KRISTINA MARIAN LEMMER, PH.D.

Western Michigan University
Department of Mechanical and Aerospace Engineering
Parkview Campus G-229 * Kalamazoo, MI 49008
Phone: (734) 330-5932 * email: kristina.lemmer@wmich.edu

EDUCATION

Ph.D. in Aerospace Engineering – Advisor: Professor Alec D. Gallimore August 2009
The University of Michigan, Ann Arbor, MI
Plasmadynamics and Electric Propulsion Laboratory (PEPL)
Doctoral Thesis: Use of a Helicon Source for Development of a Re-Entry Blackout Amelioration System

MSE in Aerospace Engineering, Concentration in Aerospace Fluids and Propulsion May 2004
The University of Michigan, Ann Arbor, MI

BSE in Aerospace Engineering – Concentration in Spacecraft May 2003
The University of Michigan, Ann Arbor, MI

RESEARCH INTERESTS

- Electric propulsion fundamentals
- Experimental plasma diagnostic development and applications
- Laser diagnostics for atmospheric plasma applications and electric propulsion research
- Atmospheric pressure plasma discharges and non-thermal plasma discharges
- Small satellite and CubeSat propulsion integration
- Small satellite and CubeSat development

RESEARCH AND EMPLOYMENT EXPERIENCE

Full Professor July 2023 – Present
Associate Professor July 2018 – June 2023
Assistant Professor August 2012 – June 2018
Western Michigan University, Kalamazoo, MI
Department of Mechanical and Aerospace Engineering
Presidential Innovation Professor
Director, Aerospace Laboratory for Plasma Experiments (ALPE)

- Plasma diagnostic experimentation
  - Emission spectroscopy, laser spectroscopy, Laser scattering, Langmuir probes, retarding potential analyzers, Faraday probes, high-speed diagnostics, etc.
- Hall thruster oscillations and erosion
- Hollow cathode oscillations
- Electrospray propulsion
- Electric propulsion facility effects
- Nanosecond repetitively pulsed atmospheric discharges
- Basic vaporization and ionization processes for ionic liquids
- Extensive experience in vacuum operations and setting up vacuum testing facilities
- Small satellite design and development
- Balloon based experiment development

Faculty Advisor, Western Aerospace Launch Initiative (WALI)

- Mentor to undergraduate and graduate Registered Student Organization
- Lead group of diverse students in the design, build, test, and future operations of a nanosatellite
- Liaison with Air Force Research Laboratory to handle funding for satellite design and build, organize design reviews, and ensure design progress.

Dream Fellow August 2021 – May 2022

- Job shadow positions of university leadership including VP for Research, Dean of the College of Arts and Sciences, and Provost
- Participate in diversity, equity, and inclusion seminars and meetings
- Lead a DEI enhancement project on campus
    - Revision of the undergraduate research program to be more inclusive of students who cannot afford to participate in extracurricular activities due to the need for external support

Air Force Research Laboratory, May 2018 – July 2018/ June 2019 – July 2019
Summer Faculty Fellow
Electrical Systems Branch, AFRL, RQQE

- Rayleigh and Raman scattering laser diagnostics of a nanosecond pulsed plasma discharge

Jet Propulsion Laboratory, Summer Faculty Fellow June 2012 – August 2012
Electric Propulsion Group

- Development of a testing platform and procedure for optical emission spectroscopy for Boron detection in the plume of Hall thrusters

Assistant Professor (tenure track) August 2009 – August 2012
Central Michigan University, Mt. Pleasant, MI
School of Engineering and Technology
Director, Experimental Plasma Diagnostics Laboratory

- Plasma diagnostic experimentation
- Microwave plasma sources
    - High pressure plasma experimentation and probe development
- Langmuir Probe development and improvement
    - High pressure probe diagnostics and non-thermal plasmas
- Undergraduate student involvement in experimental plasma and vacuum system research

Graduate Student Research Assistant September 2003 – May 2009
University of Michigan, Ann Arbor, MI
Department of Aerospace Engineering
Plasmadynamics and Electric Propulsion Laboratory (PEPL)

