



Forensic Engineering & Applied Research Expertise

Electrical Engineering

I investigate electrical and electronic systems, equipment, and devices to support litigation related to design, use, defects, malfunctions, modifications, and equipment breakdown in civil and criminal matters.

Wireless and Telecommunications Engineering

Over 25 years of experience in research, design, analysis, & measurement of cellular, GPS, 3G-5G, LTE, public safety comm systems, satellite, Internet, wireless, RF, Wi-Fi, radar, networks, data communications, communications protocols and standards, instrumentation, and control systems.

Cellular Evidence Mapping and Analysis

Understanding cell phone & base station records is critical for cases involving cellular evidence. I present the cellular record in easy to understand maps, animations, and timelines. These can show patterns of communications, whereabouts, and activity. I map & analyze records from all carriers.

Quality Sciences and Applied Research

Understanding *variability* is crucial to improving and controlling any process. I bring scholarship & practical experience in applied research & quality sciences to help clients understand variability and improve outcomes.

Studies show that most published scientific research cannot be reproduced [NAS, 2018]. The scientific, financial, and legal consequences of irreproducible research, from arbitrary research methods to improper analyses, are enormous. I ensure that solid and defensible methods inform your decisions.

Education


2017	Master of Engineering Engineering Management	<i>University of Colorado</i>
2015	Six Sigma Master Black Belt Quality Sciences: 24 graduate credit hours in applied research & statistics	<i>University of Colorado</i>
2007	Master of Engineering Telecommunications	<i>University of Colorado</i>
1997-2000	MSEE Coursework Nine trimester courses in microwave & control systems engineering	<i>Drexel University</i>
1996	Bachelor of Science Electrical Engineering	<i>Lehigh University</i>


Work History


Since 2015	Founder & CEO Discovery Engineering, PLLC	<i>Colorado</i>
Since 2002	Electronics Engineer US Department of Commerce Institute for Telecommunication Sciences	<i>Colorado</i>
2000-2001	Software Engineer Motorola Broadband Communications	<i>Pennsylvania</i>
1996-2000	Antenna Engineer Lockheed Martin Missiles and Space	<i>Pennsylvania</i>


MARK MCFARLAND, PE

ELECTRICAL & TELECOM ENGINEER STATISTICIAN

 Mark@DiscoveryEngineering.net

 (720) 593-1640

 Boulder, Colorado

 www.DiscoveryEngineering.net

LICENSED & BOARD CERTIFIED

Practice Areas

- ★ Electrical Engineering
- ★ Telecommunications Engineering
- ★ Wireless Engineering
- ★ Cellular Evidence Mapping & Analysis
- ★ Quality Sciences & Applied Research

Credentials

- ★ Diplomate in Forensic Engineering
- ★ Nationally Recognized Expert
- ★ Published in National & International Peer-Reviewed Journals
- ★ Speaker at National & International Technical Conferences
- ★ BS, Electrical Engineering
- ★ MEng, Telecommunications
- ★ MEng, Engineering Management
- ★ Certified Expert in the Quality Sciences (*Six Sigma Master Black Belt*)
- ★ Twenty-Five+ Years of Experience





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Selected Litigation History

1. **Mining Accident** Investigated underground mine communication system failure resulting in serious personal injury. *Plaintiff: Consultation*
2. **Automotive Wireless** Investigated insurer's claim that vehicle anomalies were caused by insured/claimant using a hidden wireless key fob. *Plaintiff: Consultation & Report*
3. **Securities Fraud** Investigated high-volume stock trades (*cross-trading*) resulting in \$40M deficit to broker. At issue: trades initiated on a private network with computers having allegedly spoofed MAC addresses. *FINRA Arbitration Defense: Consultation & Report*
4. **Electrocution** Investigated an electric circuit breaker panel which caused a severe shock, leading to personal injury. *Plaintiff: Consultation & Report*
5. **Murder Appeal** Provided opinion on the whereabouts of an individual's cell phone based upon service provider records for criminal murder appeal. *Appellant: Consultation, Report, & Court Testimony*
6. **Distracted Driver** Analyzed mobile phone records to quantify voice, SMS, & data usage at time of auto accident. *Defense: Consultation & Report*
7. **Software Licensing** Explained differences between types of software licenses related to disagreements regarding the technical terms of a *field of use* software license. *Defense: Consultation & Report*
8. **Protection Order** Examined threatening SMS texts & social media posts. Testified on authenticity and source. *Defense: Consultation & Court Testimony*
9. **Home Invasion** Mapped location and provided opinion on the whereabouts of an individual's cell phone based upon cellular carrier records for criminal appeal. *Appellant: Consultation, Report, & Pending Court Testimony*
10. **Sex Trafficking** Analyzed, tabulated, and mapped an individual's Google location history record. I provided an opinion on the individual's whereabouts over a three month period. *Defense: Consultation & Report*

License and Certifications

2006	Professional Engineer PE-0040278	State of Colorado
2016	Six Sigma Master Black Belt	University of Colorado
2016	Competent Communicator	Toastmasters International
2022	Diplomate in Forensic Engineering	Nat'l Academy of Forensic Engineers

