Mark P. Mahon, Ph.D.
Teaching Professor
Pennsylvania State University
School of Electrical Engineering and Computer Science
W209A Westgate Bldg.
Pennsylvania State University
University Park, PA

Highlights

Teaching faculty experienced in research and systems development in cellular and mobile wireless networks, wireless local area networks, wireless network security, mobility management, mobile data systems including networks, protocols, and applications, wideband signal processing, modulation theory, algorithms, mathematical/analytical modeling, communication, detection and estimation, and control systems. Pursues funding for and conducts advanced research in computer and mobile networks, theoretical and experimental analysis of communication systems, cellular, wireless, and mobile systems, wideband signal processing, sensors, tracking, localization, and data fusion. Experienced in hardware/software development, data acquisition, integration, and testing, field test planning, preparation, and execution. Extensive programming experience including UI, analysis tools, real-time object-oriented programming, and embedded systems code development in C, C++, python, java, Verilog, VHDL, and assembly.

Education

PhD. Acoustics, The Pennsylvania State University, University Park, PA 16802, 2001
M.S. Electrical Engineering, The Pennsylvania State University, University Park, PA, 16802, 1991
B. S. Electronics Engineering, The University of Scranton, Scranton, PA, 18510, 1987

Employment

July 2021 – Present: *Teaching Professor, School of Electrical Engineering and Computer Science, The Pennsylvania State University, University Park, PA 16801*
June 2018 – June 2021: *Associate Teaching Professor*
Aug. 2015 – June 2018: *Assistant Teaching Professor*
Teach graduate and undergraduate courses in computer science and electrical engineering such as communication networks, mobile networks, programming, mathematics, and wireless security. Advise and direct graduate students' MS and PhD research in the areas of computer networks, wireless and cellular networks, simultaneous localization and mapping, and cybersecruity. Guide Schreyer Honors College students' honors theses. HackPSU and BlockChain@PSU faculty adviser, member of graduate advising committees, member of Computer Science Undergraduate Curriculum Committee, member of School of EECS Management Committee, advise undergraduate electrical engineering, computer science, computer engineering, and data science students.

2003 – Aug. 2015: *Associate Research Professor, Applied Research Laboratory, Communications, Information, and Navigation Office, The Applied Research Laboratory, The Pennsylvania State University, State College, PA* Principal Investigator, Co-Principal Investigator, Technical lead conducting research on cellular and mobile networks, computer network security, mobile communication systems, data fusion, and wideband signals and image processing with total funding over $12M.

2002 – 2003: *Sr. Systems Engineer, Klein & Stump, Inc., 2120 Washington Blvd. #400, Arlington, VA 22204* Researcher and technical consultant working on wireless communications projects for US Special Operations Command (SOCOM) and Naval Information Warfare Activity (NIWA). Awarded $150k SBIR for SOCOM advanced signal simulator.

1991 – 2002: *Assistant Research Professor, Applied Research Laboratory, Communication Sciences and Technology Division, The Applied Research Laboratory, The Pennsylvania State University, State College, PA 16804* Principal Investigator and researcher conducting research on cellular and mobile networks, wideband signals, tracking and localization, adaptive signal processing, acoustic propagation, sensor systems, remote sensing, and active noise control. Awarded $750k for development of novel wavelet based wideband signal detection for high altitude sensors.

1988 – 1989: *Program Engineer, Central Intelligence Agency, Langley, VA 22101*
Assisted in the development of algorithms and signal processing systems for novel applications in the areas of RF communications and signal modulation techniques.

Detailed Research Experience:

Current ongoing research:
Energy optimization for crowd-sourced image processing in mobile 4G/5G networks; Multiple Input Multiple Output - Sparse Coding Multiple Access (MIMO-SCMA) techniques for increased capacity in 5G systems; Fast handover techniques using blockchains to reduce mobility interruption times in 5G networks; AI techniques applied to mobile robotics for localization and mapping; Automated object detection and 3D mapping using sonar array data. Security vulnerabilities in UWB ranging.

2015 – Present
Lead graduate and undergraduate student research in wireless communication networks, distributed video processing in cellular systems, UWB ranging, communication systems and security, software defined network security, application of game theory to cyber resiliency, wireless, machine learning, big data analytics, and artificial intelligence for mobile and computer network security and automated detection in acoustic and sonar systems.

2014 – 2015
Leading internal research and development effort on deep packet inspection for zero day and predictive detection for data networks. Technical performer developing novel deformable wavelet-based contour matching technique for automated object detection in satellite images. Acoustic tracking and identification of drones for area defense system.