- Developed First Helicon Source at PEPL: Researched, designed, built, conducted tests on and analyzed data from the PEPL 2-kW helicon source.
    - Experiments performed include static probe measurements downstream and inside of helicon source, ion energy distribution function measurements downstream of helicon

source, and antenna transmitted and received measurements downstream of helicon source.
    - Measured effects of an electromagnetic plasma attenuation system downstream of helicon source.
    - Diagnostics used include single Langmuir probe, retarding potential analyzer (RPA), S21 probe (signal transmitted and received), hairpin resonance probe, and network analyzer to measure plasma attenuation effect.
    - Used different gasses, including hydrogen, air, argon, and water vapor, as propellant for helicon source to look at different ionization effects
- Developed new micro-RPA for Helicon plasma characterization
- Researched, designed, built, and conducted tests on a new turbo-pumped vacuum system
- Practical experience in electrical circuit design and construction, mechanical design and construction, vacuum technology, machining, data acquisition and analysis, and RF electronics and plasma generation.
- Modeled particle trajectories in crossed electric and magnetic fields using COMSOL software package
- Researched, designed experiments for, conducted tests on, and analyzed data from an ExB probe located in the plume of a Hall thruster.
    - Modeled ExB probe magnetic and electric fields using MagNet and ElecNet
    - Set up experiments downstream of a 5-kW Hall thruster in the Large Vacuum Test Facility at PEPL.
- Researched, built, and performed experiments with an emissive probe in the discharge chamber of an ion engine.

Project Engineer May 2004 – August 2004
The Aerospace Corporation – Electric Propulsion Experimental Group, El Segundo, CA

Junior Project Engineer May 2003 – August 2003
Lockheed Martin Space Systems – Spacecraft Propulsion Team, Sunnyvale, CA

Engineering Intern May 2002 – August 2002
Lockheed Marin Aeronautics Company – F-16 External Loads Team, Fort Worth, TX

GRANT ACTIVITIES

External Grants/Contracts – Awarded/In Review

1. "Electrospray Luminescence Imaging: Direct Observation of Ion Emission and Fragmentation," Sponsored by AFOSR, $436,636, Duration: September 2022 – August 2025, Role: PI, Status: **Awarded**, In Progress.
2. "Cross pollination of plasma diagnostic techniques for spacecraft electric propulsion," Submitted to Royal Society's International Exchanges Program, £12,000, Duration: September 2022 – August 2024, Role: Co-PI, Status: **Awarded,** In Progress.
3. "Performance of Electrospray Propulsion on Ground and in Space (PEP-GS) CubeSat," Sponsored by Michigan Space Grant Consortium, $10,000 ($5,000 WMU match included), Duration: June 2022 – May 2023, Role: PI, Status: **Awarded**, In Progress.

