Crossing the Chasm” into the early majority phase defining the mainstream market. In this phase, adopters select a technology not because it is innovative or visionary but because it has been shown to successfully solve a problem within their specific market. Examples of SDR adoption illustrating the transition to the mainstream are abundant:

- * Thousands of software defined radios have been successfully deployed in defense applications
- * Cellular infrastructure systems are increasingly using programmable processing devices to create “common platform” or “multi-mode” base stations supporting multiple cellular infrastructure standards
- * Cellular handsets are increasingly utilizing System on Chip (SoC) devices that incorporate programmable “DSP Cores” to support the baseband signal/modem processing
- * Satellite “modems” in the commercial and defense markets make pervasive use of programmable processing devices for intermediate frequency and baseband signal processing

While these types of systems are often not marketed as “SDRs”, they utilize SDR technologies to solve market specific problems; cost of development, cost of production, cost of upgrades and maintenance, time to market in supporting new and evolving air interface standards, or problems associated with network interoperability. This workshop will explore the use of SDR and SDR technologies in commercial and defense markets, future trends, and key challenges that need to be addressed in further advancing SDR technologies into the mainstream.

Wednesday, October 29: Setting the Regulatory Framework for Next Generation Radio Technologies (Regency F)

Led by Bernie Eydt, chair of the SDR Forum Regulatory Committee

Software defined and cognitive radio technologies will only succeed in the market place if the regulatory framework allows them to. Unfortunately, as more and more radio technologies supporting multimode operation and dynamic spectrum access enter the market, the advanced capabilities of these technologies challenge the legacy regulatory environment. If regulations remain as is, the result may be a win for incumbents in the advanced wireless market, but could represent a loss for new operators, existing end-users, innovative software developers, and many others. This workshop will explore some of regulatory challenges inherent in software defined and cognitive radio, and propose ways forward for regulating the technology to benefit the industry and, more important, the users the industry serves.

The tentative agenda includes:

- **Opening Keynote:** Ari Virtanen, Executive Vice President, Wireless Solutions, Elektrobit Corporation (EB)
- **Session 3.1**
 - “Introduction,” **Manuel Uhm** of *Xilinx* and Chair of the SDR Forum Markets Committee
 - “What is SDR,” **Lee Pucker**, CEO of the *SDR Forum*
 - “SDR in Commercial Wireless Infrastructure,” **Aditya Kaul**, *ABI Research*
 - “SDR in Defense Applications,” **Garrick Ngai**, *Frost and Sullivan*
 - “Public Safety Software Defined Radio (SDR) Roadmap,” **Mark Jones**, *Noblis*
- **Session 3.2**
 - “SDR in Mobile Handsets: The Road Ahead,” **Kaustubha Parkhi**, *ARCchart*
 - “The Roadmap for Technologies Supporting Commercial SDR,” **Will Strauss**, *Forward Concepts* (30 minutes)
- **Panel Session and Q&A** “Overcoming Barriers to Mainstream Adoption” (30 Minutes)
- **Invited Paper:** “Clean Slate Radio,” **Ronan Farrell**, Director of the Institute of Microelectronics and Wireless Systems National *University of Ireland, Maynooth*
- **Closing Panel Session:** “Standards Collaboration: What is Required to Advance SDR Technologies in Mainstream Markets?”

Each analyst session will include:

- Very brief overview of company and research reports
- Market Size and 3 year projections
- Current state of applicable technology, regulations and business models
- Technical, regulatory and business issues hampering adoption

Session 3.3

“SDR 2.0 Certification and Accreditation: Do existing processes need reform?”

The features and capabilities of software defined radios can be updated in minutes using remote or over the air reprogramming capabilities, and the development time for these changes can often be measured in weeks or even months. Under today’s processes, the time associated with certifying that these changes will not cause harmful interference can often take much longer. Moreover, the cost of such a certification could exceed the value of the change. This issue is compounded when considering cognitive radio technologies that can essentially “reprogram” themselves to adapt to a changing environment.

