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## James (Jody) Neel, Ph.D.

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### VITAE

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#### Section I: Interests and Education

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**Professional Interests:** Research, development, education, and implementation of adaptive communications algorithms and cognitive radio

<u>Cognitive Radio</u>	<u>System Implementation</u>	<u>Networks</u>
Architecture	ADC architectures	Wireless standards
Big Data	DSP architectures	Radio resource management
Cognitive network design	Multirate signal processing	Ad-hoc networking
Game theoretic analysis	OFDM / MIMO	MANET routing protocols
Heuristic optimization algorithms (e.g., genetic algorithms)	Synchronization	Adaptive algorithms
Machine learning (neural nets, HMMs, POMDP, IRL)	Middleware	Topology formation
Pattern recognition (e.g., data mining, hidden markov models)	SCA	
Policy design	Software radio	
Signal detection & classification		
Spectrum Access Systems		

#### EDUCATION

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- PhD Virginia Tech 2006** Dissertation: *Analysis and Design of Cognitive Radio and Distributed Radio Resource Management Algorithms*  
Advisor: Dr. Jeffrey H. Reed  
Online: <http://scholar.lib.vt.edu/theses/available/etd-12082006-141855/>
- MSEE Virginia Tech 2002** Thesis: *Implementation and Evaluation of the Layered Radio Architecture*  
Advisor: Dr. Jeffrey H. Reed  
Online: <http://scholar.lib.vt.edu/theses/available/etd-01092003-162405/>
- BSEE Virginia Tech 1999**
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#### Section II: Professional Experience Overview

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**Feb 2007-Present**      **President, Cognitive Radio Technologies, LLC**

Leveraging expertise in artificial intelligence and wireless networks, CRT researches and develops technology solutions to challenging wireless networking problems. From its inception, Dr. Neel guided CRT's technical and business development activities and has built CRT to a company with \$1M in annual revenues. For these efforts, Dr. Neel was named one of the top 50 tech entrepreneurs in Virginia by CIT.

Under government and commercial contracts, CRT has delivered an array of cutting edge capabilities including:

- A prototype cognitive HF radio system that significantly improves link reliability and performance by synthesizing awareness of current and future channel conditions from observations, internal machine learning models, and online databases.
- A distributed, small-footprint software upgrade that increases the capacity of WNW by 8x by improving its spectrum management routines by dynamically learning optimal parameterizations based on metrics from the SiS (PHY), MDL (link), and MI (network) layers. Software upgrade also implements policy-controlled

Dynamic Spectrum Access (DSA) to simplify network management and dramatically improve spectrum access. Prototyped and tested on JTRS radios.

- A handheld device that integrates a smart-phone with a small-form factor spectrum analyzer for discrete mapping of spectrum usage in a geographic area. Networking tools provide spectrum situational awareness to subscribed users and machine learning algorithms automatically analyze for deviations from expected patterns to detect anomalous transmissions.
- Software based on machine learning and game theory that enables a SATCOM system to recognize RF attacks, characterize the capabilities of the attacker, and solve for optimal counter-measures.
- Proof-of-concept software that leverages inverse-reinforcement learning techniques to enable a wireless device to infer the presence of hostile or friendly devices and to estimate those devices' objective functions from spectrum measurements.
- Multi-agent software for distributed cross-layer optimization of spectrum sharing wireless MANETs; built from new fundamental research into game theory and optimization theory.

### **2013-Present                      Neel Consulting**

Neel Consulting provides Dr. Neel's customers a means to leverage his wireless expertise beyond the R&D and prototyping efforts of CRT. In this capacity, Dr. Neel has provided assessed and contributed to patent portfolios, expert patent consulting, guidance on regulatory actions and filing preparation, and technology training services. Customers include Alston & Bird, VRINGO, and Federated Wireless.

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## **Section III: CRT Projects**

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### **SBIR N101-099 Distributed Subcarrier Allocation Techniques for WNW**

Customer: SPAWAR / JPEO

TPOC: Phase I: Scott Busecemi, [scott.buscemi@navy.mil](mailto:scott.buscemi@navy.mil). Phase II: Joe Oleksa, [joseph.oleksa@navy.mil](mailto:joseph.oleksa@navy.mil)

Duration: Sep 17, 2010 – Present

Activities: Phase I developed techniques for distributed adaptation of OFDM subcarriers to exploit discontinuous spectrum and mitigate narrow-band interferers. Phase II integrated several cognitive spectrum management algorithms into a software package for WNW.