4. "Joint Advanced Propulsion Institute (JANUS)," Sponsored by NASA Space Technology Mission Directorate through Georgia Tech, Federal Grant, $15,000,000 (WMU total: $850,000), Duration: October 2021 – September 2026, Role: Co-I, Status: **Awarded**, In Progress.
5. "University Nanosatellite Program 11 – Performance of Electrospray Propulsion on Ground and in Space (PEP-GS)," Sponsored by the Air Force Research Laboratory and the Space Dynamics Laboratory, Federal Grant, $220,000, Duration: January 2022 – January 2024, Role: PI, Status: **Awarded**, In Progress
6. "Collaborative Research: Development and Evaluation of a Miniature Coaxial Ion Trap Mass Analyzer for Portable Chemical Analysis," Sponsored by National Science Foundation, Federal Grant, $380,000, Duration: 3 years, Role: Co-PI, Status: **Awarded**, in progress.
7. "Molecular Decomposition of AF-M315E Propellant: Examination of Temperature and Applied Potential," Sponsored by Air Force Research Laboratory, Federal Contract, $120,000, Duration: September 2020 – August 2021, Role: PI, Status: **Awarded**, completed.
8. "CubeSat Ideas Lab: Collaborative Research: Space Weather Atmospheric Reconfigurable Multiscale Experiment (SWARM-EX) CubeSats," Sponsored by National Science Foundation, Federal Grant, $3,999,953 (WMU total: $224,469), Duration: January 2020 – December 2024, Role: Co-PI, Status: **Awarded**, in progress.
9. "DURIP: Development of a Coherent Anti-Stokes Raman Scattering System for Plasma-Assisted Combustion Diagnostics," Sponsored by Air Force Office of Scientific Research, Federal Grant, $289,782, Submitted May 2019, Duration: 1 year, Role: Co-PI, Status: **Awarded**, completed.
10. "NASA Space Technology Graduate Research Opportunity (NSTGRO): Low speed azimuthal instability in the plume of a hollow cathode instigated by a magnetic field," Sponsored by NASA Space Technology Mission Directorate, Federal Fellowship for Ph.D. student, ~$320,000; Duration: August 2020 – July 2024, Role: Faculty Mentor/PI, Status: **Awarded,** in progress.
11. "Optical Plasma Spectroscopy Cubesat (OPS-Cube)," Michigan Space Grant Consortium Hands-On Experiences for College Student Groups (HONES), Federal Grant, $10,000, Duration: July 2020 – May 2021, Role: PI, Status: **Awarded**, completed.
12. "Development of an Electrospray Testing Platform for Ionic Liquid Investigation Thruster," Michigan Space Grant Consortium, Federal Grant, $10,000, Duration: July 2020 – May 2021, Role: PI, Status: **Awarded**, completed.
13. "Cathode Oscillation Modes in High-Powered Cathodes for Electric Propulsion," Jet Propulsion Laboratory, ICS-RTD2, Federal Grant, $20,000, March 2020 – June 2020, Role: PI, Status: **Awarded**, completed.
14. "Optical Plasma Spectroscopy CubeSat (OPS-Cube)," Sponsored by Air Force Research Laboratory, Federal Grant, $220,000; Duration: January 2019 – January 2021, Role: Co-PI, Status: **Awarded**, completed.
15. "Decomposition and Ionization of Ionic Liquids as Monopropellants and Bipropellants," Sponsored by AFOSR, $512,627; Duration: September 2017 – December 2022, Role: PI, Status: **Awarded**, in progress.
16. "DURIP: Advanced Laser Diagnostic Equipment for Plasma and Combustion Analysis," Sponsored by DOD, AFOSR, Defense University Research Instrumentation Program, Federal Grant, $317,961; Duration: October 2017 – September 2018, Role: PI, Status: **Awarded**, completed.
17. "NASA Space Technology Research Fellowship (NSTRF): Understanding newly discovered oscillation modes in magnetically shielded Hall thrusters utilizing state of the art high speed diagnostics," Sponsored by NASA Space Technology Mission Directorate, Federal Fellowship

for Ph.D. student, ~$284,000; Duration: September 2016 – August 2020, Role: Faculty Mentor/PI, Status: **Awarded**, completed.

18. "Plasma Spectroscopy CubeSat (P-Spec)," Sponsored by Air Force Research Laboratory, Federal Grant, $113,500; Duration: January 2016 – January 2018, Role: PI, Status: **Awarded**, completed.
19. "EAGER-NEON: Exploring Ecosystem Contributions of Microbial Diversity to the Vertical Atmosphere," Sponsored by NSF – National Science Foundation, Federal Grant, $314,995 (includes REU supplement); Duration: January 2016 – December 2017, Role: Co-PI, Status: **Awarded**, completed.
20. "The Study of Complex Molecular Plasma Chemistry Dynamics in Ionic Liquids," Sponsored by **AFOSR Young Investigator Program**, Federal Grant, $360,000; Duration: September 1, 2014 – August 31, 2017, Role: PI, Status: **Awarded**, completed.
21. "Studying Simple Molecular Ionization using Radiation Emission Spectroscopy," Sponsored by the Michigan Space Grant Consortium, Federal Grant, $10,000; Duration: May 1, 2014 – December 31, 2015, Role: PI, Status: **Awarded**, completed.
22. "Propulsion System and Orbit Maneuver Integration in CubeSats," Sponsored by NASA Space Technology Mission Directorate, Federal Grant, $200,000, Duration: September 2013 – December 2015; Role: Co-PI, Status: **Awarded**, completed.
23. "Development and Testing of a Microwave Plasma Source for Plasma Diagnostic Characterization" Sponsored by the Michigan Space Grant Consortium, Federal Grant, $10,000; Duration: May 1, 2011 – April 30, 2012, Role: PI, Status: **Awarded**, completed.