So given the capabilities of these new technologies, what should an updated certification and accreditation process look like? To answer that question, this session will start

Workshops

with presentations on new risks inherent in next generation radio technology that the accreditation process needs to address as well as risk management processes or technical mechanisms that the accreditation process may need to evaluate. Presentations during this session will be given by:

- * **Dr. William Scott**, *General Dynamics C4S* and Chair of the SDR Forum Security Work group
- * **Dr. Jung-Min "Jerry" Park**, Assistant Professor, Department of Electrical and Computer Engineering, *Virginia Tech*
- * **Dr. Shu Kato**, Professor at Tohoku University and Program Coordinator at *NICT*

These presentations will be followed by an expert panel discussion, moderated by Dr. John Chapin of Vanu, on whether government regulators need to require and assess these mechanisms to protect public interests. Panellists will include:

- * **Eric Blossum**, Founder, *Blossum Research*
- * **Dr. Douglas Sicker**, *University of Colorado*
- * **Mr Michael Whittaker**, Managing Director of *Futurepace RF Solutions*

Session 3.4

"Pointing the finger: How should governments assign liability to promote the success of next generation radio technology"

If a rogue software defined or cognitive radio were to interrupt the TV broadcast of a championship football game, replacing it with a screen filled with snow, then the broadcaster would certainly face a barrage of complaints from viewers, and a potential loss in revenue from advertisers. In most nations today, the manufacturer that sold the device would be responsible for any damages associated with such an occurrence. However, in order for users to benefit from the flexibility inherent in next generation radio technologies, they need to be able to update software on the devices in ways that the manufacturer may not reasonably anticipate at point of sale, much like what occurs in the personal computing industry. In a more open environment, entities in the value chain that might be liable for problems also include:

- * The software developer that implemented the air interface protocols
- * The software developer that wrote the operating system that allowed the rogue radio software to be loaded on the radio device
- * The operator or end-user that downloaded the software onto the device

Clear liability assignment through statute and regulation could facilitate much quicker resolution of any problems that occur and give manufacturers, developers, and operators the assurance they need to make investments in the next generation radio technology space. The problem is who should assume the liability. Finding the right answer

is critical to the growth of the industry. This session will explore this question by examining the various proposed liability regimes. Presentations will be made by subject matter experts in this area including

- * **Dr. Klaus Moessner**, Senior Research Fellow in Mobile Communications in the Centre for Communication Systems Research, *The University of Surrey, UK* and creator of the "SDR Responsibility Chain" concept
- * **Dr. Dale Hatfield**, Adjunct Professor in the Interdisciplinary Telecommunications Program at the *University of Colorado at Boulder*, and former Chief of the Office of Engineering and Technology at the Federal Communications Commission
- * **Mr Michael Whittaker**, Managing Director of *Futurepace RF Solutions* (www.futurepace.com.au) and principal architect of the method of spectrum licensing used in Australia involving space-centric management

The presentations will be followed by an expert panel discussion, moderated by Bernie Eydt, on why these approaches may or may not be successful, focusing in particular on liability issues inherent in TV white space communications. Panellists will include:

- * **Joe Jacob**, Senior Vice President, *Objective Interface*
- * **Steve Muir**, Chief Technology Officer, *Vanu Inc.*
- * **Dr. James Neel**, President, *Cognitive Radio Technologies, LLC*
- * **Ellen Goodman**, *Rutgers University School of Law; Covington & Burling LLP*

Afternoon Panel Discussion

"What Should the Incoming US Administration Do To Promote The Success of Next Generation Radio Technology"