### **Game Theory Enabled Radio Spectrum Management and Waveform Adaptation for Advanced Wideband Satellite Communications**

Customer: AFRL

TPOC: Khan Pham, [khanh.pham.1@us.af.mil](mailto:khanh.pham.1@us.af.mil)

Duration: August 21– May 21 2014

Activities: Develop techniques for managing wideband SATCOM spectrum in the presence of adversarial interference

### **Integration of DSA with GPS**

Customer: AFRL

TPOC: Michael Huffman, [Michael.Huffman@wpafb.af.mil](mailto:Michael.Huffman@wpafb.af.mil)

Duration: June 1, 2012– March 1, 2013

Activities: Research and develop techniques for creating synergies from the integration of Dynamic Spectrum Access techniques with positioning systems

### **Inferring the intent of Cognitive Radios from Sampled Behavior**

Customer: Air Force Research Lab

TPOC: Vasu Chakravarthy, [Vasu.Chakravarthy@wpafb.af.mil](mailto:Vasu.Chakravarthy@wpafb.af.mil)

Duration: May 2010 – Present

Activities: Develop techniques for estimating the goals guiding cognitive radios in networks from samples of their behavior.

### **Cognitive Radio for Positive Train Control**

Customer: Federal Rail Commission (sub to VT)

TPOC: Ashwin Amana, [aamanna@vt.edu](mailto:aamanna@vt.edu)

Duration: October 2009-September 2011

Activities: Recommend algorithms and implementation techniques for adaptive modulation control, interference detection and classification, rapid assessment of spectrum occupancy, data sharing between cognitive radios

### **SBIR N08-099: Spectrum Planning and Management Capability for Radio Communications**

Customer: SPAWAR / JPEO

TPOC: Doug Hulbert [doug.hulbert@navy.mil](mailto:doug.hulbert@navy.mil)

Duration: July 9 2008 – March 2012.

Activities: Develop distributed low-overhead embedded algorithms for automating spectrum management Phase I studied this problem in the context of 802.11. Phase II applied these techniques to WNW to improve interference resiliency and throughput.

### **Cognitive SDR**

Customer: Global Electronics

TPOC: Bob Wiebe, [bwiebe@geltd.net](mailto:bwiebe@geltd.net)

Duration: October 2009 – Oct 2012

Activities: Design a rapidly deployable, iPhone based system for communicating with and managing the disaster response of assisting first responders in infrastructure-uncertain environments.

### **SBIR AF-083-160: Cognitive Radio Technology**

Customer: Air Force Research Lab

TPOC: Cliff Bullmaster, [Clifton.Bullmaster@WPAFB.AF.MIL](mailto:Clifton.Bullmaster@WPAFB.AF.MIL)

Duration: Jan 9 2009 – April 2010

Activities: Develop MAC for compartmentalized cross-layer cognitive network algorithms with support for discontinuous DSA, demonstrate proof-of concept in simulation

### **Development of a SDR, CR, and Software Controlled Antenna System**

Customer: Diversified Technology, Inc.

TPOC: Steve Craven, [scraven@dtims.com](mailto:scraven@dtims.com)

Duration: Oct 6 2008 – June 2010 (Phase I, II)

Activities: Support prototyping efforts. Develop cognitive HF waveform.

### **Trade Study of Implementation of SDR: Fundamental Limitations and Future Prospects**

Customer: DARPA (sub through VT, Charles Bostian, PI)

TPOC: Preston Marshall; [Preston.Marshall@darpa.mil](mailto:Preston.Marshall@darpa.mil)

Duration: March 11 2008 – Aug 31 2008

Activities: Characterize fundamental limits of ADCs and DSPs and project future performance trends

### **Software for Estimating Cycle and Power Consumption of Waveforms**

Customer: CERDEC (sub through VT, Carl Dietrich, PI)

TPOC: Tim Leising; [Timothy.leising@us.army.mil](mailto:Timothy.leising@us.army.mil)

Duration: August 2007 – July 2008

Activities: Develop software for estimating the computational resources and power consumption of waveform components across disparate DSP architectures.

