Kenneth McAfee

kennethmcafee7201@gmail.com | 914-318-7555 | linkedin.com/in/kennymcafee

Education

Ph.D., Aerospace Engineering *Spring 2021 — Fall 2025*
University of Maryland, College Park, MD
GPA: 4.0
Advisor: Prof. Oded Rabin, Co-Advisor: Prof. Peter Sunderland
NASA Space Technology Research Fellow, Clark Doctoral Fellow
Thesis title: *Heat Flux Sensors and Reconstruction Techniques for Atmospheric Entry Spacecraft*

M.S., Mechanical Engineering *Fall 2019 — Spring 2020*
Binghamton University, Binghamton, NY
GPA: 4.0

B.S., Mechanical Engineering *Fall 2015 — Spring 2019*
Binghamton University, Binghamton, NY
GPA: 3.85, *Summa Cum Laude*

Professional Experience

NASA Space Technology Research Fellow *Sept 2023 — Present*
Materials and Interface Nanotechnology Laboratory, University of Maryland *College Park, MD*

- Developed efficient Green's function-based numerical algorithms to investigate atmospheric entry heating from measurements embedded in spacecraft thermal protection systems, demonstrating a 3+ order of magnitude lower computation cost versus current analysis techniques.
- Developed sensor fusion techniques to merge data from temperature and heat flux sensors aboard entry spacecraft to increase robustness of post-flight analyses.

Visiting Technologist *June 2025 — Aug 2025*
Thermal Protection System Materials Branch, NASA Ames Research Center *Moffett Field, CA*

- Characterize catalytic recombination efficiency of surface coatings on entry spacecraft for refinement of atmospheric entry heating predictions.
- Validate gas-surface interaction models against arc-jet test data using Icarus and PATO material response codes.

Visiting Technologist *June 2024 — Aug 2024*
Entry Systems and Vehicle Development Branch, NASA Ames Research Center *Moffett Field, CA*

- Validated Green's function-based reconstruction methodology using measurements from arc-jet test articles.
- Utilized Green's function-based reconstruction methodology to analyze the atmospheric entry heat loads on the Mars 2020 backshell.
- Performed full-flight uncertainty quantification and variance-based sensitivity analysis of reconstructed heating profiles to identify primary sources of reconstruction uncertainty.
- Developed portable heat flux sensor calibration systems for in-situ testing during flight qualification (prototype advanced to TRL 4+).

Graduate Research Assistant *Jan 2021 — Aug 2023*
Materials and Interface Nanotechnology Laboratory, University of Maryland *College Park, MD*

- Led project to develop robust heat flux sensors for extreme environment applications.
- Designed, fabricated, and characterized prototype heat flux measurement devices compatible with operating temperatures exceeding 1000 °C using novel thermoelectric principles.
- Developed sensor characterization techniques to analyze prototype measurement systems at application-relevant temperatures (up to 500 °C).
- Conducted characterization of thermoelectric transport properties in transducer materials.
- Performed spectral analysis of thin-film, fast response (>1 MHz) heat flux sensors.

Visiting Graduate Research Assistant *Feb 2023 — April 2023*
Leibniz Institute for Solid State and Materials Research *Dresden, Germany*

- Investigated artificial multi-layered thermoelectric materials for use in solid-state devices.
- Characterized transport properties of novel thermoelectric materials.

Hardware Development Intern *Jan 2020 — Aug 2020*
IBM *Poughkeepsie, NY*

- Developed cost-effective, efficient thermomechanical finite element models using Python to analyze the performance of land-grid-array signal contacts.

Mechanical Engineering Intern *Summer 2018, Summer 2019*
Corning Incorporated *Corning, NY*

- Developed image processing-based measurement techniques capable of nanoscale precision to improve the performance of optical fiber cable connectors.
- Designed experiments to characterize thermomechanical behavior of optical fiber connectors.
- Developed thermomechanical numerical models to validate experimental results.

Project Experience

Solid-State Annular Power Generators for Waste Heat Harvesting in Directed Energy Systems *Fall 2024 — Spring 2025*
College Park, MD
Radiance Technologies Innovation Bowl (1st Place)

- Led the design, fabrication, and characterization of mass-efficient annular thermoelectric generator (ATEG) concept to harvest waste heat from high-powered laser systems.
- Developed in-house fabrication process to manufacture proof-of-concept device within a limited time-frame (<2 months) and budget (<$500).
- Simulated prototype device performance using ANSYS Mechanical APDL to correlate experimental measurements with theoretical predictions.