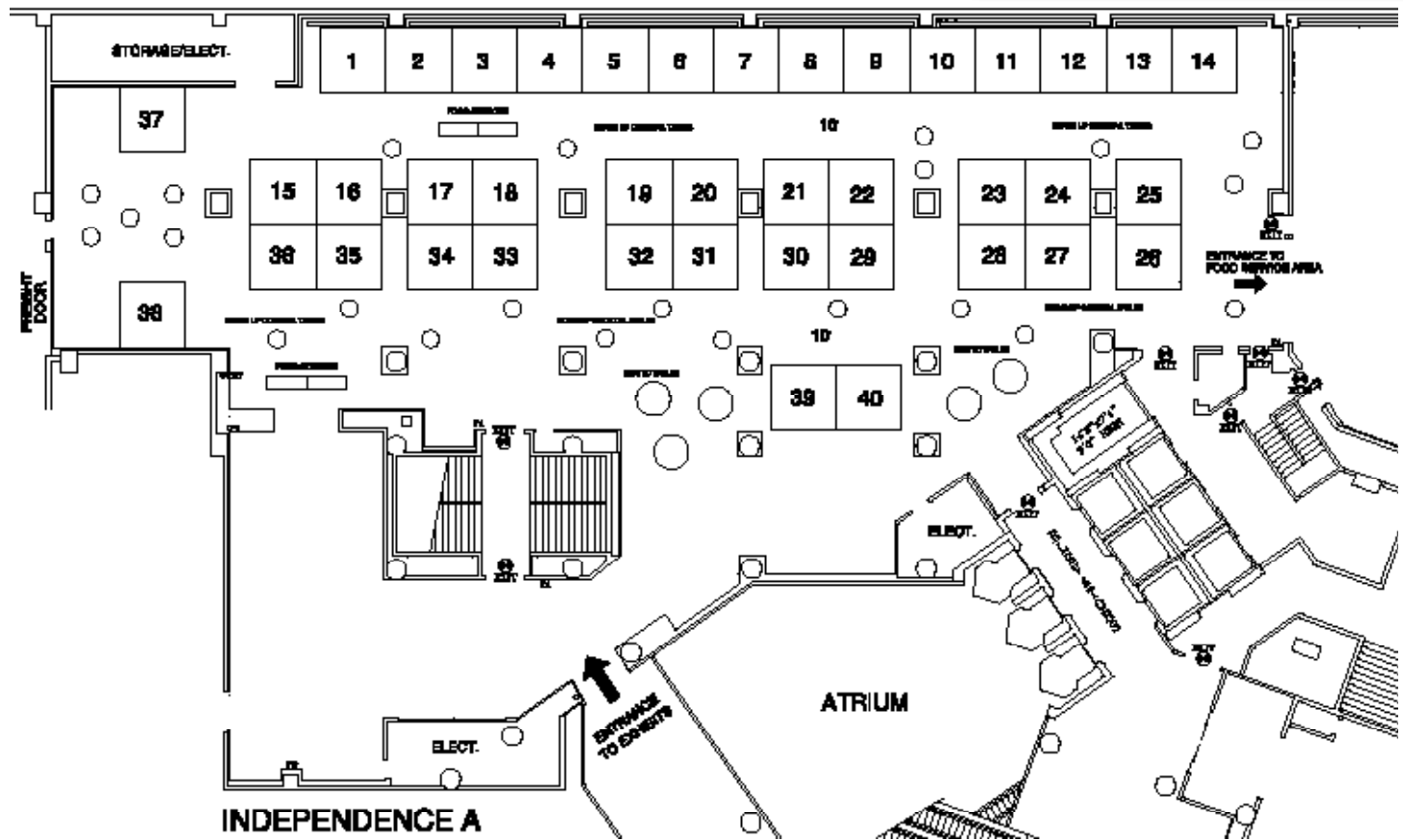
US citizens will elect a new President the week after the SDR Forum Technical Conference. This panel discussion will focus on concrete steps the incoming Administration can take to help various communities of interest (military, public safety, household consumers) maximize the potential benefit of innovation in SDR and cognitive radio. Areas to be addressed include communications regulation, research funding, large system procurements, and positions in international organizations such as the International Telecommunication Union (ITU).

Panellists participating in this discussion will include:

- * **Bruce Oberlies**, Senior Director of Advanced Technology and Strategy, *Motorola*
- * **Jennifer Warren**, Vice President, Technology Policy & Regulation, *Lockheed Martin Corporation*
- * **Bernard Eydt**, Chair, SDR Forum Regulatory Committee, and Associate at *Booz Allen Hamilton*
- * **Peter Tenhula**, Vice President and General Counsel, *Shared Spectrum Company*

This panel will be moderated by Lee Pucker, CEO of the SDR Forum.

Exhibitors

**Agilent - Booth 6**

Agilent Technologies Inc. (NYSE: A) is the world's premier measurement company and a technology leader in communications, electronics, life sciences and chemical analysis. The company's 19,000 employees serve customers in more than 110 countries. Agilent had net revenues of \$5.4 billion in fiscal 2007.