### **Software Radio Technologies Applicable to Naval Communications**

Customer: Naval Research Lab / Office of Naval Research

TPOC: Ray Cole, NRL, [Ray.Cole@nrl.navy.mil](mailto:Ray.Cole@nrl.navy.mil)

Duration: April 1 – August 1 2007

Activities: Assess and identify JTRS technologies which would be beneficial to Naval operations. Participate in MILES program reviews

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## **Section IV: Consulting Work**

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### **Neel Consulting**

**Federated Wireless**, Jan 2014- Present

Prepared FCC Filings for 3550 MHz proceedings (12-354), model city, and above 24 GHz. Business development assistance related to US federal spectrum sharing and collaboration with DoD. White paper and proposal preparation. Patent drafting on concepts proposed related to enabling spectrum access systems. Lead development of technical recommendations for industry standards for test and certification of spectrum access systems.

**VRINGO**, Aug 2013-June 2014

Review and advise on technical viability and patentability of cognitive radio-related patents and applications to wireless standards.

### **Reed Consulting**

*Syracuse Research Corporation (2007)*

Review of wireless standards with a focus on WiMAX with recommendations for Syracuse Research Corporation.

*Assessment of Emerging Wireless Communications Standards (2006)*

Surveyed existing and emerging wireless standards – cellular (GSM, IS-95, WCDMA, CDMA2000, 1xEVDO, UMB, LTE, TD-SCDMA, TD-SOFDMA), WPAN (Zigbee, Wibree, Bluetooth, Wireless USB, WiMedia, Z-Wave), WLAN (802.11), WMAN (WiMAX, WiBRO), WAN (802.20, 802.22), and satellite- to assess technologies and trends. Later developed into presentation on applications to electronic warfare presented at CESAS EW Conference Dec. 4, 2006.

*Processing Hardware Evaluation for SDR (2005)*

Developed methodology for estimating processing resources and power consumption for DSPs and FPGA implementing varying wireless standards. Estimated resource consumption for 802.11a and GSM waveforms on Virtex II, Virtex IV, Stratix II FPGA families and 11 families of DSPs (C54, C55, C62, C64, C67, TS203, CEVA, ARM, Blackfin, MSC, ZSP).

*Assessment of Emerging Wireless Communications Standards(2005)*

Surveyed existing and emerging wireless standards - cellular, WPAN, WLAN, WMAN, WAN, and satellite - to assess technologies and trends. Later developed into presentation on applications of commercial wireless standards to military waveforms at IDGA SDR Summit Feb. 21, 2006.

*Middleware Options for Signal Processing and Rapid Prototyping (2003-2004)*

Examine commercially available middleware solutions and alternatives to support advanced signal processing environments. Evaluate needs of current signal processing solution, survey existing mature COTS solutions, match best COTS solutions to needs of current system

*A Review of "Data Recovery in Differentially Encoded Quadrature Phase Shift Keying" (2003)*

Verified BER performance patent claims of a novel demodulation scheme through analysis and simulation.

### **Unincorporated Consulting**

**Alston & Bird** April 1, 2007 – July 28, 2008

Review and provide expert reports on patents related to PHY and MAC algorithms, speech encoding for GSM, WCDMA, cdma200

**SDR Forum, 2004-2007**

*A Review of the Proceedings of the 2002-2007 SDR Forum Technical Conference*

Annually reviewed the papers from the SDR Forum Technical Conference to identify papers that may provide significant guidance to the SDR Forum, to standards bodies, to the defense community and/or to the commercial sector.

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## **Section V: Activities of Virginia Tech**

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## **Research Activities at Virginia Tech**

### **Assessment of Emerging Wireless Technologies 2006-March 2007 (NRO)**

Proposed metrics for evaluating suitability of commercial wireless standards for various data-centric applications including range, latency, throughput, and coverage. Evaluated wireless standards (e.g., 802.11, 802.15, WiMedia, 802.16, GSM, GPRS, EDGE, WCDMA, IS-95, cdma2000, EVDO, EVDO Rev A) according to metrics. Projected suitability of emerging wireless technologies (e.g., UMB, LTE, EDGE Evolution, 802.11n, 802.11p, 802.11y) three and five years into future. Proposed architecture for integrating disparate wireless services and provide real-time adaptation of network in response to changing user demands and priorities.