Chassis Technical Lead *Fall 2018 — Summer 2019*
SAE Supermileage, Binghamton University *Binghamton, NY*

- Led the design and manufacturing of composite monocoque chassis used in Binghamton University's 2019 SAE Supermileage competition vehicle.
- Used SolidWorks and ANSYS Mechanical APDL to design and analyze composite chassis.
- Conducted composite testing to determine optimal sandwich structure configuration.
- Developed custom in-house manufacturing process used to fabricate composite structures with optimal material properties.

Leadership Experience

Academic and Professional Chair *Fall 2021 — Fall 2023*
Aerospace Graduate Student Advisory Committee, University of Maryland *College Park, MD*

- Organized industry-oriented networking events for aerospace engineering graduate students.
- Organized academic networking luncheons for aerospace engineering graduate students.

Advisor *Fall 2019 — Fall 2021*
SAE Supermileage, Binghamton University *Binghamton, NY*

- Advised teams of undergraduate students developing the Binghamton University SAE Supermileage competition vehicle.
- Led the knowledge retention of composite materials research and advised on future chassis designs.

Honors and Awards

- 1st Place - Radiance Technologies Innovation Bowl *April 2025*
- Best Poster Award, The WE-Heraeus Seminar on Transverse Effects in Thermoelectric Systems *Oct 2024*
- Alexander Brown Memorial Scholarship and Leadership Award, University of Maryland *May 2024*

- Clark Doctoral Fellows Mid-Career Award, University of Maryland *Jan 2024*
- NASA Space Technology Graduate Research Opportunities (NSTGRO) Fellowship *Fall 2023*
- Best Poster Award, The 34th NASA Thermal Fluids and Analysis Workshop *Aug 2023*
- Dan Hogan Service Award, Binghamton University *Spring 2020*
- 2019-2020 Mechanical Engineering Student Excellence Scholarship, Binghamton University *Fall 2019*
- Tau Beta Pi National Engineering Honors Society *Spring 2018*
- 2017-2018 Ahilya Devi Memorial Scholarship, Binghamton University *Fall 2017*
- Pi Tau Sigma International Mechanical Engineering Honors Society *Fall 2017*
- Eagle Scout *Fall 2013*

Technical Skills

Programing: MATLAB, ANSYS APDL, Python, Git, SolidWorks, PATO, Icarus, LabView, Excel/VBA.
Experimental: Heat flux measurements, thermoelectric properties measurements, optics-based measurements, image processing, thermomechanical properties measurements, device fabrication, welding, soldering, manual milling/turning.

Refereed Publications

1. McAfee, K., Sunderland, P. B., & Rabin, O. "A Heat Flux Sensor Leveraging the Transverse Seebeck Effect in Elemental Antimony." *Sensors and Actuators A: Physical* **363**, 114729 (2023).
2. McAfee, K., Sunderland, P. B., & Rabin, O. "A High-Temperature Heat Flux Sensor Using the Transverse Seebeck Effect in Elemental Rhenium." *Sensors and Actuators Reports* **10**, 100391 (2025).
3. McAfee, K., Song, Z., Sunderland, P. B., & Rabin, O. "Transfer Calibration of Heat Flux Sensors Up to 500 °C." *International Journal of Heat and Mass Transfer* (2025, in preparation).
4. McAfee, K., Alpert, H. S., & Rabin, O. "Reconstruction of Ablative Thermal Protection System Aeroheating Using a Green's Function Approach." *Journal of Spacecraft and Rockets* (2025, in preparation).
5. McAfee, K., Alpert, H. S., & Rabin, O. "A Sensor Fusion-Based Regularization Approach for Stabilizing Inverse Heat Transfer Problems for Atmospheric Entry Spacecraft." *Journal of Thermophysics and Heat Transfer* (2025, in preparation).

