Tal R. Nagourney

PhD, PE, CFEI

Senior Consultant

Dr. Tal Nagourney is an electrical engineer specializing in fire investigation and failure analysis of batteries, electrical systems, consumer electronics, and semiconductor devices. He conducts scientific investigations to guide critical decisions.

His expertise is built on a foundation of research and experimental design from his doctoral studies in micro-electro-mechanical systems. As a forensic electrical engineer, he leverages that experience to lead an effective investigation, identify the root cause, and present the findings clearly to any audience.

Dr. Nagourney has investigated hundreds of incidents around North America. In the field, he thoroughly documents the scene and ensures critical evidence is preserved. In the laboratory, he performs meticulous testing to identify issues with design, manufacturing, and usage. His experience with failures lends itself to design review, and he helps his clients avoid product failures that elude typical safety standard testing.

Education

PhD, Electrical Engineering, University of Michigan, 2018

High-Q Fused Silica Micro-Shell Resonators for Navigation-Grade MEMS Gyroscopes

MEng, Electrical Engineering, Cornell University, 2012

BS, Microelectronic Engineering, Rochester Institute of Technology, 2010

Licenses & Certifications

- WA PE License No. 21031868
- CFEI Certification No. 23786-13772

Positions Held

Engineering Systems Inc., Seattle, Washington

- Senior Consultant, 2025 – Present
- Senior Staff Consultant, 2022–2024
- Staff Consultant, 2018–2021

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Areas of Specialization

- Electrical & Electronic Equipment
- Fire and Explosion Investigation
- Lithium-ion Battery Failure
- Battery Management Systems
- Consumer Electronics
- Consumer Appliances
- Semiconductor Devices
- USB Devices
- Radio Communications (RF)

University of Michigan, Ann Arbor, Michigan

- Doctoral Researcher, 2013–2018
- Lurie Nanofabrication Facility, User Committee Member, 2014–2018

Bright Source Industries (Israel) Ltd., Jerusalem, Israel

- Future Technologies, Electrical Engineering Consultant, 2011

Rochester Institute of Technology, Rochester, New York

- Team Galt, Research Assistant, 2009–2010

Eastman Kodak Company, Rochester, New York

- Display Technologies Group, Co-Op Employee, 2008

Continuing Education

- **Electrical Safety Training Program** — 2024 NFPA 70E Standard for Electrical Safety in the Workplace, 2025
- **Fire Investigation Training Program —** National Association of Fire Investigators (NAFI), 2024
- **Li-ion Battery Safety and Thermal Runaway** — Battery Safety Summit, 2023
- **Intensive Course on Electrical Contacts and Connector Design for Electronics and Microelectronics Applications** — Timron Advanced Connector Technologies, 2022
- **National Electrical Code Essentials** — National Fire Protection Association (NFPA), 2019
- **Fire Investigation Training Program** — National Association of Fire Investigators (NAFI), 2019

Professional Affiliations/Honors

Institute of Electrical and Electronics Engineers (IEEE)

- Member since 2016

Product Safety Engineering Society (PSES)

- Member since 2018

National Association of Fire Investigations (NAFI)

- Member since 2018

International Consumer Product Health and Safety Organization (ICPHSO)