Western Michigan University Internal Grants – Awarded

1. "Preliminary Research for the Development of a Laser-Induced Fluorescence Diagnostic for Electrospray Thrusters," Sponsored by WMU – Faculty Research and Creative Activities Award, $10,000; Duration June 2022 – May 2023, Role PI, Status: **Awarded**, in progress
2. "Investigating the applicability of C12A7 Electride Material for use in Electric Propulsion Hollow Cathodes," Sponsored by WMU – Faculty Research and Creative Activities Award, $10,000; Duration: July 2017 – June 2018, Role PI, Status: **Awarded**, completed.
3. "The Airborne Microbiome: Exploring an Undiscovered Biological Frontier," Sponsored by WMU – College of Arts and Sciences Interdisciplinary Award, $5,000; Duration: May 2015 – April 2016, Role: Co-PI: Status: **Awarded**, completed.
4. "In Situ Erosion of Hall Thrusters," Sponsored by WMU – Support for Faculty Scholars Award, $2,000; Duration: November 2014 – November 2015, Role: PI, Status: **Awarded**, completed.
5. "Measuring Boron Nitride Erosion using Emission Spectroscopy," Sponsored by WMU – Faculty Research and Creative Activities Award, $10,000; Duration: July 1, 2013 – June 30, 2014, Role: PI, Status: **Awarded**, completed.

External Fellowships

1. "Incoherent Thomson Scattering in Nanosecond Repetitive Pulsed Plasma Discharge," Sponsored by the Air Force Research laboratory, $16,400; June 2019 – July 2019, Summer Faculty Research Fellowship, **Awarded**, completed.
2. "Spatial Optical Emission Spectroscopy in Nanosecond Repetitive Pulsed Plasma Discharge," Sponsored by the Air Force Research laboratory, $14,800; May 2018 – July 2018, Summer Faculty Research Fellowship, **Awarded**, completed.
3. "Extending Hall Thruster Life through Acceleration Channel Wall Erosion Investigations", Sponsored by the Jet Propulsion Laboratory and the Michigan Space Grant Consortium, $18,575; June 2012 – August 2012, JPL Summer Faculty Research Fellowship, **Awarded**, completed.

Central Michigan University Internal Grants

1. "Extending Lifetime of High Current LaB_6 Cathodes," Sponsored by CMU – Office of Research and Sponsored Programs, $45,000; Duration: September 2012 – April 2014, Role: PI, Status: **Awarded**, declined.
2. "Testing of a Microwave Plasma Source for Plasma Diagnostic Characterization," Sponsored by CMU – Faculty Research and Creative Endeavors, $7,500; Duration: May 1, 2011 – July 1, 2012, Role: PI, Status: **Awarded**, completed.

PUBLICATIONS AND PRESENTATIONS

I. Books and Book Chapters

1. Cervone, A., Chai, W. S., Cheah, K. W., DeLuca, L. T., Ganani, C., Guerrieri, D. C., He, Z., Kakami, A., Katsumi, T., Koh, K. S., **Lemmer, K.**, Leverone, F., Li, Y., Ru, C., Shen, R., de Athayde Costa e Silva, M., Wang, X., Xu, G., and Ye, Y., **Space Micropropulsion for Nanosatellites: Progress, Challenges and Future**, Chapters: 2 Cold gas microthruster, 6 Electrostatic microthrusters, and 7 Electromagnetic Microthrusters, Editor: Cheah, K. W., Elsevier, 2022, ISBN: 978-0-12-819037-1