### **Application of Game Theory to Wireless Networks 2002-2006 (ONR)**

Managed the research of four PhD students and one MS student into the application of game theory to wireless networks. Research focused on creating techniques for establishing steady-states, convergence criteria, and stability for distributed radio resource management algorithms operating at the physical, link, network, and transport layers. Authored the two proposals funding this work. Research publicly available at [www.mprg.org/gametheory/](http://www.mprg.org/gametheory/)

### **Object-Oriented WLAN Simulator 2001-2002 (Boeing)**

Developed integrated OPNET/Matlab simulation for simulating performance of antenna array algorithms (MIMO, beamforming) in a WLAN and studying cross-layer design techniques.

### **IS-95 Link Simulation 2001**

Coded a simulation of a IS-95 physical layer link in Matlab/C (mex).

### **Virginia Tech Space Time Advanced Radio (VT-STAR) 2001**

VT-STAR is a 2x2 MIMO testbed developed on TI's 6701 EVM boards. Created Matlab performance visualization tool. Optimized radio's DSP code (C/assembly).

### **Chariot 1999-2000**

Chariot was Virginia Tech's primary contribution to GloMo - a multi-university, multi-corporation DARPA funded software radio research program. Responsible for developing simulation/programming interface (Matlab/C++/VHDL) for Stallion - a custom computing machine designed at Virginia Tech and the core processor of Chariot. Also mapped communications algorithms to Stallion processor and contributed to the design of the Chariot controller. Project website: <http://mprg.org/research/glomo/index.shtml>

## **Teaching Activities at Virginia Tech**

### **Software Radio, Fall 2006**

Co-taught class with three post-doctoral researchers at Virginia Tech. Class follows **Software Radios: A Modern Approach to Radio Engineering**. Instruction responsibilities included processing hardware tradeoffs, multirate processing, data conversion, and cognitive radio.

### **DSP Implementation of Communications Systems, Spring Semesters 2001, 2002, 2003**

DSP Implementation of Communications System has both lab and lecture aspects, covers basic communications algorithms (filtering, signal generation, synchronization, demodulation, equalization), processor architectures, and optimization techniques, and implements these concepts in C and assembly on a TMS320C6701 EVM development board using the Code Composer Studio development environment. Responsibilities included transitioning class material to C67 from C30, developing new labs and lectures on fixed point implementations, code optimization, and rake receivers.

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## **Section V: Publications**

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### **Journal and Magazine Publications**

J. Neel, P. Cook N. Mellen, I. Akbar, D. Devasirvatham, C. Sheehe, R. Schutz, "The Role of Context in Cognitive Systems," *Journal of Signal Processing Systems*, April 2014.

D. Devasirvatham, **J. Neel**, C. Tompsett, K. Link, "3 Layers of Disaster Recovery," *Radio Resource Magazine*, March 2013.

A. Ge, A. Hussien, E. Imana, J. Neel, C. Bostian, A. Eltawil, S. Hasan, "Software Defined Radio After Twenty Years: Current Status, Challenges, and Future Directions," Submitted to IEEE Proceedings, 2011.

J. Neel, "Practical Considerations for Cognitive Radio Networking," To appear Journal of Analog Integrated Circuits and Signal Processing Special Issue on extended papers from the Best of the Wireless Innovation Forum's Software Defined Radio Conference 2010 (SDR'10)

A. He, K. Bae, T. Newman, J. Gaeddert, K. Kim, R. Menon, L. Morales, J. Neel, Y. Zhao, J. Reed, W. Tranter;"A Survey of Artificial Intelligence for Cognitive Radios;" IEEE Transactions on Vehicular Technology Special Issue on Cognitive Radio, February 2010.

Y. Zhao, S. Mao, J. Neel, and J. Reed, "Performance Evaluation of Cognitive Radios: Metrics, Utility Functions and Methodologies," Proceedings of the IEEE vol 97, Issue 4, April 2009.

J. Neel, P. Robert, J. Reed, D. Jackson, "A formal methodology for estimating the feasible Processor solution space for a software radio", *Journal of Intelligence Community Research and Development*.