2014
Developed real-time scanner for 802.15.4 (LR-WPAN) protocol deployed on software defined radio platform.

2013-2014
Technical lead on developing novel mathematical model for analyzing torpedo acoustic threat surrogate systems for US Navy. Experimental lead on disposable, adaptive, high bandwidth fiber-optic undersea communication system for US Navy.

2013
Implemented a novel matched filter receiver for a unique OFDM signal of interest to facilitate signal detection in a high co-channel interference environment of a wide field of view high altitude receiver and wideband signal set design in highly complex propagation environments for Department of Defense (DoD).

2012-2013
Technical lead for design and implementation of a real-time transmitter/receiver on a software defined radio platform for maritime communication systems (Automatic Information System/Maritime Security).

2012
Communications/signal processing technical consultant on Maritime Domain Operations and Unmanned Surface Ship Interdiction study effort for US Navy.

2011-2012
Principal Investigator, technical and experimental lead on fiber optic undersea communication system for Advanced Submarine System Development effort for US Navy.

2011
Technical lead on mathematical analysis, algorithm development, and implementation of pattern of life signal to noise ratio analysis in high co-channel interference environment for DoD.

Trusted agent for Army Research Lab to review and critically analyze work associated with wideband signaling and passive emissions collection from cell phones. Reviewed contractor data analysis and technical briefings for scientific accuracy and rigor. Advised the sponsor on contractor testing methodologies, procedures, and analysis techniques. Technical lead implementing unique wideband acoustic communication system and specialized signal processing hardware for an acoustic system being utilized in a complex maritime environment for the DoD.

2009 – 2010
Tiger team lead for large unmanned undersea vehicle (UUV) assigned to identify platform induced electromagnetic interference with electronic payload system in the HF and acoustic regimes for the US Navy.

Developed and implemented a novel algorithm to calculate the effective force charge based on muzzle sensor data utilizing MEMS transducers and PIC controller on a portable howitzer for the US Army.

Conducted study and authored Intelligence, Surveillance, and Reconnaissance (ISR) for Unmanned/Minimally Manned Undersea Vehicle (UMUV) report presented to Defense Advanced Research Projects Agency (DARPA).

2006 – 2009
Principal Investigator for a multi-year research and FPGA-based engineering prototype development effort in the area of 3G/4G (UMTS/LTE) cellular and wireless (IEEE 802.16 and 802.11) communication systems; Effort consisted of three phases: theoretical and analytical study, proof-of-concept development, and testing, and prototype development for DoD.

2005-2006
Technical lead on Information Fusion engine integration into a sandbox enclave at Joint Interagency Task Force South (JIATF-S) to support multi-int data fusion.

2003 – 2006
Principal Investigator for multi-year Office of Secretary of Defense sponsored research program in the area of multi-intelligence data fusion as part of the overall initiative of Force Transformation; worked extensively with NGA, DIA, DISA, OSD, all military services, and some coalition components.

2002 – 2003
Pursued funding for research interests in the areas of wireless/wideband communications, wideband systems, source detection/localization, intelligent system of systems design, and data fusion; Awarded Phase I, Small Business Innovative Research contract for Portable Signal Training System by SOCOM (02-013); Technical consultant for Naval Information Warfare Center on Common for High Performance Computing Software Support Initiative's (CHSSI) Electronic Battlefield Environment (EBE) portfolio (Electromagnetic Environmental Effects Toolkit), SBIR, MERIT/TENCAP, TST programs

1998 – 2002
Researcher and principal investigator performed research in large time-bandwidth product (wavelets) source detection and localization – theoretical, analytical, and field testing; CDMA IS-95A/3G cellular communications; Developed mathematical analytical models and included code development of the CDMA air interface physical layer implementing major aspects of the CDMA protocol for test and analysis purposes; Built real-time hardware platform for deploying developed CDMA physical layer code.

1997 – 1998
Principal Investigator in charge of signal processing algorithm and code development, image acquisition and compression, telephony, and user interface design for an experimental remote, autonomous, acoustic rockslide detection for Conrail. Work included algorithm and code development utilizing embedded digital signal processing (DSP) board and development of unique algorithms for real-time monitoring of transducers to create an event detection system.

