

LT Wurtz, Ph.D.
Senior RF/Radar Electrical Engineer

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2004



2020

RESEARCH/DESIGN INTERESTS

Radar/communication/telemetry/GNSS system hardware, firmware, and software design, Radar and communication system signal analysis and DSP-based algorithm development, RF/microwave/analog/digital electronic circuit and system design.

EDUCATION

Doctor of Philosophy in Electrical Engineering, Auburn University, Auburn, Alabama, 1988.

Master of Science in Electrical Engineering, Auburn University, Auburn, Alabama, 1985.

Master of Science in Computer and Information Science, Troy University, Montgomery, Alabama, 1982.

Bachelor of Science in Computer and Information Science, Troy University, Troy, Alabama, 1979.

Bachelor of Science in Mathematics, Troy University, Troy, Alabama, 1979.

DOD Security Level: TS/SCI with polygraph - October 2020

TS - March 2026, DCSA continuous vetting status

HANDS-ON EXPERIENCE

Over 25 years hands-on experience with radar, communication, and telemetry system hardware, firmware, and software design. A recent radar called "Silent Multi-Mode Radar" supporting pulse-doppler, FMCW, and silent modes was designed to detect UAS drones. The silent mode concept involves random spreading codes that push the illumination power to the noise floor making detection improbable. Also having good success with a GNSS-based passive radar system. Over 25 years experience with antenna design including beam steered phased arrays. Over 7 years experience with GPS and Galileo GNSS IF receiver hardware, firmware, and software development. Spent 24 years at Auburn University and The University of Alabama as a tenured professor teaching undergraduate and graduate classes and conducting research in RF/Microwave electronics, analog and digital electronics, analog and digital integrated circuit design, control systems, and computer architecture. Over 15 years hands-on experience with software defined radio and DSP-based algorithm development. Designed many printed circuit boards using Altium Designer and Mentor Graphics PADS professional supporting frequencies up to 40 GHz. Over 25 years experience programming Xilinx and Quartus FPGAs using VHDL and Verilog. Over 25 years experience designing numerous telemetry and flight termination packages including all aspects of hardware design, PCB layout, and firmware/software programming with the Redstone Test Command Telemetry Branch and Dynetics Avionics Division. Over 25 years experience designing fiber optic delay lines and optical-based systems for range calibration and EW jamming and countermeasures. Built the first optical-based jammer for Patriot which was delivered to VAL, White Sands Missile Range. Over 25 years experience writing 2D and 3D image processing and display software packages. Over 25 years hands-on experience with all forms of test equipment by personally owning a complete RF, microwave, digital, and optical design laboratory including all forms of test equipment from network analyzers to oscilloscopes to logic analyzers to spectrum analyzers. Over 25 years experience with machining custom RF/Microwave enclosures by personally owning a complete CNC machine shop. Over 25 years software experience including the following: Visual C#, Visual C++/CLI, Visual Basic .NET, DirectX 3D applications, Visual Fortran, numerous assemblers, Autocad, Altera Quartus Verilog FPGA design software, PCAD PCB design tools, Mentor Graphics DXDesigner/PADs Professional PCB design tools, SPICE, Genesys RF/Microwave simulation tool, Matlab, Xilinx ISE/Vivado VHDL FPGA design software, Altium Designer PCB design tools, SONET EM Simulation Software, and Mentor Graphics Hyperlynx. More hands-on information can be found on my personal website: <https://www.custommicroelectronicsystems.com>.

EMPLOYMENT EXPERIENCE

Black => full-time position, Brown => part-time/consulting

Senior RF/Microwave Electrical Engineer, Custom Microelectronic Systems, Inc., Huntsville, Alabama, 1994-present. (part-time position)

Specialization in the research and design of prototype analog, RF/microwave, and digital microelectronic systems and fiber-optic based systems for military and commercial applications. High-performance, programmable optical delay lines built for Patriot Weapon System, White Sand Missile Range, Lockheed Martin, Boeing, Northrop Grumman Norden Systems, Naval Research Laboratory, and many others. **Many SBIR phase I and II contracts awarded with two taken to phase 3.** Prototype phase shifters built for a Raytheon/TI early warning system. Design of a prototype S-band pseudo monostatic research radar supporting FMCW and pulse-doppler modes. Spent many years developing a passive-like radar called Silent Multi-Mode Radar (SMMR) to detect UAS drones. SMMR supports FMCW, pulsed-doppler, and silent modes. The silent mode is a concept involving a technique to push the illumination power level to the noise floor making detection improbable. Radar hardware and software simulator design to study range/radial velocity unfolding techniques, atmospheric RF propagation effects, link-margins using various antennas with sidelobes, and support radar algorithm development.

