



Forensic Engineering & Applied Research Expertise

Electrical and Electronics Engineering

I investigate electrical and electronic components, equipment, systems, & devices to support litigation related to design, use, defects, malfunctions, modifications, and equipment breakdown for 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.

GPS and Cellular Evidence Analysis

Understanding GPS, cell phone, & base station evidence is critical. I present data and uncertainties in easy to understand maps, animations, timelines, and tables. These can show patterns of communications, whereabouts, and activity. I map & analyze records from all manufacturers and 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>


Employment 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 & Electronics Engineering
- ★ Telecommunications Engineering
- ★ Wireless Engineering
- ★ GPS & Cellular Evidence 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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Licenses and Certifications

2006	Professional Engineer	PE-0040278	State of Colorado
2022	Professional Engineer	E-24276	State of California
2016	Six Sigma Master Black Belt (Quality Sciences)		University of Colorado
2016	Competent Communicator		Toastmasters International
2022	Diplomate in Forensic Engineering		Nat'l Academy of Forensic Engineers

Testimony History

1. Jeffrey Williams v. State of Maine, State of Maine, Docket No. ALFSC-CR-13-726, February 23, 2021. Trial testimony for appellant. (Criminal murder appeal)
2. Tomkins v. Remacle, Boulder County Court, Case No. 21C139, May 11, 2021. Trial testimony for defendant. (Civil protection order)

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. **Social Media Metadata** Examined social media metadata, logs, cache, history, and device system records, as well as email metadata to provide an opinion on an individual's location. *Plaintiff: Consultation & Reports*
8. **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*
9. **Protection Order** Examined threatening SMS texts & social media posts. Testified on authenticity and source. *Defense: Consultation & Court Testimony*
10. **Home Invasion** Provided opinion on the whereabouts of an individual's cell phone based upon cellular carrier's base station GPS records for criminal appeal. *Appellant: Consultation, Report, & Pending Court Testimony*
11. **Sex Trafficking** Analyzed, tabulated, and mapped an individual's Google location history record. I provided an opinion on the plaintiff's whereabouts and activity over a three month period. *Defense: Consultation & Report*
12. **Hearing Damage** Investigated audio equipment which exposed Plaintiff to unsafe and damaging sound levels. *Plaintiff: Consultation & Report*
13. **Medical Electronics** Investigated hospital nurse call button and bed alarm to provide opinion on the cause of a malfunction. *Plaintiff: Consultation & Report*
14. **Wrongful Death** Investigated telecommunications wires & other equipment spanning roadway which contributed to death of motorist. *Plaintiff: Consultation*



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)
- 2014 LTE Air Interface and Interference Considerations

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>

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Refereed Publications (continued)

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>
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.
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. *Assessing the Quality of Recorded Surveillance Video*, US Department of Homeland Security. February 2009, Boulder, CO. (invited talk)
13. *A Subjective Video Quality Test Method for the Assessment of Recorded Surveillance Video*, American Academy of Forensic Sciences. February 2009, Denver, CO
14. *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 **Journal of the National Academy of Forensic Engineers**
Associate Editor
- 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

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