1991 – 1997
Performed fundamental research in the areas of signal processing algorithm development, acoustic atmospheric propagation, detection, source localization, beamforming, system identification, and active control; Main responsibilities include real-time code development (C, Visual C++, assembly) for signal processing systems, adaptive beamforming, and embedded processing for eight major projects during this time. Multiple DSP platform development; Active Noise Control, feature extraction, data logging and fusion, passive acoustic tracking, beamforming, and analysis for these projects

1988-1989
Assisted in the development of algorithms and signal processing systems for novel applications in the areas of RF communications and signal modulation techniques.

Case History:

March 2022 – Present, Knobbe, Martens, Olson & Bear, LLP
Jawbone Innovations, LLC v. Amazon.com, Inc., et al.
Consulting for Amazon re: IPR.

May 2022 – Dec. 2022, McKool Smith; Alston Bird
Ericsson Inc. and Telefonaktiebolaget LM Ericsson vs. Apple Inc., Case No. 2:21-cv-376, EDTX
Consulting for plaintiff and counter-defendant Ericsson.
Report on Essentiality and Rebuttal report (FRAND). Deposed 10/4/2022. Testified 12/7/2022. Case settled during trial.

March 2022 – Dec. 2022, McKool Smith
Ericsson Inc. and Telefonaktiebolaget LM Ericsson vs. Apple Inc., Inv. No. 337-TA-1299, ITC
Consulting for Ericsson. Opening and Rebuttal report. Deposed 10/7/2022. Case settled.

September 2021 – December 2021, Duane Morris, LLP
KAIFI LLC v. Verizon Wireless, Case No. 2:20-cv-280-JRG, EDTX
Consulted for defendant Verizon. Wrote Non-Infringing Alternatives and Non-Infringement reports. Deposed 12/15/21. Case settled.

September 2021 – December 2021, Quinn Emanuel, LLP
L2 Mobile Technologies, LLC v. Google, Case No. 6:21-cv-358, WDTX
Consulted for defendant Google. Wrote reply Claim Construction brief. Case settled.

August 2021 – May 2022, McKool Smith
Godo Kaisha IP Bridge 1 v. Ericsson, Case No. 2:21-cv-00213-JRG, EDTX
Consulted for defendant Ericsson. IPR and Claim Construction declarations.

July 2021 – August 2021, Quinn Emanuel, LLP
Finesse Wireless, LLC v. Nokia, et al., Case No. 2:21-CV-00063-JRG, EDTX
Consulted for defendant Nokia on claim construction. Wrote declaration and deposed on 8/17/21.

June 2021 – Dec 2021, Knobbe, Martens, Olson & Bear, LLP
Vocalife LLC v. Amazon.com, Inc., et al., Case No. 2:20-cv-00401-JRG-RSP, EDTX
Consulted for defendant Amazon on claim construction. Stayed pending sister case outcome.

March 2021 – Sept 2021, Wilson Sonsini
Lenovo Holding Co, Inc., et al. v. InterDigital Technology Corp.
IPR. Consulted for InterDigital. Wrote three declarations. Deposed 7/27/21.

January 2021 – May 2021, Winston & Strawn, LLP
Ericsson, Inc. v. Samsung Electronics, Ltd., ITC
Consulted for plaintiff. Settled May 2021. No deposition. No declaration filed.
Patents dealt with antenna arrays for 5G/4G base stations, access point signaling, bearer handling.

November 2020 – June 2021, Sheppard Mullin
Hong Kong uCloudlink v. SIMO Holdings, Inc. and Skyroam, Inc., Case No. 18-cv-05031-EMC, NDCA. Consulted for plaintiff uCloudlink on infringement and validity. Deposed (3/26/21). Case settled. Virtual SIM technology.

August 2019 – August 2020; June 2021 – Sept 2021 McKool Smith/Irell & Manella
Optis Wireless Technology, LLC et al. v. Apple, Inc., EDTX, Civ No. 2:19-cv-66
Consulted for plaintiff Optis. Infringement and validity analysis/reports, IPR. Deposed 06/01/20 and testified at trial 8/3/20 – 8/9/20. Re-trial for damages 8/10/21 – 8/16/21.

March 2019 – May 2020 Gibson, Dunn, & Crutcher, LLP
Sol IP v. AT&T, Ericsson, Nokia, Verizon, and Sprint, EDTX, Case No. 2:18-cv-526
Consulted for defendants on patents involving LTE downlink cell search and synchronization signaling. Invalidity, non-infringement analysis/reports, claim construction. No deposition, case settled.