- Member since 2022

University of Michigan Engineering Graduate Symposium

- Best Poster Award, 1st Prize, 2017
- Best Poster Award, 2nd Prize, 2016

University of Michigan Lurie Nanofabrication Facility Users Symposium

- Best Poster Award, 1st Prize, 2017
- Best Poster Award, 1st Prize, 2016

University of Michigan Workshop on Microsystems Tech for Internet of Things

- Best Poster Award, 1st Prize, 2017

DARPA micro-PNT MRIG micro-Challenge

- Winner, 2015

Project Experience

Investigations

Fire Investigation

- Hundreds of military-grade lithium-ion batteries were destroyed when one entered thermal runaway and ignited a fire that caused $2,700,000 of collateral damage. Analyzed the battery design, historical performance, and sequence of events to reveal the initiating factors and contributing conditions.
- A wildland fire burned 15,000+ acres, 100+ structures, and required 100,000+ residents to evacuate. Analyzed security camera footage, electrical utility fault data, and eyewitness accounts to create a coherent timeline and identify the root cause.
- A residential fire was blamed on a battery failure in a consumer electronics product. Despite not having the opportunity to inspect the fire scene, identified physical features on the collected evidence that proved the battery entered thermal runaway due to heat exposure and was a victim of the fire, not the cause.
- A residential fire originated at an e-bike battery. Through laboratory examination of the failed battery and an exemplar battery, determined that the failed battery had a different architecture that lacked a battery management system (BMS) and was therefore not supplied by the e-bike manufacturer.
- A residential fire caused extensive damage, resulting in a total loss. Through occupant interviews and scene and evidence inspections, traced the point of origin to a high resistance connection at an outdated circuit breaker panelboard.
- Deliberately initiated thermal runaway in a battery-powered product to evaluate the risk of fire spread. Determined that the packaging materials were combustible and the product construction did not prevent propagation, so thermal runaway resulted in rapid fire spread.

Failure Analysis

- The power supplies for LED-lit Christmas trees were overheating and burning floors. Identified improper circuit design that overheated resistors and transistors, then guided and validated a redesign with improved circuit architecture, fail-safes, and thermally stable materials.
- A company received hundreds of warranty claims for melted USB-C ports in their product. Extensive testing and analysis revealed electrochemical copper migration that formed short circuits through seams in the USB-C ports; confirmed this hypothesis by recreating the failure mode in the laboratory.
- Solar panel connectors were failing in the field, interrupting service and creating a fire hazard. An interdisciplinary investigation into the electrical design and material properties found that the electrical contacts had inadequate spring force, leading to high resistance connections that caused arcing failures.
- While a commercial aircraft was being powered by a ground power unit (diesel generator) on the tarmac, the aircraft fuselage plug failed and ejected sparks and flames. Identified the mechanism of connector failure and proposed an inspection routine for early detection of degrading plug contacts.
- Circuit boards in a certain model clothes dryer were repeatedly failing with thermal damage near a power relay. Determined that heat from the overloaded relay charred the cellulose circuit board, creating a short circuit failure that propagated toward the power source. Guided design revisions to prevent recurrence.
- The lithium-ion batteries in fever-detection thermal cameras were swelling after six months of service. Characterized the battery management system and identified the cause as improper charge termination.

Design Assistance

Battery Safety

- Guided comprehensive battery improvements for a handheld electronic device. Audited the battery manufacturer and recommended changes to prevent manufacturing defects, implemented a safer battery management system (BMS), and validated the design changes through inspection and electrical testing.
- A prototype product used lithium-ion batteries manufactured by two different vendors. Tested the battery management of each battery against the design specifications, evaluated performance during fault conditions, identified inconsistencies, and recommended revisions to improve safety and reliability.

Design Evaluation

- Performed a comprehensive design safety review for a prototype surge protective device (SPD). Identified hazards and guided revisions to improve safety. Evaluated the efficacy of the metal oxide varistor (MOV) thermal protection to reduce the risk of fire in the event of MOV thermal runaway.
- Tested the performance of a battery-powered wireless phone charger under misuse, abuse, and fault conditions. Using thermal imaging, identified a circuit component that exceeded 380 °C (716 °F) during an overcurrent fault and recommended design revisions to improve safety.
- Measured the electrical quality factors (energy leakage) of retail security tags from a manufacturer and their competitor using a vector network analyzer and RFID keycard test fixture. Produced a statistical analysis highlighting differences in performance and consistency.

Publications

"Gyroscope and Fabrication Process," K. Najafi, A. Darvishian, G. He, B. Shiari, and **T. Nagourney**, U.S. Patent 11 548 805, Jan. 10, 2023.

"High-Q Navigation-Grade Fused-Silica Micro Birdbath Resonator Gyroscope," J. Cho, S. Singh, **T. Nagourney**, J-K. Woo, A. Darvishian, B. Shiari, G. He, C. Boyd, E. Bentley, and K. Najafi, 2021 IEEE Sensors, Sydney, Australia, 2021, pp. 1–4, DOI: 10.1109/SENSORS47087.2021.9639559.

"The Implications of Post-Fire Physical Features of Cylindrical 18650 Lithium-Ion Battery Cells," **T. Nagourney**, J. Jordan, L. Marsh, D. Scardino, and B. May, J. Fire Technol., Jan. 2021, DOI: 10.1007/s10694-020-01077-8.

"Laser Self-Mixing Interferometry for Precision Displacement Measurement in Resonant Gyroscopes," G. He, R. Gordenker, J-K. Woo, J. Nees, B. Shiari, **T. Nagourney**, J. Cho, and K. Najafi, in 2019 IEEE Int. Symp. on Inertial Sensors and Systems (INERTIAL), Naples, FL, 2019, pp. 183–186, DOI: 10.1109/ISISS.2019.8739659.