II. Published Peer-Reviewed Journal Publications:

1. Thomas, A., and Lemmer, K., "Time-resolved Ion Energy Measurements Using A Retarding Potential Analyzer for Electric Propulsion Applications," *Review of Scientific Instruments,* Accepted for publication January 2024.
2. Begoña, A., Alberi, K., *et al*, "The 2022 Applied Physics by Pioneering Women: A Roadmap," *Journal of Physics D: Appied Physics,* **56**, 7 (2023). DOI: 10.1088/1361-6463/ac82f9
3. Baird, M., McGee-Sinclair, R., Lemmer, K., Huang, W., "Time-Resolved Ion Energy Measurements using a Retarding Potential Analyzer," *Review of Scientific Instruments*, **92**, 077306 (2021). DOI: https://doi.org/10.1063/5.0039621
4. Baird, M., Kerber, T., McGee-Sinclair, R., and Lemmer, K., "Plume Divergence and Discharge Oscillations of an Accessible Low-Power Hall Effect Thruster," *Applied Sciences* special issue Plasmas for Space Propulsion, Vol. 11, 1973 (2021) DOI: https://doi.org/10.3390/app11041973
5. Spring, A., Domingue, K., Kerber, T., Mooney, M., Hale, R., Lemmer, K., and Docherty, K., "Land use effects on airborne bacterial communities are evident in both near-surface and higher-altitude air," *Diversity*, Vol. 13(2), 85 (2021), DOI: https://doJointi.org/10.3390/d13020085.
6. Miles, J., Murray, C., Ross, A., Lemmer, K., Russell, J., and Adams, S., "Time resolved electron density and temperature measurements via Thomson scattering in an atmospheric nanosecond pulsed discharge," *Plasma Sources Science and Technology*, Vol. 29, 07LT02, (2020), DOI: https://doi.org/10.1088/1361-6595/aba114.
7. Lev, D., Myers, R., Lemmer, K., Kolbeck, J., Koizumi, H., Polzin, K., "The technological and commercial expansion of electric propulsion," *Acta Astronautica*, Vol. 159, 213-227, (2019). DOI: 10.1016/j.actaastro.2019.03.058
8. Spring, A., Docherty, K., Domingue, K., Kerber, T., Mooney, M., and Lemmer, K., "A method for collecting atmospheric microbial samples from set altitudes for use with next generation sequencing techniques to characterize communities," *Air, Soil and Water Research*, Vol. 11 (2018). DOI: 10.1177/1178622118788871
9. Docherty, K., Pearce, D., Lemmer, K., and Hale, R., "Distributing regionally, distinguishing locally: Examining the underlying effects of local land use on airborne bacterial biodiversity," *Environmental Microbiology*, (2018). DOI: 10.1111/1462-2920.14307

10. Baird, M. and Lemmer, K., "Investigation of the Effects of Gimbaling and Magnetic Attitude Control on an Integrated CubeSat Ion Thruster," *Journal of Small Satellites*, Vol. 7, No. 1, pp. 665-681, (2018).
11. Kidd, F.G., Taylor, N.R., and Lemmer, K.M., "Decomposition of hydroxylammonium nitrate in a low pressure flowing thermal capillary system," *Journal of Molecular Liquids* (2018). DOI: 10.1016/J.MOLLIQ.2018.04.065.
12. Lemmer, K., "Propulsion for CubeSats," *Acta Astronautica*, Vol. 134, pp. 231-243, (2017). DOI: 10.1016/j.actaastro.2017.01.048.
13. Hudson, J., Spangelo, S., Hine, A., Kolosa, D., and Lemmer, K., "Mission Analysis for CubeSats with Micropropulsion," *Journal of Spacecraft and Rockets*, Vol. 53, No. 5 (2016). DOI: 10.2514/1.A33564, 2016.
14. Lemmer, K. M., and Kirtley, D. E., "Complex Plasma Structure Observed in the Inlet of an Argon Radio-Frequency Discharge," *IEEE Transactions on Plasma Science*, Vol. 42, No. 12, pp. 4038-4039, 2014.
15. Lemmer, K. M., Gallimore, A. D. Smith, T. B., Davis, C. N., and Peterson, P., "Experimental Results for Communications Blackout Amelioration Using Crossed Electric and Magnetic Fields," Journal of Spacecraft and Rockets (AIAA), Vol. 46, No. 6, 2009).
16. Lemmer, K. M., Gallimore, A. D., and Smith, T. B., "Using a helicon source to simulate atmospheric re-entry plasma densities and temperatures in a laboratory setting," Plasma Sources Sci. Technol., 18, 2009, March, 025019.