V. Srivastava, J. Neel, A. MacKenzie, J. Hicks, L.A. DaSilva, J.H. Reed and R. Gilles, "Using Game Theory to Analyze Wireless Ad Hoc Networks," *IEEE Communications Surveys and Tutorials* 4<sup>th</sup> quarter 2005, vol. 7, no 4, pp. 46-54.

### **Conference Papers**

J. Neel, S. Baban, N. Mellen, I. Akbar, C. Sheehe, R. Schutz, P. Cook, "Big RF for Homeland Security Applications," *Technologies for Homeland Security 2015*, April 14-16, 2015.

J. Neel, S. Baban, N. Mellen, I. Akbar, C. Sheehe, P. Cook, "Big RF for Spectrum Sharing Applications," *WinnComm 2015*, San Diego, March , 2015.

J. Neel, S. Baban, P. Cook, N. Mellen, I. Akbar, D. Devasirvatham, C. Sheehe, B. Schutz, "An Introduction to Big RF," *SDR-WinComm 14*, March 11-13, 2014.

J. Neel, P. Cook, I. Akbar, D. Devasirvatham, C. Sheehe, N. Mellen, and R. Schutz, "Context Aware Cognitive Radio," *SDR Wincomm-Europe 2013*, June 2013.

J. Neel, "Game Theory, Learning, and Cognitive Radio in Adversarial and Networked Settings," 2012 International Waveform Diversity & Design Conference, January 2012.

J. Neel, "Issues in Fielding Large Scale Cognitive Radio Networks in Hostile Environments," International Software Radio Conference, June 7-8, 2010.

J. Neel, S. Sayed, M. Carrick, C. Dietrich, J. Reed, "PCET: A Tool for Rapidly Estimating Statistics of Waveform Components Implemented on Digital signal Processors," SDR Forum Technical Conference, October 27-30, 2008. [Best Paper Award] J. Neel, "Synthetic Symmetry in Cognitive Radio Networks," *SDR Forum Technical Conference*, November 5-9, 2007.

S. Won, H. Park, J. Neel, "Inter Cell Interference Co-ordination/Avoidance for Frequency Reuse by Resource Scheduling in OFDM based Cellular System," *VTC Fall 2007*, September 30- October 3, 2007.

J. Neel, R. Menon, A. MacKenzie, J. Reed, R. Gilles, "Interference Reducing Networks," *CrownCom07*, August 1-3, 2007.

J. Neel, C. Aguayo, J. Reed, "Automated Waveform Partitioning and Optimization for SCA Waveforms," *SDR Forum 2006*, Orlando FL, November 13-17, 2006.

J. Neel, J. Reed, "Performance of Distributed Dynamic Frequency Selection Schemes for Interference Reducing Networks," *Milcom 2006*, Washington DC, October 23-25, 2006.

J. Neel, P. Robert, J. Reed, "A formal methodology for estimating the feasible Processor solution space for a software radio", *SDR Forum Technical Conference 2005*, Orange County, CA, Nov. 14-18, 2005, #1.2-03.

J. Neel, R. Menon, A. MacKenzie, J. Reed, "Using Game Theory to Aid the Design of Physical Layer Cognitive Radio Algorithms," *Conference on Economics, Technology and Policy of Unlicensed Spectrum*, May 16-17 2005, Lansing, Michigan.

J. Hicks, A. MacKenzie, J. Neel, J. Reed, "A Game Theory Perspective on Interference Avoidance," *Globecom 2004*, Nov. 29 – Dec. 3, 2004, vol. 1, pp. 257-261.

[Best Paper Award] J. Neel, J. Reed, R. Gilles, "Game Models for Cognitive Radio Analysis," *SDR Forum 2004 Technical Conference*, Nov. 2004, paper # 01.5-05.

J. Neel, S. Srikanteswara, J. Reed, P. Athanas, "A Comparative Study of the Suitability of a Custom Computing Machine and a VLIW DSP for Use in 3G Applications," *IEEE Workshop on Signal Processing Systems SiPS2004*, Oct 13-15, 2004, pp. 188-193.

J. Neel, J. Reed, and R. Gilles, "Convergence of Cognitive Radio Networks," *Wireless Communications and Networking Conference 2004*, March 21-25, 2004, vol. 4, pp. 2250-2255.