"Design and fabrication of high-Q birdbath resonator for MEMS gyroscopes," S. Singh, **T. Nagourney**, J. Cho, A. Darvishian, K. Najafi, and B. Shiari, in 2018 IEEE/ION Position, Location and Navigation Symp. (PLANS), Monterey, CA, 2018, pp. 15–19, DOI: 10.1109/PLANS.2018.8373358.

"Simulation-Based Approach for Fabrication of Micro-Shell Resonators with Controllable Stiffness and Mass Distribution," B. Shiari, **T. Nagourney**, S. Singh, J. Cho, and K. Najafi, in 2018 IEEE Int. Symp. on Inertial Sensors and Systems (INERTIAL), Moltrasio, Italy, 2018, pp. 145–148, DOI: 10.1109/ISISS.2018.8358146.

"Fabrication of Hemispherical Fused Silica Micro-Resonator with Tailored Stiffness and Mass Distribution," **T. Nagourney**, S. Singh, B. Shiari, J. Cho, and K. Najafi, in 2018 IEEE Micro Electro Mechanical Systems (MEMS), Belfast, Ireland, 2018, pp. 1000–1003, DOI: 10.1109/MEMSYS.2018.8346727.

"Three Dimensional Microstructures and Fabrication Process," K. Najafi, **T. Nagourney**, and J. Cho, U.S. Patent 9 796 586, Oct. 24, 2017.

"Thermoelastic Dissipation in Micromachined Birdbath Shell Resonators," A. Darvishian, **T. Nagourney**, J. Cho, B. Shiari, and K. Najafi, J. Microelectromech. Syst., vol. 26, no. 4, pp. 758–772, Aug. 2017, DOI: 10.1109/jmems.2017.2715319.

"Simulation of Blowtorch Reflow of Fused Silica Micro-Shell Resonators," B. Shiari, **T. Nagourney**, A. Darvishian, J. Cho, and K. Najafi, J. Microelectromech. Syst., vol. 26, no. 4, pp. 782–792, Aug. 2017, DOI: 10.1109/JMEMS.2017.2693291.

"259 Second Ring-Down Time and 4.45 Million Quality Factor in 5.5 kHz Fused Silica Birdbath Shell Resonator," **T. Nagourney**, J. Cho, B. Shiari, A. Darvishian, and K. Najafi, in 2017 Transducers — 19th Int. Conf. on Solid-State Sensors, Actuators and Microsystems (TRANSDUCERS), Kaohsiung, Taiwan, 2017, pp. 790–793, DOI: 10.1109/transducers.2017.7994167.

"Numerical Study of Impact of Surface Roughness on Thermoelastic Loss of Micro-Resonators," B. Shiari, **T. Nagourney**, A. Darvishian, J. Cho, and K. Najafi, in 2017 IEEE Int. Symp. on Inertial Sensors and Systems (INERTIAL), Kauai, HI, 2017, pp. 74–77, DOI: 10.1109/isiss.2017.7935681.

"Effect of Drive-Axis Displacement on MEMS Birdbath Resonator Gyroscope Performance," C. Boyd, J.-K. Woo, J. Cho, **T. Nagourney**, A. Darvishian, B. Shiari, and K. Najafi, in 2017 IEEE Int. Symp. on Inertial Sensors and Systems (INERTIAL), Kauai, HI, 2017, pp. 175–176, DOI: 10.1109/isiss.2017.7935697.

"Anchor Loss in Hemispherical Shell Resonators," A. Darvishian, B. Shiari, J. Cho, **T. Nagourney**, and K. Najafi, J. Microelectromech. Syst., vol. 25, no. 1, pp. 51–56, Feb. 2017, DOI: 10.1109/JMEMS.2016.2636080.

"Ultra Conformal High Aspect-Ratio Small-Gap Capacitive Electrode Formation Technology for 3D Micro Shell Resonators," J. Cho, **T. Nagourney**, A. Darvishian, and K. Najafi, in 2017 IEEE 30th Int. Conf. on Micro Electro Mechanical Systems (MEMS), Las Vegas, NV, 2017, pp. 1169–1172, DOI: 10.1109/MEMSYS.2017.7863623.