2016 – March 2019 Sidley Austin, LLP
Huawei v. Samsung, NDCA
Case No. 3:16-cv-02787-WHO
Consulted for plaintiff Huawei on original complaint and for defendant Huawei on counterclaims on patents involving control channel signaling, network access, and security. Assisted claim construction, IPR petition and preliminary response, wrote validity and non-infringement reports. Deposed 6/20/18, 7/19/18. Case settled.

Case Testimony History:

March 2022 – December 2022, McKool Smith
Ericsson Inc. and Telefonaktiebolaget LM Ericsson vs. Apple Inc., Inv. No. 337-TA-1299, ITC
Consulting for Ericsson. Opening and Rebuttal report. Deposed 10/7/2022. Testified 12/7/2022. Case settled during trial.

May 2022 – December 2022, McKool Smith; Alston Bird
Ericsson Inc. and Telefonaktiebolaget LM Ericsson vs. Apple Inc., Case No. 2:21-cv-376, EDTX
Consulting for plaintiff and counter-defendant Ericsson.
Report on Essentiality and Rebuttal report. Deposed 10/4/2022. Case settled.

September 2021 – December 2021, Duane Morris, LLP
KAIFI LLC v. Verizon Wireless, Case No. 2:20-cv-280-JRG, EDTX
Consulted for defendant Verizon. Wrote Non-Infringing Alternatives and Non-Infringement reports. Deposed 12/15/21. Case settled

July 2021 – August 2021, Quinn Emanuel, LLP
Finesse Wireless, LLC v. Nokia, et al., Case No. 2:21-CV-00063-JRG, EDTX
Consulted for defendant Nokia on claim construction. Deposed on 8/17/21.

March 2021 – Sept 2021, Wilson Sonsini
Lenovo Holding Co, Inc., et al. v. InterDigital Technology Corp.
IPR. Consulted for InterDigital. Wrote three declarations. Deposed 7/27/21.

November 2020 – June 2021, Sheppard Mullin
Hong Kong uCloudlink v. SIMO Holdings, Inc. and Skyroam, Inc., Case No. 18-cv-05031-EMC, NDCA. Consulted for plaintiff uCloudlink on infringement and validity. Deposed 3/26/21.

August 2019 – August 2020; June 2021 – Sept 2021 McKool Smith/Irell & Manella
Optis Wireless Technology, LLC et al. v. Apple, Inc., EDTX, Civ No. 2:19-cv-66
SEPs – Consulted for plaintiff Optis on control channel MIMO switching; control channel information fields. Infringement and validity analysis/reports, IPR. Deposed 06/01/20 and testified at trial 8/3/20 – 8/9/20. Testified at re-trial for damages 8/10/21 – 8/16/21.

2016 – March 2019 Sidley Austin, LLP
Huawei v. Samsung, NDCA
Case No. 3:16-cv-02787-WHO
Consulted for plaintiff Huawei on original complaint and for defendant Huawei. Assisted claim construction, IPR petition and preliminary response, wrote validity and non-infringement reports. Deposed 6/20/18, and 7/19/18.

Teaching:

<u>Courses:</u>

- CSE 516 (Mobile Networks): Redesigned the course to integrate latest developments in mobile network architecture design. The course now includes signaling, control, and protocol issues unique to 4G and 5G architectures addressing eMBB, mMTC, and URLLC use cases critical to IoT and future wireless network development and future 6G networks.
- CSE 514 (Communication Networks)
- CSE 590 (Colloquium)
- CMPEN 462 (Wireless Communication Systems and Security): Created and designed this course to address a gap in the wireless communications area focusing on security. This course is included in the cybersecurity computational foundations minor.

- EE 456 (Introduction to Neural Networks): Created and designed this course and will apply to have it approved as a regular course in 2023. This course is intended to address the need for EE and CMPEN students to be exposed to the principles associated with artificial intelligence with a focus on the integration of physics-based approaches.
- CMPEN/EE 362 (Communication Networks)
- CMPSC 297 (Blockchain - Deep Dive): This course is 'module' driven and designed to provide students with a broad range of academic backgrounds an opportunity to learn about blockchains and cryptography. Under supervision, students in the Distributed Ledger Society teach the modules including theory and practice in the areas of programming, math, and cryptography.
- ACS 505 (Experimental Techniques in Acoustics)
- MATH 141 (Calculus with Analytical Geometry II)
- CMPSC 101 (Programming in C++)

Open Publications:

Sorensen, Mahon, Mehmeti, and LaPorta, *QoE-Analysis of 5G Network Resource Allocation Schemes for Competitive Multi-User Video Streaming Applications,* submitted January 2023.