J. Neel, P. Robert, A. Hebbbar, R. Chembil, J. Reed, S. Srikanteswara, R. Menon, R. Kumar, S. Sayed, "Critical Technology Challenges to the Commercialization of Software Radio," *WWRF10 2003*.

S. Ginde, R. Buehrer, and J. Neel, "Game Theoretic Analysis of Joint Link Adaptation and Distributed Power Control in GPRS," *Fall VTC 2003*, vol. 2 pp. 732-736.

[Best Paper Award] J. Neel, J. Reed, R. Gilles, "The Role of Game Theory in the Analysis of Software Radio Networks," *SDR Forum Technical Conference*, San Diego Nov. 11-12, 2002, paper # 04.3-001.

S. Srikanteswara, J. Neel, and J. Reed, "Resource Allocation in Software Radios Using Configurable Computing Machines Based on the SCA," *SDR Forum Technical Conference* November, 2002, paper #06.4-03.

J. Neel, R. Buehrer, J. Reed, and R. Gilles, "Game Theoretic Analysis of a Network of Cognitive Radios," *Midwest Symposium on Circuits and Systems 2002*.

S. Srikanteswara, J. Neel, J. Reed, "Soft Radio Implementations for 3G and Future High Data Rate Systems," *Globecom 2001*, San Antonio TX, no, 1 pp. 3370 – 3374.

S. Srikanteswara, J. Neel, J. Reed, and P. Athanas, "Designing Soft Radios for High Data Rate Systems and Integrated Global Services," *Asilomar Conference on Signals, Systems, and Computers*, Nov. 4-7 2001, vol 1 pp. 51-55.

R. Gozali, R. Mostafa, R.C.Palat, S. Marikar, P.M. Robert, W.G. Newhall, C. Beaudette, S.A. Tsiakkoris, C. Anderson, J. Neel, B.D. Woerner and J.H. Reed, "Virginia-Tech Space-Time Advanced Radio (VT-STAR)," in Proceedings, *Radio and Wireless Conference (RAWCON) 2001*, Boston, MA, pp. 227-231.

### **Textbook chapters**

J. Neel, J. Reed, A. MacKenzie, *Cognitive Radio Network Performance Analysis in Cognitive Radio Technology*, B. Fette, ed., Elsevier August 2006. (Edition 2: 2009)

W. Tranter, J. Neel, and C. Anderson, *Simulation of Ultra Wideband Communication Systems*, in **An Introduction to Ultra Wideband Communication Systems**, Prentice Hall 2005.

J. Neel and J. Reed. *Case Studies in Software Radio Design*, in Jeffrey H. Reed. **Software Radios: A Modern Approach to Radio Engineering**, Prentice Hall 2002.

J. Reed, J. Neel and S. Sachindar, *Analog to Digital and Digital to Analog Conversion*, in Jeffrey H. Reed, **Software Radios: A Modern Approach to Radio Engineering**, Prentice Hall 2002.

### **Other Publications**

J. Neel, "Facilitating Spectrum Sharing Between Secondary Systems," Wireless Innovation Forum Webinar, Aug 28 2012.

J. Neel, "Introduction to Cognitive Radio and Game Theory," 2<sup>nd</sup> International Summer School on Cognitive Wireless Communications, Paris, July 10-13, 2012. (tutorial)

J. Neel, "Application of Game Theory to Cognitive Radio," 2<sup>nd</sup> International Summer School on Cognitive Wireless Communications, Paris, July 10-13, 2012. (tutorial)

J. Neel, et al., "Information Process Architecture Volume 2: Survey of IPA-Like Systems," Document WINNF-09-P-0021. June 2012.

J. Neel, et al., "Quantifying the Benefits of Cognitive Radio," WINNF-09-P-0012-V1.0.0, Dec 2, 2010.

J. Neel, et al., "IPA – Information Process Architecture Volume I," WINNF-09-P-0020-V1.0.0, Nov 2010.

J. Reed, J. Neel, "Second Wave of Wireless Communications," Presentation to World Bank, October 28, 2010.

J. Neel, et al., "SDR Forum Response to ITU Question ITU-R 241/8: Cognitive radio systems in the land mobile service" Oct 2009, SDRF-08-R-0010-V1.0 Oct 17, 2008.