Boeing - Booth 5

Boeing is mobilizing the power of the network to enhance the effectiveness of the Warfighter by delivering revolutionary command, control and communications capabilities to satisfy its customers' enduring needs for interoperability, intelligence superiority, and rapid decision making within the Integrated Battlespace. In partnership with its customers, Boeing offers robust capabilities to develop and deliver NCO solutions that are pivotal to completion of the Global Information Grid (GIG).

CRC Canada - Booths 27, 28

For over 50 years, CRC has been providing technical expertise to both the Government of Canada and Industry in satellite, terrestrial, wireless, and optical communications. CRC is recognized as a world leader in software development for SDR technology. Maker of the JTRS certified SCA reference implementation (SCARI), CRC also offers the most comprehensive integrated development environment for the SCA. CRC has been intimately involved in driving the evolution of the SCA and draws from its long experience to offer consulting services and training. CRC's team is constantly pushing the limits to improve performance, collaborating with best-in-class partners to support the major RTOS, ORBS, processors, boards and systems. Visit our booth to see a demonstration of our latest Core Framework and SCA Development Tools for Eclipse.

D-TA Systems Inc. - Booth 14

D-TA Systems Inc. provide sensor interfacing and processing solutions for demanding applications. Combining the state of the art RF, IF, and 10GbE technologies, D-TA has simplified sensor processing problems in demanding applications such as software radio, radar, communications, SIGINT, sonar, and test & measurement. D-TA high-speed 10GbE network based products provide the best front-end analog performance, highest bandwidth and speed. D-TA products

require very little software development for system integration. This simplifies system integration complexity and greatly reduces system deployment costs.

DataSoft - Booth 4

DataSoft specializes in software and hardware research, design, and engineering of customized components, products, middleware, and protocols for communication systems based on software-defined radio technologies. In addition to being recipient of multiple research grants (SBIR), DataSoft is actively working on projects for the Joint Tactical Radio System (HMS & AMF JTRS, HDR-RF Modem, MUOS) that enable superior wireless communications capabilities. Expertise includes SCA, MANET, tunable RF components, embedded software, SCA-compliant design, networking protocols, advanced network management, test waveform, and modeling & simulation.

Elektrobit - Booth 23

EB (Elektrobit) is a world leader in innovative wireless test equipment and a leading-edge developer of wireless communication solutions, including SDR based systems. EB's PropSim radio channel emulators and channel measurement systems provide unique capabilities for advanced testing of new SDR systems, including MIMO, smart antenna and MANET technologies.

Element CXI - Booth 15

ElementCXI has developed the first novel IC technology in the last 20 years and offers super-computer performance on battery power at consumer price points. Element CXI has created virtual logic ICs, meaning that 85% of the usable logic only exists when needed, thus greatly lowering product cost and power consumption.

Etherstack - Booth 16

Etherstack is a wireless communications software company, and a leading independent waveform specialist. The company has been developing waveforms for radio manufacturers and defence clients internationally for over ten years - since the outset of commercial Software Defined Radio (SDR) - and pioneered many unique techniques and tools key to successful SDR waveform development. Etherstack's engineers combine waveform design best-practice with a

Exhibitors

detailed knowledge of communications standards such as APCO P25, TETRA, DMR, MPT1327, UMTS, WiMAX, LTE and military specifications. They also specialise in multi-protocol IP core networks, which can be used with waveforms for completely flexible wide-area, field-deployable communications.

Ettus - Booth 17

Ettus Research designs and builds the Universal Software Radio Peripheral (USRP) product family, which enables engineers to rapidly create powerful, flexible software radio systems. The company specializes in ASIC-, FPGA- and software-based DSP systems. In addition, Ettus Research provided wireless, DSP and software radio design consulting services.

GateHouse - Booth 1

GateHouse is specialized in technical software and system integration for advanced communications systems. Software Defined Radio: A SCA compliant BGAN waveform for SDR is developed based on extensive BGAN software experience. Satellite Communications: GateHouse is a leading provider of market proven protocol and test software for satellite terminals.

GE Fanuc Intelligent Platforms - Booth 31

GE Fanuc Intelligent Platforms, a unit of General Electric, is a leading global provider of embedded computing systems and boards for a wide range of industries and applications. Our extensive line of products include data acquisition and signal conditioning systems, and fully integrated rugged mission systems available in a range of environmental grades. Our customers include those in the space and aviation, energy, oil and gas, defense, telecommunications and medical imaging industries. GE Fanuc Intelligent Platforms is an industry leader/innovator in the field of Software Defined Radio, providing COTS modules, sub-systems and systems for defense applications such as tactical communications, signal intelligence, rugged base station, secure communications, radar and high-speed signal recording.