Sorensen, Mehmeti, Mahon, LaPorta, and Cao, "EQMS: An Improved Energy-Aware and QOE-aware Video Streaming Policy across Multiple Competitive Mobile Devices", Wireless Networks: The Journal of Mobile Communication, Computation and Information, Dec. 2022.

Sorensen, Mehmeti, Mahon, Qui, Chan, Qui, and LaPorta, "Optimal Resource Allocation for Crowdsourced Image Processing", *IEEE Transactions on Mobile Computing*. June 2022.

Sorensen, Mehmeti, Mahon, La Porta, Cao, "Mutli-User Competitive Energy-Aware and QoE-Aware Video Streaming on Mobile Devices", *ACM Proceedings of the QoS and Security for Wireless and Mobile Networks (Q2SWinet) Symposium collocated with Modeling, Analysis, and Simulation of Wireless and Mobile Systems* (MSWIM 2020), Alicante, Spain, Nov. 2020.

Sorensen, Mehmeti, Mahon, Qui, Chan, and LaPorta, "Optimal Resource Allocation for Crowdsourced Image Processing", *IEEE International Conference on Sensing and Networking* (IEEE SECON 2020), Como, Italy, June 2020.

Swanson, Mahon, Norris, and Mast, "Atmospheric Multipath Resolution Using Spread Spectrum Acoustic Signals", *Proceedings of Meetings on Acoustics,* September 2017.

Aquaviva, Mahon, Einfalt, and LaPorta, "Optimal Cyber-Defense Strategies for Advanced Persistent Threats: A Game Theoretic Approach," *2017 International Symposium on Reliable and Distributed Systems,* Hong Kong, China, September 27 – 29, 2017.

Young, Mahon, and Wyckoff, "Automated Information Management," Chap. 12, *Mathematical Techniques in Multisensor Data Fusion,* Hall, David L., Artech House Inc., Mar 2004

Mahon, Sonsteby, and Wenchel, "Application of Non-Orthogonal Waveletes for Geolocation," *Radiolocation and Direction Finding Symposium*, Southwest Research Institute, San Antonio, Texas, 2-4 Nov. 1999.

Myers, Lovette, Kilgus, Giannini, Swanson, Reichard, Mahon, Mast, "A Java-based Information System for Wayside Sensing and Control," *Proc. of the 1998 ASME/IEEE Joint Railroad Conference,* 1998, pp. 135-147.

Mast, Swanson, Mahon, Norris, "Resolution of multipath outdoor sound propagation using spread spectrum signals," *J.Acoustic. Soc. Am.*, *Volume 101, Issue 5,* 1997

Swanson, Mast, Mahon, "Atmospheric Multipath Resolution Using Spread Spectrum Acoustic Signals," *Proceedings of the 133rd Meeting of the ASA*, June 15-20, 1997.

Mahon, Swanson, "Acoustic Holography as an Active Control Measurement Tool," *Proceedings of Active 95, The 1995 International Symposium on Active Control of Sound and Vibration,* Newport Beach, CA, July 1995, pp. 673-684.

Mahon, Sibul, Valenzuela, "A Sliding Window Update for the Basis Matrix of the QR Decomposition," IEEE Transactions on Signal Processing, May 1993, pp. 1951-1953.

Mahon, Sibul, Valenzuela, "An Alternative Updating Scheme for the QR Algorithm as Applied to Adaptive Beamforming," *Proc. 25th Annual Conf. on Info. Sciences and Systems,* Johns Hopkins University, Baltimore, MD, March 1991, pp. 193-199.

Awards/Honors:

Senior Member IEEE

2001 Formal citation letter from National Reconnaissance Office (NRO) for experimental work with mobile wireless systems

2001 Formal citation letter for excellence in software development from the NRO for work associated with mobile wireless systems

2000 Formal citation letter from NRO for development of wavelet course presented at NRO Technology Symposium

1997 Invited session chair of "Signal Processing in Acoustics: General Signal Processing," Noise-Con '97, 133rd meeting of the ASA

1996 Simowitz Citation Acoustics Department PSU for outstanding publication by a graduate student

1995 Invited co-chair of "Transducers for Active Control of Sound and Vibration," Active 95, Active Noise Control Conference

1993 Simowitz Award Acoustics Department PSU for outstanding publication by a graduate student

1987 Dr. A. J. Cawley Award for Excellence in Electronics Engineering by Physics/EE Department University of Scranton