Training and Continuing Education

2021	5G Networks and Services
2020	Spectrum Analysis Fundamentals
2020	RF Fundamentals Seminar
2020	Signal Integrity Workshop
2019	LTE 5G Boot Camp
2019	Vector Signal Analyzer Training
2018	GPS and the Global Navigation Satellite System
2012-15	Quality Sciences (Applied Statistics: 24 graduate credit hours)
2015	Radiowave Propagation
2014	LTE Air Interface and Interference Considerations
2007	Regression, Contingency Tables, and Logistic Regression
2003	Ethernet Network Analysis and Troubleshooting
2003	Troubleshooting with the Sniffer Portable Network Analyzer



Refereed Publications

1. R. T. Johnk, M. Powell, J. Griffith, M. McFarland, K. Baker, P. Daithanker, S. Samdian, L. Gopal, and S. Gavva, "In-building LTE testing at the University of Colorado," National Telecommunications and Information Administration (NTIA), U.S. Dept. of Commerce, NTIA Report TR-15-518, July 2015. Available: <http://www.its.bldrdoc.gov/publications/2807.aspx>
2. R. Achatz, M. McFarland, R. Dalke, P. McKenna, F. Sanders, and G. Sanders, "Effects of broadband radio service reallocation on S-band marine radars: Front-end overload," National Telecommunications and Information Administration (NTIA), U.S. Dept. of Commerce, NTIA Report TR-15-515, April 2015. Available: <http://www.its.bldrdoc.gov/publications/2798.aspx>
3. M. McFarland and R. Johnk, "Characterizing an S-band marine radar receiver in the presence of interference," in *Electromagnetic Compatibility (EMC), 2012 IEEE International Symposium on*, August 2012, pp. 579–583. Available: <http://ieeexplore.ieee.org/xpl/articleDetails.jsp?partnum=6350926&searchProductType=IEEE%20Conferences>
4. R. Johnk, C. Hammerschmidt, M. McFarland, and J. Lemmon, "A fast-fading mobile channel measurement system," in *Electromagnetic Compatibility (EMC), 2012 IEEE International Symposium on*, August 2012, pp. 584–589. Available: <http://ieeexplore.ieee.org/xpl/articleDetails.jsp?partnum=6350925&searchProductType=IEEE%20Conferences>
5. M. McFarland, M. Pinson, C. Ford, A. Webster, W. Ingram, S. Hanes, and K. Anderson, "Relating audio and video quality, using CIF video," National Telecommunications and Information Administration (NTIA), U.S. Dept. of Commerce, NTIA Technical Memorandum 10-472, September 2010. Available: <http://www.its.bldrdoc.gov/publications/2547.aspx>
6. R. Johnk, J. Ewan, N. DeMinco, R. Carey, P. McKenna, C. Behm, T. Riley, S. Carroll, M. McFarland, and J. Leslie, "High-resolution propagation measurements using biconical antennas and signal processing," in *Electromagnetic Compatibility (EMC), 2010 IEEE International Symposium on*, July 2010, pp. 85–90. Available: <http://ieeexplore.ieee.org/xpl/articleDetails.jsp?reload=true&arnumber=5711252&contentType=Conference+Publications>
7. DHS Public Safety Communications, "Task-based tactical and surveillance video quality tests," Statement of Requirements, US Department of Homeland Security, DHS Technical Report DHS-TR-PSC-10-07, July 2010. Available: <https://www.hsd1.org/?abstract&did=16117>
8. C. Ford, M. McFarland, A. Webster, S. Hanes, M. Pinson, A. Webster, and K. Anderson, "Multimedia synchronization study," National Telecommunications and Information Administration (NTIA), U.S. Dept. of Commerce, NTIA Technical Memorandum 10-464, February 2010. Available: <http://www.its.bldrdoc.gov/publications/2501.aspx>
9. F. Sanders, R. Johnk, M. McFarland, and R. Hoffman, "Emission measurement results for a cellular and PCS signal-jamming transmitter," National Telecommunications and Information Administration (NTIA), U.S. Dept. of Commerce, NTIA Technical Report 10-465, February 2010. Available: <http://www.its.bldrdoc.gov/publications/2503.aspx>
10. M. McFarland, "A subjective video quality test method for the assessment of recorded surveillance video," in *Proceedings of the American Academy of Forensic Sciences*, vol. 15, February 2009, p. 158. Available: <http://www.aafs.org/sites/default/files/pdf/ProceedingsDenver2009.pdf>
11. C. Ford, M. McFarland, and I. Stange, "Subjective video quality assessment methods for recognition tasks," in *Proceedings of the SPIE*, vol. 7240, February 2009. Available: <http://proceedings.spiedigitallibrary.org/proceeding.aspx?articleid=811708>

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Refereed Publications (continued)