"130 Second Ring-Down Time and 3.98 Million Quality Factor in 10 kHz Fused Silica Micro Birdbath Shell Resonator," **T. Nagourney**, J. Cho, A. Darvishian, B. Shiari, and K. Najafi, in Hilton Head Workshop: A Solid-State Sensors, Actuators and Microsystems Workshop, Hilton Head Island, SC, 2016, pp. 408–411, DOI: 10.31438/trf.hh2016.109.

"Numerical Prediction of Stress Evolution During Blowtorch Reflow of Fused Silica Micro-Shell Resonators," B. Shiari, **T. Nagourney**, A. Darvishian, J. Cho, and K. Najafi, in 2016 IEEE Int. Symp. on Inertial Sensors and Systems, Laguna Beach, CA, 2016, pp. 13–16, DOI: 10.1109/ISISS.2016.7435533.

"Micromachined High-Q Fused Silica Bell Resonator with Complex Profile Curvature Realized Using 3D Micro Blowtorch Molding," **T. Nagourney**, J. Cho, A. Darvishian, B. Shiari, and K. Najafi, in 2015 Transducers — 18th Int. Conf. on Solid-State Sensors, Actuators and Microsystems (TRANSDUCERS), Anchorage, AK, 2015, pp. 1311–1314, DOI: 10.1109/TRANSDUCERS.2015.7181172.

"A Comparison Between Experiments and FEM Predictions for Blowtorch Reflow of Fused Silica Micro-Shell Resonators," B. Shiari, A. Darvishian, **T. Nagourney**, J. Cho, and K. Najafi, in 2015 Transducers — 18th Int. Conf. on Solid-State Sensors, Actuators and Microsystems (TRANSDUCERS), Anchorage, AK, 2015, pp. 776–779, DOI: 10.1109/TRANSDUCERS.2015.7181038.

"Effect of Metal Annealing on the Q-Factor of Metal-Coated Fused Silica Micro Shell Resonators," **T. Nagourney**, J. Cho, A. Darvishian, B. Shiari, and K. Najafi, in 2015 IEEE Int. Symp. on Inertial Sensors and Systems, Hapuna Beach, HI, 2015, pp. 13–17, DOI: 10.1109/ISISS.2015.7102361.

"Fused Silica Micro Birdbath Shell Resonators with 1.2 Million Q and 43 Second Decay Time Constant," J. Cho, **T. Nagourney**, A. Darvishian, B. Shiari, J.-K. Woo, and K. Najafi, in Hilton Head Workshop: A Solid-State Sensors, Actuators and Microsystems Workshop, Hilton Head Island, SC, 2014, pp. 103–104, DOI: 10.31438/trf.hh2014.28.

"Investigation of Thermoelastic Loss Mechanism in Shell Resonators," A. Darvishian, B. Shiari, J. Cho, **T. Nagourney**, and K. Najafi, in ASME 2014 Int. Mech. Eng. Congr. and Expo., Montreal, Canada, 2014, pp. 1–6, DOI: 10.1115/IMECE2014-39331.

Presentations

"Investigating Electrical Fires," **T. Nagourney**, Training course presented to Texas Fire Marshals Association (TFMA), San Marcos, TX, Oct. 2025.

"Unraveling the Mystery: A Forensic Approach to Alleged Battery Failures," **T. Nagourney** and B. May, Amazon SafeTech Vendor Talk, Seattle, WA, Sep. 2025.

"Unraveling the Mystery: A Forensic Approach to Alleged Battery Failures," **T. Nagourney** and B. May, Volta Foundation Battery Forum, Seattle, WA, Jul. 2025.

"Electricity and Fire," **T. Nagourney**, Training course presented to National Association of Fire Investigators (NAFI), Fire Investigation Training Program, Tempe, AZ, Jun. 2025.

"Investigation of Electrical Fires," **T. Nagourney**, Training course presented to International Association of Arson Investigators (IAAI), Washington Chapter 21, Kent, WA, Jan. 2024.

"Pursuit of Lithium-Ion Battery Fire Claims," **T. Nagourney**, K. Farnam, and N. Simons, Cozen O'Connor CLE, Seattle, WA, Mar. 2023.

"USB Type-C: Connect With Care," **T. Nagourney**, International Consumer Product Health and Safety Organization (ICPHSO), Orlando, FL, Feb. 2023.

"Defense of Lithium Batteries Involved in a Fire," **T. Nagourney** and D. Fleming, Washington Defense Trial Lawyers (WDTL) CLE, Seattle, WA, Nov. 2020.