Conference Publications

1. McAfee, K., Alpert, H., & Rabin, O., "Reconstruction of Thermal Protection System Aeroheating Using a Green's Function Approach." In *AIAA SCITECH 2025 FORUM*, American Institute of Aeronautics and Astronautics, Orlando, FL (2025).
2. McAfee, K., Alpert, H., Sunderland, P., & Rabin, O., "A Green's Function Sensor Fusion Approach for Evaluating Spacecraft Entry Heating From On-Board Thermal Instrumentation." In *AIAA AVIATION 2024 FORUM*, American Institute of Aeronautics and Astronautics, Las Vegas, NV (2024).

Oral Seminars

1. McAfee, K., "Green's Functions for Efficient Inverse Heat Transfer Solvers." NASA Ames Research Center, Moffett Field, CA (2025).
2. McAfee, K., "Design and Characterization of a Transverse Seebeck Effect Heat Flux Sensor." Leibniz Institute for Solid State and Materials Research, Dresden, Germany (2023).

Presentations

1. McAfee, K., Alpert, H. S., & Rabin, O., "Reconstruction and Uncertainty Quantification of Atmospheric Entry Heat Loads Using a Green's Function Approach." The 36th NASA Thermal Fluids and Analysis Workshop, San Jose, CA (2025). Poster Presentation
2. McAfee, K., Alpert, H. S., & Rabin, O., "A Green's Function Sensor Fusion Approach for Reconstructing the Heat Loads on Atmospheric Entry Spacecraft." The 22nd International Planetary Probe Workshop, Stuttgart, Germany (2025). Poster Presentation.

3. McAfee, K., Sunderland, P. B., & Rabin, O., "Extreme Environment Heat Flux Sensors for Planetary Entry Spacecraft." The 22nd International Planetary Probe Workshop, Stuttgart, Germany (2025). Poster Presentation.

4. McAfee, K., Alpert, H. S., Sunderland, P. B., & Rabin, O., "Direct Reconstruction of Ablative Thermal Protection System Aeroheating Using a Green's Function Approach." The 14th Ablation Workshop, Laurel, MD (2024). Poster Presentation.

5. McAfee, K., Sunderland, P. B., & Rabin, O., "Robust Through Simplicity: Leveraging the Transverse Seebeck Effect for Extreme Environment Heat Flux Sensing." The WE-Heraeus Seminar on Transverse Effects in Thermoelectric Systems, Bonn, Germany (2024). Poster Presentation. *Awarded Best Poster.*

6. McAfee, K., Sunderland, P. B., & Rabin, O., "Robust Heat Flux Sensors for Power Plant Extreme Environments." The 2024 APS March Meeting, Minneapolis, MN (2024). Oral Presentation.

7. McAfee, K., Sunderland, P. B., & Rabin, O., "Design and High-Temperature Characterization of an Extreme Environment Heat Flux Sensor." The 2023 JANNAF Joint Subcommittee Meeting, Salt Lake City, UT (2023). Oral Presentation.

8. McAfee, K., Sunderland, P. B., & Rabin, O., "Leveraging the Transverse Seebeck Effect for Robust Heat Flux Sensors." The 34th NASA Thermal and Fluids Analysis Workshop, College Park, MD (2023). Poster Presentation. *Awarded Best Poster.*

9. McAfee, K., Sunderland, P. B., & Rabin, O., "Design and Characterization of a Single Crystal Antimony Heat Flux Sensor Utilizing the Transverse Seebeck Effect." The 39th Annual International Conference on Thermoelectrics, Seattle, WA (2023). Oral Presentation.

10. McAfee, K., Sunderland, P. B., & Rabin, O., "Robust Heat Flux Measurement Systems via the Transverse Seebeck Effect." Burger's Program and Combustion Institute Summer School on Fire Safety Science, College Park, MD (2023). Poster Presentation.

11. McAfee, K., Sunderland, P. B., & Rabin, O., "Utilizing the Transverse Seebeck in Anisotropic Single Crystals for Novel Heat Flux Sensing Devices." The 30th International Materials Research Congress, Virtual (2022). Oral Presentation.

12. McAfee, K., Sunderland, P. B., & Rabin, O., "Leveraging Thermoelectric Anisotropy in Single Crystal Antimony for Novel Heat Flux Sensing Devices." The 64th Electronic Materials Conference, Columbus, OH (2022). Poster Presentation.