12. ITU-T, *Subjective Video Quality Assessment Methods for Recognition Tasks*, International Telecommunications Union– Telecommunication Standardization Sector Recommendation P.912, August 2008. Available: <https://www.itu.int/rec/T-REC-P.912-200808-S/en>
13. M. McFarland, M. Pinson, and S. Wolf, "Batch video quality metric (BVQM) user's manual," National Telecommunications and Information Administration (NTIA), U.S. Dept. of Commerce, NTIA Handbook O6-441a, December 2006. Available: <http://www.its.bldrdoc.gov/publications/2476.aspx>
14. M. McFarland, "Batch Video Quality Metric Release Notes," National Telecommunications and Information Administration (NTIA), U.S. Dept. of Commerce, NTIA Software & Data SD-O6-443, August 2006. Available: <https://www.its.bldrdoc.gov/publications/2480.aspx>

Non-Refereed Reports

1. M. McFarland, "Verizon's base station proposal: what does it mean to you?," Discovery Engineering, Report to Leyden Rock Metropolitan District, December 2019.
2. M. McFarland, "Potential health hazards of radio frequency radiation," Discovery Engineering, Report to Broomfield City Council, March 2016.
3. M. McFarland, "Faraday cages for electromagnetic shielding," Discovery Engineering, Report to Broomfield City Council, March 2016.
4. M. McFarland, "Electromagnetic interference and the Permobil power wheelchair," Discovery Engineering, Report to Broomfield City Council, March 2016.
5. M. McFarland, "A critique of the competitive value model for agricultural tractors," University of Colorado, Whitepaper, September 2014, EMEN 5040: Quality, Strategy, and Value Creation.
6. M. McFarland, "An empirical study of the repeatability of the DSA testbed measurements," National Telecommunications and Information Administration (NTIA), U.S. Dept. of Commerce, Whitepaper, August 2010.
7. M. McFarland, "Stability, precision, and accuracy in VSA measurements," National Telecommunications and Information Administration (NTIA), U.S. Dept. of Commerce, Internal Report, August 2014.
8. C. Ford and M. McFarland, "New advances in the quality assessment of task-based video systems," National Telecommunications and Information Administration (NTIA), U.S. Dept. of Commerce, Technical Report, March 2009, unpublished.
9. M. McFarland, "A subjective video quality test methodology for the assessment of recorded surveillance video," Master of Engineering Thesis, University of Colorado, Boulder, CO, December 2007.

Presentations and Talks

1. *Cellular Evidence in Civil and Criminal Cases: Five Case Studies*, ProVisors Silicon Valley Attorney Affinity Group. March 2022, Delivered online.
2. *Verizon's Wireless Lease Agreement: What is it, and What does it Mean to the Residents of Leyden Rock?*, Leyden Rock Metropolitan District Special Meeting. December 2019, Arvada, CO.
3. *Screening Experiments in Mobile Channel Measurements*, International Symposium on Advanced Radio Technologies. July 2018, Broomfield, CO.
4. *Six Sigma Techniques to Validate and Generalize In-Building Path Loss Models*, International Union of Radio Science (URSI). January 2018, Boulder, CO.
5. *Statistical Learning to Classify Six In-Building Propagation Environments*, International Union of Radio Science (URSI). January 2018, Boulder, CO.



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Presentations and Talks (continued)

6. *Cell Towers: Their Present, Their Future*, Broomfield City Council meeting. March 2016, Broomfield, CO.
7. *In-Building Path Loss Model Analysis: Testing Assumptions and Identifying Outliers in Propagation Models*, International Union of Radio Science (URSI). January 2016, Boulder, CO. (session co-chair)
8. *In-Building Path Loss Modeling: An Application of Simple Linear Regression Analysis*, University of Colorado Boulder, Guest lecturer for graduate course in applied statistics. March 2015, Boulder, CO. (invited talk)
9. *A Fast-Fading Mobile Channel Measurement System*, IEEE Antenna Measurement Techniques Association. April 2013, San Diego, CA. (Presented by B Johnk)
10. *Characterizing an S-band Marine Radar Receiver in the Presence of Interference*, IEEE International Symposium in Electromagnetic Compatibility. August 2012, Pittsburgh, PA.
11. *Engineering Licensure: from Point A to P.E.*, Metropolitan State College of Denver, Tau Alpha Pi National Honor Society 35th Annual Dinner and Awards Program. April 2012, Denver, CO. (invited talk)
12. *Engineering Licensure: from Point A to P.E.*, University of Colorado Boulder, Undergraduate Professional Seminar. November 2011, Boulder, CO. (invited talk)
13. *Assessing the Quality of Recorded Surveillance Video*, US Department of Homeland Security. February 2009, Boulder, CO. (invited talk)
14. *A Subjective Video Quality Test Method for the Assessment of Recorded Surveillance Video*, American Academy of Forensic Sciences. February 2009, Denver, CO
15. *Assessing the Quality of Recorded Surveillance Video*, Scientific Working Group on Imaging Technology. January 2007, Orlando, FL. (invited talk)

Professional Affiliations

- Since 2022 **National Academy of Forensic Engineers**
Member
- Since 2022 **Institute of Electrical and Electronics Engineers (IEEE)**
Member
- Since 2018 **NSPE-Colorado Education Foundation**
Trustee
- Since 2008 **National Society of Professional Engineers (NSPE) - Colorado**
President, Vice President, Director, Secretary, Member