J. Neel, "Game theory can be used to analyze cognitive radio," *EE Times*, August 29, 2005.

J. Neel, J. Reed, "Wireless, wireless everywhere and now it starts to think," *EE Times*, November 11, 2004.

### **Selected Conference Presentations (no Paper)**

J. Neel, "Socially-Aware Routing Algorithms for Context-Aware Cognitive Radio," WinnComm 2015, March 2015.

J. Neel, P. Cook, I. Akbar, N. Mellen, S. Baban, C. Sheehee, B. Schutz, D. Devasirvatham, "IPA v3: Cognitive Radio Context, WISDM, and Big RF," SDR WinnComm Europe November, 2014

J. Neel, P. Cook, I. Akbar, D. Devasirvatham, C. Sheehee, N. Mellen, B. Schutz, "Context-Aware Cognitive Radio," *SDR WinnComm 2013*, Aachen, Germany, June 11-13, 2013.

J. Neel, "Game Theory and Cognitive Radio Network Design," SDR Winncomm 2013, January 8-10, 2013.

J. Neel and D. Maldonado, "Synergies Between Cognitive Radio and Positioning Systems," SDR Winncomm 2013, January 8-10, 2013.

J. Neel, P. Cook, I. Akbar, D. Devasirvatham., N. Mellen, C. Sheehee, "Context-Aware Applications for Cognitive Radio," SDR Winncomm 2012, January 8-10, 2013.

J. Neel, "Cognitive Radio: Issues and Challenges," European Wireless Conference 2012, April 2012, Poznan Poland.

J. Neel, "A TVWS ZigBee Prototype," Wincomm 2011, Nov 29- Dec 2, 2011.

J. Neel et. al, "Information Process Architecture v1," SDR Europe 2010.

P. Cook, J. Neel, "Overview of the Information Process Architecture," SDR 10.

J. Neel, "Trends and Theoretical Limits to ADC Performance and Their Impact on SDR and CR Design," SDR 10.

J. Neel, "Practical Considerations for Cognitive Radio Networking," SDR'10.

J. Neel, "Inferring the Intent of Observed Cognitive Radios," AFRL Cognitive RF Workshop, Sep 15-16, 2010.

J. Neel, "Issues in Fielding Large Scale Cognitive Radio Networks in Hostile Environments," International Software Radio Conference, June 7-8, 2010.

J. Neel, "Emerging Wireless Standards," Presented at 18th Virginia Tech Wireless Symposium June 2-4, 2010.

J. Neel, "Game Theory in the Analysis of Cognitive Radio Networks," Presented at Wright State University May 12, 2010.

J. Neel, A. Amana, "An Overview of Cognitive Radio and Intelligent Transportation Systems," SDRF Workshop on Smart Communications in Transportation Systems, June 18, 2009.

J. Neel, "Using the identifying information of Section 15.711(e) to facilitate coexistence of incompatible whitespace protocols," SDRF Workshop on Spectrum Sharing by TV Band Devices, June 16, 2009.

J. Neel, "Emerging Wireless Standards," Presented at 17th Virginia Tech Wireless Symposium June 4-6, 2009.



B. Eydt, E. Good, D. Hatfield, J. Jacob, S. Muir, J. Neel, "Pointing the Finger: How should governments assign liability to promote the success of next generation radio technology," Panel in Regulatory Workshop, SDR Forum Technical Conference 2008, Oct 29, 2008.

J. Neel, "The SDRF Contribution to ITU Question ITU-R 241/8: Cognitive radio systems in the land mobile service," E3-SDRF Joint Workshop, SDR Forum Technical Conference 2008, Oct 27, 2008.

J. Neel, "Analysis of Cognitive Radio Networks," Tutorial, SDR Forum Technical Conference 2008, Oct 26, 2008.

M. Martin, H. Zhao, J. Neel, "Intellectual Property in the Wireless Market: Research, Commercialization and Standards," 17th Virginia Tech Wireless Symposium June 4-6, 2008.