III. Conference Publications:

1. Mooney, M. and Lemmer, K. "The effect of probe separation distance on the analysis of plasma waves in a cathode plasma," AIAA 2024-0923, AIAA SCITECH 2024 Forum, Orlando, FL, January 2024.
2. Taylor, N., and Lemmer, K. "Laser-Induced Fluorescence Detection of the Nitroxyl (HNO) Radical via Thermal Decomposition of Hydroxylammonium Nitrate and ASCENT Monopropellants," 12th Spacecraft Propulsion Joint Army, Navy, NASA, Air Force Conference, Huntsville, AL, December 2022
3. Asif, M., Nuzzo, N., and Lemmer, K., "Design and Development of the Western Miniature ECR Gridded Ion Thruster," IEPC-2022-265, 37th International Electric Propulsion Conference, Cambridge, MA, June 2022.
4. Asif, M., Watts, H., Allwine, N., Fouch, L., Baiocchi, J., Hefferan, L., Adams, D., and Lemmer, K., "Design and Development of a Torsional Thrust Stand for mNs Thrust Measurements," IEPC-2022-170, 37th International Electric Propulsion Conference, Cambridge, MA, June 2022.
5. Kerber, T., Sargent, H., Lemmer, K., "Effects of Extractor Axial Position on Porous Ionic Liquid Ion Source Performance," IEPC-2022-194, 37th International Electric Propulsion Conference, Cambridge, MA, June 2022.
6. Mooney, M., and Lemmer, K., "Wave characterization of a hollow cathode plume in a HET-like magnetic field," IEPC-2022-113, 37th International Electric Propulsion Conference, Cambridge, MA, June 2022.
7. Thomas, A., Watts, H., and Lemmer, K., "Development and Initial Testing of a Plasma Confinement Cage," IEPC-2022-160, 37th International Electric Propulsion Conference, Cambridge, MA, June 2022.
8. Thomas, A., Asif, M., Lemmer, K., "Performance Evaluation of an Electron Cyclotron Resonance Thruster," IEPC-2022-511, 37th International Electric Propulsion Conference, Cambridge, MA, June 2022.

9. Agarwal, R., Oh, B., Fitzpatrick, D., Buynovskiy, A., et al, "Coordinating Development of the SWARM-EX CubeSat Swarm Across Multiple Institutions," 2021 Small Satellite Conference, Logan, Utah (*virtual*), August 2021.
10. Taylor, N. and Lemmer, K., "Laser-induced Fluorescence Analysis of HNO Generated from the Thermal Decomposition of Hydroxylammonium Nitrate," 10th Spacecraft Propulsion Joint Army, Navy, NASA, Air Force Conference, Tampa, FL, December 2019.
11. Taylor, N. and Lemmer, K. "On the Formation of Ammonium Nitrate from the Thermal Decomposition of Hydroxylammonium Nitrate: Quantification of NH3 and HNO3," 10th Spacecraft Propulsion Joint Army, Navy, NASA, Air Force Conference, Tampa, FL, December 2019.
12. Baird, M. J., Kerber, T. V, Lemmer, K. M., and Huang, W., "Hall Thruster Plume Measurements of Time Resolved Ion Energy," 36th International Electric Propulsion Conference, Vienna, Austria, September 2019.
13. Kerber, T. V, Baird, M. J., Mcgee-sinclair, R. F., and Lemmer, K. M., "Background Pressure Effects on Plume Properties of a Low-Cost Hall Effect Thruster," 36th International Electric Propulsion Conference, Vienna, Austria, September 2019.
14. Mooney, M., Baird, M., Lemmer, K., "Featherweight Heaterless Hollow Cathode Characterization", 36th International Electric Propulsion Conference, Vienna, Austria, September 2019.
15. Baird, M., Simmons, N., and Lemmer, K., "Design and Initial Operation of a Small Low-Cost Hall Thruster," IEPC-2017-534, 35th International Electric Propulsion Conference, Atlanta, GA, October 2017.
16. Baird, M., Simmons, N., and Lemmer, K., "Performance characterization of a small low-cost Hall thruster," IEPC-2017-535, 35th International Electric Propulsion Conference, Atlanta, GA, October 2017.
17. Lev, D. Myers, R., Lemmer, K., Kolbeck, J., Keidar, M., Koizumi, H., Liang, H., Yu, D., Schoenherr, T., Gonzalez del Amo, J., Choe, W., Albertoni, R., Hart, W., Hofer, R., Hoskins, A., Funaki, I., Lovtsov, A., Polzin, K., Yan, S., Olshanskii, A., and Duchemin, O., "The Technological and Commercial Expansion of Electric Propulsion in the Past 24 Years," IEPC-2017-242, 35th International Electric Propulsion Conference, Atlanta, GA, October 2017.
18. Hudson, J. and Lemmer, K., "Plasma Spectroscopy CubeSat: A Demonstration of On-Orbit Electric Propulsion System Diagnostics," Advanced Maui Optical and Space Surveillance (AMOS) Conference, Wailea, HI, September 2017.
19. Kidd, F. and Lemmer, K., "Plasma Chemistry of Partially Ionized Hydroxylammonium Nitrate: Interactions with H_2O, NO, and NO_2 Ions," 23rd International Symposium on Plasma Chemistry, Montreal, Canada, July 30-August 4, 2017.
20. Hudson, J., Lemmer, K., "The Western Michigan University Launch Initiative: Challenges and Opportunities for a New University Small Satellite Team," Paper ID #20449, 124th ASEE Annual Conference and Exposition, Columbus, OH, June 25-28, 2017
21. Hudson, J., Lemmer, K., Hine, A., "Integration of Micro Electric Propulsion System for CubeSat Orbital Maneuvers," AIAA SPACE, Pasadena, CA, August 31 - September 2, 2015.
22. Lemmer, K.M., Huang, W., Shastry, R., Kamhawi, H., "Hall Thruster Discharge Wall Erosion as a Function of Operating Condition and Background Pressure," IEPC 2015-279, 34th International Electric Propulsion Conference, Kobe, Japan, July 6-10, 2015.
23. Hine, A.D., Lemmer, K.M., "Effect of Plasma Plume on CubeSat Structures as a Function of Thrust Vectoring," IEPC 2015-157, 34th International Electric Propulsion Conference, Kobe, Japan, July 6-10, 2015.