Senior RF Electrical Engineer, Qualis Corporation, Huntsville, Alabama, 2021 – 2025.

GNSS subject matter expert, Software Defined Radio hardware, algorithm, and firmware development, RF link analysis simulation development, RF/microwave/digital hardware development, and all aspects of communication system hardware, firmware, and DSP-based algorithm design, Ka-band (29 to 36 GHz) weather radar/SATCOM receiver hardware and firmware design for the International Space Station. Phased array antenna design. All aspects of hardware, firmware, and software design of a GPS disciplined, phase coherent, image rejection X/Ka-band and GNSS superheterodyne receiver for the International Space Station. Much time spent designing and field testing a GNSS-based passive radar system.

Senior Principal RF Electrical Engineer, Dynetics Aviation Division, Huntsville, Alabama, 2018 – 2021.

Support the Avionics Products Technology Department in the areas of hardware design, algorithm development, and advanced technologies. Some specific design tasks include: new Enhanced Flight Termination Receiver hardware, firmware, and software design, numerous telemetry packages including the Raytheon Precision Strike Missile Flight Termination and Telemetry Kit with Hyperlynx performance studies, GNSS hardware and software defined receiver, tempest encryption design, and phased array antenna design.

Senior Design Engineer, KBM, Inc., Huntsville, Alabama, 2016 – 2025. (Consulting position)

Responsible for the design of a programmable X-band fiber-optic delay line for the AMRDEC-MSS2 Facility called the “Advanced CORFM” and an assortment of additional X-band and Ka-band RF/Microwave, analog, digital, PCB design, and C#

programming projects. An additional interesting task included the design of a S-parameter based test procedure for Ka-band orthomode transducers.

Summer of 2007 joined a small engineering design group within the Redstone Test Command, Redstone Arsenal, Alabama called "Special Projects". The following three employers provided a contract funding vehicle over successive time periods for the same RTC position.

Senior Design Engineer, Torch Technologies, Inc., Huntsville, Alabama, 2015 – 2018.

Responsible for the design and test of aircraft electronic subsystems and heavy vehicle CAN-bus cryptography. Responsible for the design and test of hardware/software systems for the Common Missile Warning System, CIRCUM Pointer Tracker, and Advanced Threat Warning System. Design of a ground-based telemetry and RF surveillance van for UHF, L, C, and S-bands.

Senior Design Engineer, AI Signal Research, Inc., Huntsville, Alabama, 2013 – 2015.

Responsible for the design and test of a performance reporting system for the Common Missile Warning System and Apache Ku-band CDL communications and RF system. Design of a ground-based telemetry and RF surveillance van for UHF, L, C, and S-bands.

Principle Research Scientist, Level 5, University of Alabama, Huntsville, Alabama, 2008 – 2013 (Retired, 34 years and 2 months of service).

Responsible for the design and test of a performance reporting system for the Common Missile Warning System. Provided design support for an Apache ground-based communications system. Design and test of numerous instrumentation and telemetry systems. Design of a custom high-rate video and telemetry recorder for aircraft warning systems.

Principle Research Scientist, Level 4, University of Alabama, Huntsville, Alabama, 2007 – 2008.

Responsible for the design and test of a performance reporting system for the Common Missile Warning System. Design and test of numerous instrumentation and telemetry systems. Design of a custom high-rate video and telemetry recorder for aircraft warning systems.

Associate Professor, The University of Alabama, Electrical and Computer Engineering Department, Tuscaloosa, Alabama, Tenured, 1994-2007 (retired).

Responsible for teaching and conducting research in the areas of RF/microwave electronics, analog electronics, analog and digital IC design, control systems, and computer system design. Provided hardware/software engineering consulting services for a number of AMRDEC tasks, Redstone Arsenal, Alabama.

Design Engineer, Redstone Technical Test Center, Redstone Arsenal, Alabama, May 1996-2009.(part-time position)

Responsible for the design of high-performance analog and digital telemetry components and systems for the analysis of military weapon systems. Telemetry systems designed for the following systems: Stinger Block II, AGM 130, LCPK, BOAR, Digital Maverick.

Assistant Professor, The University of Alabama, Electrical Engineering Department, Tuscaloosa, Alabama, 1988-1994.

Responsible for teaching classes and conducting research in the areas of RF/Microwave electronics, analog electronics, analog and digital IC design, and computer system design. Established undergraduate and graduate classes and laboratories for analog and digital IC design and RF/Microwave electronics. Provided hardware/software engineering consulting services for a number of AMRDEC tasks, Redstone Arsenal, Alabama. Designed low-noise, radiation hardened sensors for the Superconducting Super Collider, Aachen University, Aachen, Germany.

