Personal Data Sheet for Robert T. Short, Ph.D.
Wireless System Engineer

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EDUCATION

Ph.D. Electrical Engineering, The University of Utah. GPA 3.95/4.00 **1988**
Statistical communications, adaptive and nonlinear signal processing, detection and estimation.
Thesis: Multiuser Receiver Structures.

Masters work in applied mathematics, Arizona State University. GPA 3.87/4.00 1976-1981

B.S. Electrical Engineering, New Mexico State University, GPA: 3.75/4.00 **1975**

CURRENT PROJECTS

- Simulation of cell phone waveforms in nonlinear dispersive channels. This involves creating detailed simulations of WCDMA and LTE physical layer waveforms to investigate the effects of channel nonlinearities with mitigation techniques. This will be extended to include WiMAX and WiFi waveforms.
- Design of custom SCADA wireless system with OFDMA and FSK waveforms.
- Design and implementation of DSP/FPGA-based signal processing system with Java interface. This will include an Android app.
- Design of an RT-linux GPS data collection system with inertial and laser assistance. My portion is primarily the linux drivers and data processing stack.

PROFESSIONAL SKILLS

- Expert in statistical communication theory and practice.
- Experienced and knowledgeable in all network layers with a strong focus on the PHY layer.
- Solid understanding of the system engineering process from requirements to testing.
- Clear understanding of the fundamentals of architecture.
- Good customer skills and works well with team members.
- Excellent teaching, presenting, and writing skills.
- Superb analytical and problem-solving skills.

- Familiar with many standards, including 2G cellular, 3GPP, Wi-Fi, WiMAX, WiMEDIA, etc.
- Expert in C++, MATLAB, octave, and many other computer languages.
- Expert with unix operating system.
- Adept at the use of object-oriented techniques in both software and system design.
- Practical and implementation-oriented in outlook.
- Expert at using mathematics and computer modeling to generate clear, intuitive solutions.

PROFESSIONAL HISTORY

PhaseLocked Systems (August 1989-Present). Principal and Founder

Technical consulting services for wireless and RF systems, including UWB, WiMAX, 3G/4G, spread-spectrum, CDMA, and OFDM radios. Support for intellectual property portfolio management.

- Part time and occasional consulting from August 1989-July 2004.
    - Design and implementation of a satellite-based broadcast system including hardware design and integration, unix control software including application layer as well as device drivers and other kernel-layer code.
    - Designed of a Sigma-Delta data converter system.

- Designed a voice scrambler/descrambler for wireless telephones.
- Designed software-based equalizer system for digital signaling in a severe dispersion environment.
- Designed software FSK radio system.
- Performed mathematical analysis and simulation of a variety of wireless and telephony systems including WiFi, IS-95, and UMTS/WCDMA.
- Designed device drivers for data communication cards in custom unix applications.
- Expert witness in patent dispute, including depositions.
- Tutorials, including spread-spectrum, DS-CDMA, 2G & 3G telephony, communications.
- Analysis of 3GPP waveforms in adjacent channel, co-channel, and nonlinear interference environments.

- Full time since July 2004.
  - System engineering including requirements analysis, specifications, simulation, analysis, test design and implementation.
  - RF system design and test.
  - Support for intellectual property portfolios: patent infringement technical support, technical assistance with patent disclosures and validity analysis. This included testimony in Federal District Court, depositions, expert reports, claim chart analysis, claim construction.
  - Supported clients in the development of "WiMax-like" OFDMA and UWB systems.
  - Developed algorithms for the mitigation of nonlinear distortion in satellite communication systems.
  - Analysis of spread-spectrum, DS-CDMA and OFDM(A) waveforms in nonlinear distortion environments (3GPP, UWB, and WiMAX waveforms).
  - I have created several concepts that have been patented, and have provided clients with technical support for ASIC and FPGA design.
  - Assisted clients with business acquisition efforts and management.
  - Software radio design and cognitive radio.
  - Object-oriented simulation of a variety of communication systems.
  - Audio circuit design and software-based audio and RF signal analysis.
  - Performance of noncoherent detection for DS-CDMA acquisition, OFDM(A) channel estimation algorithms, and others.
  - Tutorials, including OFDM(A), A/D and D/A conversion, 3GPP standards, ultrawideband communications.

Alereon, Inc. (September 2002-July 2004). Chief Engineer.

Technical lead for an ultrawideband chipset development. Successfully directed the rapid development of two ASICs (RFIC and digital baseband). Development took six months from team-in-place to tapeout.