24. Kidd, F.G., Baird, M.J., Neff, G.A., Lemmer, K.M., "Experimental Vaporization and Computational Modeling of Ionization of Hydroxylammonium Nitrate in Vacuum Conditions," IEPC 2015-237, 34th International Electric Propulsion Conference, Kobe, Japan, July 6-10, 2015.
25. Lemmer, K.M., Kidd, F.G., Neff, G.A., "Preliminary Setup and Simulation for the Vaporization and Ionization of Ionic Liquids," 62nd Joint Army Navy NASA Air Force (JANNAF) Propulsion Meeting/10th MSS/8th LPS/7th SPS Joint Subcommittee Meeting, Nashville, TN, June 1-5, 2015.
26. Lemmer, K.M., Hine, A., Neff, G., "Establishing an In Situ Technique for Measuring Boron Nitride Erosion," *50th Joint Propulsion Conference at the AIAA Energy and Propulsion Forum,* Cleveland, OH, July 28-30, 2014.
27. Kolosa, D., Spangelo, S., Lemmer, K., Husdon, J., "Mission Analysis for a Micro RF Ion Thruster for CubeSat Orbital Maneuvers," *50th Joint Propulsion Conference at the AIAA Energy and Propulsion Forum,* Cleveland, OH, July 28-30, 2014.
28. Lemmer, K. M., and Gallimore, A. D., "Using a Helicon Source to Simulate Atmospheric Re-entry Plasma Densities," 31st International Electric Propulsion Conference, Ann Arbor, MI, USA, September 20 – 24, 2009.
29. Lemmer, K. M., Gallimore, A. D., Smith, T. B., and Austin, D. R., "Review of Two Retarding Potential Analyzers for Use in High Density Helicon Plasma," Proceedings of the 30th International Electric Propulsion Conference, Florence, Italy, September 17 – 20, 2007.
30. Lemmer, K. M., Gallimore, A. D., Smith, T. B., Nguyen, S. B. T., Morris, D., Davis, C., and Zagel, J., "Simulating Hypersonic Atmospheric Conditions in a Laboratory Setting Using a 15-cm-diameter Helicon Source," Proceedings of the 2007 IEEE Pulsed Power and Plasma Science Conference, Albuquerque, NM, June 17 – 22, 2007.
31. Nguyen, S. V. T., Lemmer, K. M., Gallimore, A. D., and Foster, J. E., "Identifying Plasma Species in High Density Helicon Plasmas Produced from Water Vapor," Proceedings of the 30th International Electric Propulsion Conference, Florence, Italy, September 17 – 20, 2007.
32. Nguyen, S. V. T., Lemmer, K. M., Gallimore, A. D., and Smith, T. B., "An Experimental Study of Hydrogen Production by Dissociation of Water Vapor in a Helicon Plasma Source," Proceedings of the 2007 IEEE Pulsed Power and Plasma Science Conference, Albuquerque, NM, June 17 – 22, 2007.
33. Beal, B. E., Gallimore, A. D., Morris, D. P., Davis, C. and Lemmer, K. M., "Development of an Annular Helicon Source for Electric Propulsion Applications," AIAA-2006-5240, 42nd AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit, Sacramento, CA, July 2006.