General Dynamics C4 Systems - Booth 39

General Dynamics C4 Systems manufactures and markets software-defined communication systems that can be reconfigured to meet user needs without any hardware modifications. Benefits of this cutting edge technology include: Migration/Interoperability; Tactical Deployment; Reduced Ownership Cost; Flexible Infrastructure; and Security. General Dynamics C4 Systems is leading the Joint Tactical Radio System HMS Team to bring miniaturized software defined radio technology into small devices such as unattended ground sensors and soldier systems that can overcome size, weight and power constraints. A JTRS HMS Manpack TD demonstration will be featured in the General Dynamics booth. Also featured, the HOOK2(tm) Combat Search and Rescue System including the AN/PRC-112G (R) CSAR/BFT Transceivers, and the Quickdraw2(R) Handheld GPS Interrogator. For more information, please visit www.gdc4s.com.

Green Hills Software - Booth 29

Green Hills Software, Inc. is the technology leader in device software optimization (DSO) and real-time operating systems (RTOS) for 32- and 64-bit embedded systems. Our Platform for Software Defined Radio delivers a complete, standards-based reference platform for developing and deploying SDR systems ranging from the armed forces Joint Tactical Radio Systems (JTRS) to public safety radios as well as commercial small form-factor reconfigurable radios. The Green Hills Platform for SDR includes multiple SCA OE solutions that are compliant with the latest POSIX and SCA standards. The Platform for SDR also provides integrated, host-based tools for every aspect of development, debugging, optimization, and deployment as well as a variety of integrated hardware platforms. Founded in 1982, Green Hills Software is headquartered in Santa Barbara, CA.

Harris - Booth 32

Harris is an international communications and information technology company serving government and commercial markets in more than 150 countries. Headquartered in Melbourne, Florida, the company has annual revenue of over \$4 billion and 16,000 employees — including nearly 7,000 engineers and scientists. Harris is dedicated to developing best-in-class assured communications™ products, systems, and services.

HYPRES - Booth 24

HYPRES is the leader in developing and delivering All Digital Radio Frequency technology based on Superconductor MicroElectronics (SME). SME delivers performance capable of direct digitization at RF. HYPRES has delivered high performance satellite ground stations incorporating technology capable of

providing significant link margin improvements to support SDR and CR applications. Please visit us at the HYPRES booth.

IMEC - Booth 19

IMEC is a world-leading independent research center in nanoelectronics and nanotechnology. Its research focuses on the next generations of chips and systems, and on the enabling technologies for ambient intelligence and bridges the gap between fundamental research at universities and technology development in industry.

Interconnect Devices - Booth 18

IDI has the most reliable interconnect designs available, resulting in the world's most complete offering of spring contact probes, contacts and connectors - both off-the-shelf and custom made. IDI connectors are found in a variety of industries including medical, avionics, military, automotive, telecommunications and consumer electronics.

LynuxWorks - Booth 36

LynuxWorks is a world leader in the embedded software market, providing operating systems, software development products and consulting. Our products include the open-source BlueCat Linux, the scalable, POSIX conformant & Linux-compatible LynxOS RTOS and LynxOS-178 RTOS certified by the FAA to DO-178B level A, as well as Common Criteria security solutions.

The MathWorks - Booth 21

The MathWorks produces software for technical computing and Model-Based Design for engineers, scientists, mathematicians, and researchers. Our two core products are MATLAB®, used for performing mathematical calculations, analyzing and visualizing data, and writing new software programs; and Simulink®, used for modeling and simulating complex multi-domain systems. MATLAB and Simulink are widely used for modeling and developing Software Defined Radio and Cognitive Radio systems. We also produce more than 90 automatic tools for specialized tasks such as signal and image processing and automatic C and HDL code generation and verification.

Objective Interface - Booth 22

Objective Interface provides real-time connectivity software development tools to meet the high-performance needs for worldwide telecommunications, data communications, industrial automation, consumer electronics, military, and aerospace markets. Objective Interface offers advanced communications infrastructures with ORBexpress®RT, ORBexpress DSP, ORBexpress FPGA and PCsexpress™. ORBexpress, the middleware foundation for the industry's first certified JTRS software-defined radio, is used successfully in virtually every major SDR program worldwide. PCsexpress is the industry's first high-assurance secure communications middleware for software-defined radio.