- Led staffing effort for RFIC and Digital ASIC development teams.
- Primary architect for the Alereon UWB chipset and support efforts.
- Helped support venture capital fundraising through technical coordination of due diligence efforts.
- Led chipset system engineering efforts.
- Performed system analysis including data converter effects (quantization, jitter, etc.),
- Coordinated PHY ASIC design from inception, hiring, through tapeout.

Pacific Crest Corporation (February 2001-August 2002). Chief Technology Officer.

Technical lead for a variety of wireless positioning products.

- Responsible for system architecture and development of a new wireless networking

product, as well as updating and re-engineering existing wireless products. Design included wireless modulation and network layer architecture, real-time operating system implementation, and application layer design.

- Responsible for updating and enhancing engineering processes, both for existing products and a new wireless networking product similar to an 802.11b system.
- Created, staffed, and managed a remote development center.
- Developed and analyzed a CDMA concept for a family of networking products.

ParkerVision, Inc. (April 1997-February 2001). Corporate Staff Scientist and Design Center Manager.

Technical lead for a team of engineers designing low power analog communication systems. Developed detailed and accurate mathematical models for a new direct downconversion technology. Coordinated the design of analog ASICs, FPGA systems, and digital ASICS. System and technical lead for discrete (COTS) and integrated wireless systems. Analyzed WiFi and 3GPP (UMTS/WCDMA) waveforms for mixer distortion products.

- Signal Space Design, Inc. (September 1998-January 2000). Founder and CEO.

Technical and managerial lead of a team of extremely competent young engineers for a contract engineering firm. Designed analog and digital communication systems, low noise circuits, and embedded systems. SSD was profitable every month and was sold to ParkerVision in January 2000.

- Digital Scientific, Inc. (April 1997-August 1998). Director of Wireless Engineering.

Technical director and manager for the development, from inception to manufacturing, of a line of 2.4 GHz spread spectrum multiprotocol data radios. Coordinated design and marketing of a flat-panel antenna line. Was awarded an SBIR for research into DS-CDMA multiuser systems in multipath and fading channels. When funding for the wireless division was eliminated, I acquired the personnel and assets and formed Signal Space Design, Inc.

Digital Radio, Inc. (April 1994-April 1997). Chief Technology Officer.

Contract engineering, including spread-spectrum radio development, embedded systems, signal processing, FSK systems, software design.

- Designed spread-spectrum radios for custom applications.
- Designed CDMA and GMSK systems for client use.
- Embedded software design in c and assembly.
- Operating system design and integration – RTOS and unix.
- DSP code design for telephony and wireless applications.
- IS-95 tutorial and waveform analysis and comparison to GSM.

The University of Utah. (July 1989-June 1994). Professor of Electrical Engineering.

Tenure-track faculty with the University of Utah.

- Courses taught: Undergraduate communications, control, and signal processing including lab design and implementation. Graduate single and multivariable controls and digital communications.
- Research into FH-CDMA and DS-CDMA multiuser communication systems, adaptive systems, spread-spectrum interference reduction, nonlinear systems, adaptive A/D converters, and implementation of communication and DSP algorithms in integrated circuits.
- Research into network performance (throughput and delay) in DS-CDMA multiuser communication systems.
- Research into ISI mitigation in GMSK systems (e.g. GSM).
- Consulting for wireless applications including CDMA, GMSK, FSK.
- Managed the Departmental and College of Engineering computer facilities.
- July 1984-July 2001**.** Research Professor of Electrical Engineering. Occasional research contract, course instructor.

Unisys, Inc. (October 1984-October 1989). Senior Staff Engineer with Advanced Technology. Group Manager with the Advanced Technology Department

- Directed simulation and analysis group including the design of a custom scripting simulation software package (vaguely similar to MATLAB). Supported entire division with analysis and simulation.
- Directed and performed R&D efforts in various communication and networking topics including DS-CDMA multiuser communication systems, robust (nonparametric) of EW signals.
- Assisted with the performance analysis of a digital baseband integrated circuit.
- Managed department unix workstation network, including unix drivers, kernel modifications, and application software.
- Remained as a part-time consultant until 1994, primarily supporting computer simulation efforts.

Hewlett-Packard. (September 1981-August 1984). Engineer.

- Member of a team that developed a custom operating system for network-based file system and peripheral sharing. Designed peripheral sharing subsystem and assisted with design and development of operating system primitives.
- Design and performance analysis of file server network systems.
- Was part of the team that transitioned our custom network designs to a unix-based design. Designed device drivers, made modifications to the unix kernel and file system to support new functionality.

Motorola GED. (January 1976-August 1981). Engineer.