Design Engineer, Countermeasures Engineering Company, Mesilla Park, New Mexico, 1991-1994. (part-time position)

Research, design, and test of military fiber-optic based countermeasure systems and optical/digital RF memory systems. Designed the first optical based jammer for the Patriot System supporting the Survivability, Vulnerability, and Assessment Laboratory, White Sands Missile Range, NM.

Visiting Assistant Professor, Auburn University, Electrical Engineering Department, Auburn, Alabama, 1988.

Responsible for teaching electronics and computer system design classes for undergraduate and graduate students.

Graduate Teaching Assistant / Doctorial Student, Auburn University, Electrical Engineering Department, Auburn, Alabama, 1983-1987.

Responsible for teaching undergraduate electronics and computer system design classes and laboratories. Provided hardware/software consulting services for the Space Shuttle Block II main engine controller.

Computer Performance Analyst, Air Force Standard Systems Center, Montgomery, Alabama, 1979-1983.

Developed software monitors and performance reporting software for Honeywell computer systems. Many system workload and bottleneck studies were performed at Air Force installations. Served as an officer with the US Air Force. Active-duty from August 1979 to August 1983. Retained in inactive reserve due to position specialty code (AFSC) until April 1991. Honorable discharge as O-3, Captain US Air Force, April 1991.

REFEREED PAPERS

J.E. Jackson, A.L. Highsmith, R.K. Pandey, and **L.T. Wurtz**, "Development of a Piezoelectric Driven Meso-Scale MEMS-Technology Gyroscope," Proceedings of the 17th International Technical Meeting of the Satellite Division of the Institute of Navigation (ION GNSS 2004), Sept. 21-24, 2004, Long Beach, CA, pp. 845-851.

J.E. Jackson, A.L. Highsmith, R.K. Pandey, and **L.T. Wurtz**, "New Inertial Sensor for Aviation Navigation Application," Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop, Fairfax, VA, April 26-30, 2004.

W. P. Wheless, Jr. and **L. T. Wurtz**, "A Near-Earth and Buried HF Antenna Computer Modeling Program," Proceedings of the 14th Annual Review of Progress in Applied Computational Electromagnetics, Monterey, CA, ACES Conference Publications no. 14, 16-20 March 98, pp. 1019-1027.

W. P. Wheless, Jr. and **L. T. Wurtz**, "Derived Distribution for Electrical Overstress Failure Thresholds of Transistors," Electronic Letters, Vol. 34, No. 21, 15 October 1998, pp. 2063-2064.

W. P. Wheless, Jr. and **L. T. Wurtz**, "Components of an Analytical Model for Snake Antennas," Applied Computational Electromagnetics Society Newsletter, Vol. 12, No. 2, ISSN: 1056-9170, July 1997, pp. 35-44.

W. P. Wheless, Jr. and **L. Wurtz**, "An Overview of Antenna Radiation Basic Principles," *Proceedings of the 13th Annual Review of Progress in Applied Computational Electromagnetics*, Monterey, CA, ACES Conference Publications no. 13, 17-21 March 1997, pp. 256-261.

L. Wurtz, W. P. Wheless, Jr., and E. Bergsagel, "Design of a Programmable 2-18 GHz Microwave Fiber-optic Delay Line," *Proceedings of the IEEE Southeastcon '97*, Blacksburg, VA: IEEE Press, 97CH36044: 11-14 April 1997, pp. 11-19.

L. Wurtz, "Design of a Variable S-Band Fiber-Optic Delay Line," *Proceedings of the IEEE SoutheastCon '96*, Tampa, Florida, pp. 179-186, April 1996.

L. Wurtz, "GaAsFET and HEMT Small-Signal Parameter Extraction from Measured S-Parameters," *IEEE Transactions on Instrumentation and Measurement*, in Press.

P. Wheless and **L. Wurtz**, "Introducing Undergraduate Students to the Moment Method," *IEEE Transactions on Education*, in press.

P. Wheless, **L. Wurtz**, and J. Wells, "An Equivalent-Circuit Radiation Sensor Model," *Proceedings of the IEEE SoutheastCon '93*, Miami, Fl, pp. 7-11, April, 1994.

L. Wurtz and P. Wheless, "Design of a High-Performance, Low-Noise Charge Pre-Amplifier", *IEEE Transactions on Circuits and Systems*, in press.

L. Wurtz and P. Wheless, "Pulse Shaping in Low-Noise Charge Pre-Amplifiers", *IEEE Transactions on Instrumentation and Measurement*, Vol. 42, No. 5, October 1993.