Pentek - Booth 26

Pentek offers powerful VME, VXS, PMC, XMC, PCI and cPCI commercial and rugged board and system solutions. Pentek's data acquisition, software radio and digital signal processing products utilize TI's C6000 DSPs, Motorola's G4 PowerPC and Xilinx FPGAs. Pentek's I/O includes A/D's, D/A's, Digital Receivers and more. Pentek equips products with high-speed interfaces including Serial RapidIO and Fibre Channel and offers strong FPGA, I/O and DSP software support.

Pico Computing - Booth 7

Pico Computing designs and manufactures small form factor FPGA boards. This line of Deployable Development Platforms are based on the Xilinx Virtex-4 and Virtex-5 FPGAs in CompactFlash, CardBus, and ExpressCard form factors. Some boards come equipped with DDR2 RAM, 2 12bit A/D, 2 14bit D/A, and Video In. Develop and Deploy all on the same platform.

PrismTech - Booth 40

PrismTech is a leading provider of middleware and productivity tools for software defined radio. PrismTech's Spectra 2 is a complete package of new products, services, & partner programs for SDR OEMs, system integrators & independent software vendors. Built upon the success of PrismTech's original Spectra products, Spectra 2 addresses the expanding SDR market by providing the industry with the most comprehensive customer service-focused product line available. With the introduction of Spectra 2, PrismTech provides a 'total customer service' package that includes robust waveform & platform developer tools, high performance & low profile operating environments, full compliance support for SDR standards, expert professional services for all phases of SDR

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development & deployment, & dynamic OEM, SI, & ISV partner programs. Spectra 2 solutions support the SCA 2.2 & 2.2.2, as well as the OMG's Software Radio Specification.

Radio Technology Systems - Booth 9

We design, build and integrate radio hardware and software applications for the research, university and experimental wireless community. Our products are wideband, phase and frequency synchronous and are multiple input and output capable. We do the hard part of software radio.

Red Rapids - Booth 35

Red Rapids offers a catalog of signal acquisition and generation products including digital transceivers, RF converters, FPGA based ADC/DAC, signal recorders, and software defined radio components. The products are designed to maximize data bandwidth across I/O channels common to embedded systems (VME/PCI/PMC), servers (PCI), desktop computers (PCI), and notebooks (PCMCIA)

SELEX Communications - Booth 34

SELEX Communications, a Finmeccanica Company, is a global supplier of advanced communications, navigation and identification solutions to protect communities and critical national infrastructure. A leader in the delivery of network centric communications, SELEX Communications supplies secure, integrated and interoperable networked solutions for governmental, civil and military applications.

Shared Spectrum Company - Booth 3

SSC is the leading developer of dynamic spectrum access and spectrum measurement technologies based in Vienna, VA. The company has developed innovative cognitive radio technologies for challenging wireless applications in a broad range of the frequency bands. SSC has devised and implemented pioneering solutions for many radio frequency receiver and dynamic spectrum sharing problems.

Softronic, Ltd. - Booth 8

Softronic Ltd. is a veteran-owned small business engaged in the design and manufacture of state-of-the-art electronic equipment and systems for both commercial and government markets, specializing in radio systems for any application. Our portfolio of products and services includes: design and manufacture of high frequency radio (up to 18 GHz) and digital products; design of software for Microchip PIC processors to Microsoft operating systems and Linux; design of DSP software for a variety of host systems and rapid prototyping for fast, one-of-a-kind or first-time sample products.

Our staff has nearly 500 years of combined experience in the design, manufacture, and support of sophisticated electronic products and systems in both ISO-9000 and MIL SPEC environments. Our well-equipped laboratory and shop allow us to do the majority of our design work in-house.

Spectrum Signal Processing - Booth 25

Spectrum Signal Processing is a leading supplier of software defined platforms for defense electronics applications. Spectrum's products and services are optimized for military communications, signals intelligence, surveillance, electronic warfare, and satellite communications applications. Spectrum's integrated, application-ready products provide its customers with compelling time-to-market and performance advantages while mitigating program risk and cost parameters. Spectrum also provides applications engineering services and modified commercial-off-the-shelf platforms to the US Government, its allies and its prime contractors. For more information on Spectrum and its flexComm product line, please visit www.spectrumsignal.com. Spectrum is part of Vecima Networks Inc. www.vecima.com.