- RF and other circuit design, breadboard and construction (phase-locked loops, amplifiers, mixers etc.).
- Radar system design and analysis for air-to-air and air-to-ground missile systems, especially target tracking in severe glint and clutter.
- Collection and analysis of field data using custom processing software (FORTRAN).
- Brief stint with reliability and components group analyzing reliability of electronic systems. Assisted with the design and implementation of a computer-based reliability analysis system.
- Assisted divisional computer staff with mainframe operating system administration and application software management.

Naval Weapons Center. (July 1973-December 1973). Coop student. Hybrid Circuit Lab.

- Assembly and testing of hybrid circuits.
- Assist engineering and physics staff with computer-based problem solving and automated testing.

PATENTS, PAPERS, AWARDS

- Numerous patents granted, including some novel CDMA multiuser structures, UWB systems, and others.
- Authored several widely referenced papers in refereed journals.
- Centennial Distinguished Alumnus, New Mexico State University, 1996.

Publications (partial list)

Currently writing a book on OFDM. Includes a chapter on the LTE air interface.

Book Chapter in Ghobad Heidari: WiMedia UWB, Technology of choice for wireless USB and bluetooth, Wiley, 2008, pp. 61-139.

Zhenhua Xie, Robert T. Short, Craig K. Rushforth: A Family of Suboptimum Detectors for Coherent Multiuser Communications, IEEE Journal Selected Areas in Communications, vol 8, pp 683-690, May 1990.

Zhenhua Xie, Craig K. Rushforth, Robert T. Short: Multiuser Signal Detection Using Sequential Decoding, IEEE Transactions on Communications, vol COM-38, pp. 578-583, May 1990.

Zhenhua Xie, Craig K. Rushforth, Robert T. Short, Todd K. Moon: Joint Signal Detection and Parameter Estimation in Multiuser Communications, IEEE Transactions on Communications, vol COM-41, pp. 1208-1216, August 1993.

Todd K. Moon, Zhenhua Xie, Craig K. Rushforth, Robert T. Short: Parameter Estimation in a Multi-User Communication System. IEEE Transactions on Communications, vol COM-42, pp. 2553-2560, August 1994.

Patents (partial list)

U.S. Patent Number 8,018,831: Method and system for a scalable radio architecture; James L. Lansford, Robert T. Short. September 13, 2011.

U.S. Patent Number 7,492,293: Variable rate analog-to-digital converter. Short; Robert Townsend, Heidari-Bateni; Ghobad, Lisenbee; Layne. February 17, 2009

U.S. Patent No. 7,379,515, Phased array antenna applications of universal frequency translation, Johnson; Martin R., Jensen; Jonathan S, Short; Robert T, et.al., May 27, 2008

U.S. Patent No. 7,321,735, Optical down-converter using universal frequency translation technology, Smith; Francis J et. al., January 22, 2008.

U.S. Patent No. 7,082,171, Phase shifting applications of universal frequency translation, Johnson, Martin R., Jensen; Jonathan J, Short; Robert T, et. al., July 25, 2006.

U.S. Patent No. 7.027,786, Carrier and clock recovery using universal frequency translation, Smith; Francis J et. al. April 11, 2006

U.S. Patent No. 6,879,817, DC offset, re-radiation, and I/Q solutions using universal frequency translation technology, Sorrells; David F. et. al., April 12, 2005

U.S. Patent No. 6,005,886, Synchronization-free spread-spectrum demodulator, Short; Robert, December 21, 1999.

U.S. Patent No. 5,031,173, Decoder for added asynchronous bit sequences, Short; Robert, Xie; Zhenhua, Rushforth; Craig K, July 9, 1991

U.S. Patent No. 4,908,836, Method and apparatus for decoding multiple bit sequences that are transmitted simultaneously in a single channel, Rushforth; Craig K., Xie; Zhenhua, Short; Robert T., March 13, 1990

List of Skills

I have direct experience in the following modulation types:
Orthogonal frequency division multiple access (OFDM, OFDMA), direct-sequence spread-spectrum (DSSS), frequency-hop spread spectrum (FHSS), BPSK, QPSK, ASK, PAM, QAM, PSK. Also DS-CDMA, UMTS, WCDMA, PSTN (Public switched telephone network).

I have designed systems that use:
Sequential and non-sequential timing, phase, and code acquisition, channel estimation, channel.equalization. Noncoherent detection including Rice and noncentral chi-squared random variable.

I am fluent in:
C++, MATLAB, octave, Python, FORTRAN
And more than passingly familiar with
Javascript, HTML, XML, Java, Verilog.

I use object-oriented techniques in my designs, software and system.
UML, Unified Process (UP), SDL

Unix, linux, Microsoft Windows, Avid Protools.