L. Wurtz, "Design and Fabrication of a CMOS Signal Conversion Integrated Circuit for Remote Control Hobbyists", *IEEE Transactions on Education*, in press.

L. Wurtz, "An Efficient Scaling Procedure for Domino CMOS Logic," *IEEE Journal of Solid-State Circuits*, Vol. 28, No. 9, pp. 979-982, September 1993.

L. Wurtz, "Design of a Low-Noise, Radiation-Hardened Charge Pre-Amplifier," *Proceedings of the IEEE SoutheastCon '93*, Charlotte, NC, pp. 251-256, April 1993.

C. Cantrell and **L. Wurtz**, "A Parallel Bus Architecture for Artificial Neural Network Implementation", *Proceedings of the IEEE SoutheastCon '93*, Charlotte, NC, pp. 547-551, April, 1993.

L. Wurtz, "Built-In Self-Test Structure for Mixed-Mode Circuits", *IEEE Transactions on Instrumentation and Measurement*, Vol. 42, No. 1, pp. 25-29, February 1993.

G. Srikant and **L. Wurtz**, "A CMOS Parallel Gouraud Shading VLSI Architecture", *Proceedings of the IEEE SoutheastCon '92*, Birmingham, AL, April 1992.

D. Jackson, D. Whiteside, and **L. Wurtz**, "Exploiting Bit-Level Parallelism in Boolean Matrix Operations for Graph Analysis", *Proceedings of the IEEE SoutheastCon '92*, Birmingham, AL, April 1992.

L. Wurtz, "A Scaling Procedure for Domino CMOS Logic", *Proceedings of the IEEE SoutheastCon '92*, Birmingham, AL, April 1992.

L. Wurtz and D. DiBitonto, "Design of a Radiation-hardened, Low-noise, High-speed Charge Pre-amplifier for the Superconducting Super Collider", *Proceedings of the IEEE SoutheastCon '90*, New Orleans, LA, April 1990.

NON- REFEREED REPORTS/WHITE PAPERS

Listed on website: <https://www.custommicroelectronicsystems.com>.

HONORS

Service Recognition Award, The University of Alabama, Huntsville, Alabama, 2013

Army Research Laboratory SBIR phase III contract recognition, DAAL01-96-C-2003

Outstanding Electrical Engineering Instructor Award, The University of Alabama - 1989

Military Accommodation Award - 1983

Virgil L. Collins Mathematics Award - 1979

General Military Cadet of the Year - 1976
George C. Wallace Scholarship - 1975
4-Year Air Force ROTC Scholarship - 1975
Valedictorian Rehobeth High School - 1975

PROFESSIONAL ACTIVITIES

Member, IEEE

SEMINARS/SHORT COURSES PRESENTED

"Microcontroller-Based Digital System Design", The University of Alabama College of Continuing Studies, Kennedy Space Center / NASA, August 13-15, 1996, Cocoa Beach, FL.

"Digital Systems Engineering", The University of Alabama College of Continuing Studies, Kennedy Space Center / NASA, July 25-28, 1995, Cocoa Beach, FL.

"Digital Systems Engineering", The University of Alabama College of Continuing Studies, Kennedy Space Center / NASA, April 24-27, 1995, Cocoa Beach, FL.

"Digital Systems Engineering for Non-specialists", The University of Alabama College of Continuing Studies, Kennedy Space Center / NASA, March 27-29, 1995, Cocoa Beach, FL.

"Digital Systems Engineering", The University of Alabama College of Continuing Studies, Kennedy Space Center / NASA, December 14-17, 1993, Cocoa Beach, FL.

"Applied Computer Architecture for Symbolic Processing and Artificial Intelligence," Auburn University Engineering Extension Service, Marshall Space Flight Center / NASA, 1984, Redstone Arsenal, AL.

Patents

Silent Multi-mode Radar (SMMR), Patent no: 64/073,281

PERSONAL

Marital Status: single
Religious Preference: Methodist
Height/Weight: 6' 2.5" / 240lbs
Military Service: United States Air Force, Captain, Active Duty 1979-1983, Inactive Reserve 1983-1991
Hobbies: RF/microwave/radar/communication system design and algorithm/DSP firmware development
Sports: Distance walking and biking

Silent Multi-Mode Radar (SMR)



Silent Multi-Mode Radar supporting FMCW, Pulse-Doppler, and "Silent" modes of operation



Real Threat Emulator injecting INS, IMU, and UV Threat Profiles into an Apache AH64D Aircraft (official photo release)