J. Neel, J. Reed, "Emerging Wireless Standards," 17th Virginia Tech Wireless Symposium June 4-6, 2008.

J. Neel, "Networking Cognitive Radios," June 8, 2007, VT Wireless Symposium. Available online: [http://crtwireless.com/Symposium\\_Tutorial.html](http://crtwireless.com/Symposium_Tutorial.html)

J. Neel, "Game Theory in the Analysis and Design of Cognitive Radio Networks," Tutorial at DySPAN 2007, April 17, 2007. Available online: [http://crtwireless.com/DySPAN\\_Tutorial.html](http://crtwireless.com/DySPAN_Tutorial.html)

J. Neel, J. Reed, "Game theory implications for cognitive radio design," *SDR Forum Workshop on Cognitive Radio*, San Francisco, April 10, 2006.

J. Reed, J. Neel, "Emerging Commercial Wireless Communication Standards and Their Application to Military Communication Systems," *IDGA Software Radio Summit 2006*, Feb 21, 2006.

J. Reed and J. Neel, "Future of Wireless Networks," July 20, 2005, Monterey, CA.

J. Reed, J. Neel, L. Morales, "Software Defined Cognitive Radio," *15<sup>th</sup> Virginia Tech/MPRG Symposium on Wireless Personal Communications* June 8, 2005, MPRG

J. Neel and J. Reed, "Analyzing Cognitive Radio Networks with Game Theory," *7<sup>th</sup> Workshop on SDR and Smart Antennas*, Hangyang University, Seoul, Korea, May 13, 2005.

R. Gilles, J. Neel, "Using Game Theory to Analyze Wireless Ad-Hoc Networks," Society for Economic Design Meeting, Palma de Mallorca, Spain, June 30 – July 2, 2004.

J. Reed and J. Neel, "Key Challenges in the Design of Software Radios," *IDGA Software Radio Summit 2004* Feb. 23-25, 2004.

J. Neel, "A Short Course in Game Theory and Adaptive Wireless Networks," Virginia Tech, August 2003.

J. Reed, S. Srikanteswara, and J. Neel, "A Short Course on Software Radios," M/A-COM Short Course, May 2003.

J. Reed, S. Srikanteswara, and J. Neel, "Critical Choices for Designing Software Radios," SDR Forum Technical Conference, November, 2002.

J. Reed, S. Srikanteswara, P. Robert, and J. Neel, "Critical Choices for Designing Software Radios," *12<sup>th</sup> Virginia Tech/MPRG Symposium on Wireless Personal Communications* June 5, 2002.

J. Neel and J. Reed, "A Wireless Integrated Services Environment (WISE) Built Upon A Software Radio Framework," AOL-CIT University Research Day, November 7, 2001.

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## **Section VI: Awards, Recognition, and Service**

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### **Awards / Recognition/Service**

Virginia 2012 GAP 50 Entrepreneur of the Year (<http://www.cit.org/gap-50-awards/>)

Chair, Cognitive Radio Working Group, SDR Forum, May 2009 – present, co-chair June 2008-May 2009.

Board of Directors, Wireless Innovation Forum Dec 2010-present.

Best Paper Awards, 2002, 2004, 2007 SDR Technical Conference, Best of SDR 10 Journal

Navy JASON 2010 on Cognitive Radio

ACROPOLIS Industrial Panelist 2011-2013 (European Cognitive Radio Research coalition)

Technical Program Committees:

- SDR Wincomm 2014, 2015
- IEEE Conference on Cognitive Radio Oriented Wireless Networks and Communications (CROWNCOM) 2009 - 2014
- IEEE Symposium on Dynamic Spectrum Access Networks (DySPAN) 2008- 2015
- IEEE Workshop on Networking Technologies for Software Defined Radio (SDR) Networks 2008
- ICC Cognitive Radio Networks Track 2010
- ISABEL 2008-2011

Organized CrownCom 2013 Panel on Cognitive Radio Research

Member WUN-CogCon 2011-Present

National Science Foundation Integrated Research and Education in Advanced Networking (IREAN) Fellow, 2003 – 2006, Virginia Tech.

Motorola University Partnership in Research Grant, 2002

Competitive Intercollegiate Trivia (Virginia Tech)

- Captain of Top 15 National Intercollegiate Academic Trivia Team, 2003
- Top Scorer College Bowl Academic Trivia Tournament Region 5, 2002
- Member of Top 5 National Intercollegiate Academic Trivia Team, 1996