Sundance DSP - Booth 37

Sundance DSP designs multi-DSP/FPGA, data acquisition, and I/O modules. Scalability and performance are the main features of Sundance solutions. PCI, cPCI, VME, XMC and PMC platforms are supported. PARS design automation tool was used for developing our latest SDR military application for the US Navy, the DSP8080-AIMM (Altitude Interference Mitigation Module). A demo of PARS capabilities will be displayed at the show.

Synplicity - Booth 20

Synplicity®, Inc. (Nasdaq: SYNP) is a leading supplier of innovative IC design and verification solutions that serve a wide range of communications, military/aerospace, semiconductor, consumer, computer, and other electronic

applications markets. Synplicity's FPGA implementation tools provide outstanding performance, cost and time-to-market benefits by simplifying, improving and automating logic synthesis, physical synthesis, analysis and debug for program-mable logic designs. Synplicity's ESL synthesis solutions significantly improve productivity for DSP designs realized in ASIC and FPGA devices. The ConfirmaT at-speed verification platform, comprising software tools and the HAPST family of prototyping systems, enables both comprehensive verification of ASIC, ASSP and SoC designs and software development prior to chip tapeout. Synplicity is the number one supplier of FPGA synthesis tools and its physical synthesis and ASIC verification technologies are the recipients of several prestigious industry awards. The company operates in over 20 facilities worldwide and is headquartered in Sunnyvale, California.

Xenotran - Booth 10

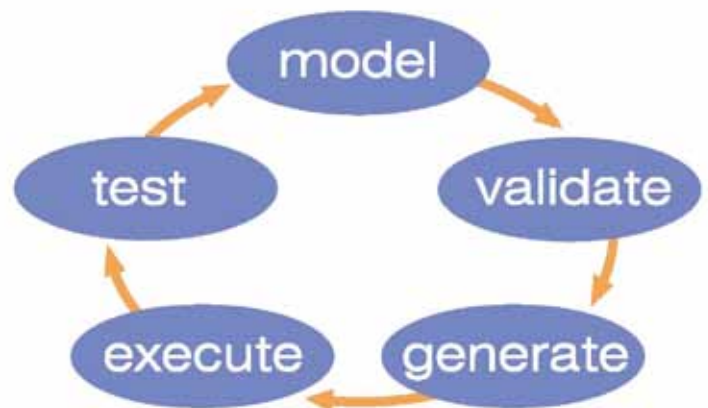
Xenotran provides SCA compliant software defined radio development, waveform test and verification, validation and integration services. Currently, Xenotran is developing, integrating and testing the MIL-STD-188-181C, -182B, -183B and -186 waveforms used in the common Interactive Broadcast - Joint Tactical Terminal (CIB-IW) community and offers a suite of development and simulation tools and engineering support services.

Xilinx - Booth 30

Xilinx is the worldwide leader in complete programmable logic solutions.

Zeligsoft - Booth 33

Founded in 2002 Zeligsoft is a respected, pioneering leader in component-oriented software engineering. We provide world-class, adaptive, and non-prescriptive, technology solutions that support a Component-Oriented development of embedded software systems. We have a proven track record for enabling development teams to achieve immediate and impressive productivity gains in application development.



ABOUT THE SDR FORUM

The SDR Forum is an international industry association dedicated to supporting the development and deployment of software defined and cognitive radios systems. Our global membership is comprised of decision makers, planners, policymakers, technical leaders, suppliers, manufacturers and educators.

Become a member and gain insight to emerging technologies. Access key technical documents, industry reports and market surveys. Network. Collaborate. Participate in committees, workgroups and workshops to define market requirements, establish the regulatory landscape, and develop specifications for SDR technologies.

Want to know more, get involved? To participate in the Forum's advocacy, opportunity development, commercialization and education activities in the defense, public safety, space, and commercial communications markets, contact the Forum's CEO at Lee.Pucker@SDRForum.org.

Want to become a member? Visit the SDR Forum's web site:

www.sdrforum.org

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