IV. Conference Posters and Presentations:

1. Miles, J., Murray, C., Ross, A., Lemmer, K., Russell, J., and Adams, S., "Experimental electron density and temperature measurements following a high voltage nanosecond pulsed atmospheric spark discharge," Gaseous Electronics Conference, College Station, TX, October/November 2019.
2. Lemmer, K., Watts, H., Miles, J., Brayfield, R., Adams, S., and Tolson, B., "Gas Density Evolution After Single Nanosecond Pulsed Discharge: Experimental and Computational Results," Applied Physical Society, Division of Plasma Physics, Meeting, Portland, OR, November 2018.
3. Domingue, K., Lemmer, K., Docherty, K., Mooney, M., Kerber, T., and Spring, A., "Atmospheric Microbial Community Sampling System for Varying Altitude Collection," Western Michigan University Research and Creative Activities Poster Day, Kalamazoo, MI, April 13, 2017.

4. Domingue, K. and Lemmer, K., "Atmospheric Microbial Community Sampling System for Varying Altitude Collection," 2017 Region III AIAA Conference, Ann Arbor, MI, March 24 – 25, 2017.
5. Domingue, K., Lemmer, K., Docherty, K., Mooney, M., Kerber, T., and Spring, A., "Atmospheric Microbial Community Sampling System for Varying Altitude Collection," Michigan Academy of Science, Arts, and Letters Annual Meeting, Kalamazoo, MI, March 10, 2017.
6. Kidd, F. and Lemmer, K., "Investigation of Partially Ionized Hydroxylammonium Nitrate," 58th Annual Meeting of the APS Division of Plasma Physics, Vol. 61, No. 18, San Jose, CA, October 31-November 4, 2016.
7. Mooney, M., Spring, A., Lemmer, K., Docherty, K., Domingue, K., and Kerber, T., "Airborne Microbiome Project," 2016 Michigan Space Grant Consortium Conference, Ann Arbor, MI, October 8, 2016.
8. Proctor, C. and Lemmer, K., "Studying Simple Molecular Ionization using Radiation Emission Spectroscopy," 57th Annual Meeting of the APS Division of Plasma Physics, Vol. 60, No. 19, Savannah, GA, November 16-20, 2015.
9. Docherty, K. M., Lemmer, K. M., and Hale, R. L., "Terrestrial Influences on Airborne Microbial Communities," 7th Annual Argonne Soil Metagenomics Meeting, Naperville, Illinois, October 20 – 23, 2015.
10. Lemmer, K. M., and Gallimore, A. D., "Using Crossed Electric and Magnetic Fields to Mitigate Atmospheric Re-Entry Communications Blackout," 10th International Workshop on the Interrelationship between Plasma Experiments in Laboratory and Space (IPELS), Djuronaset, Sweden, June 8 – 12, 2009.
11. Lemmer, K. M., Gallimore, A. D., Morris, D. P., Davis, C., Boyd, I, and Keidar, M., "Development, Fabrication and Testing of a 15-cm-diameter Helicon Source for Reentry Simulation," 8th Asian Pacific Conference on Plasma Science and Technology Poster Presentation, Cairns, Queensland, Australia, July 2006.
12. Lemmer, K. M., Gallimore, A. D., Morris, D. P., Davis, C., Boyd, I., and Keidar, M., "Development, Fabrication and Testing of a 15-cm-diameter Helicon Source," 33rd IEEE International Conference on Plasma Science Poster Presentation, Traverse City, MI, June 2006

PROFESSIONAL AFFILIATIONS AND SERVICE

1. Associate Fellow: American Institute of Aeronautics and Astronautics (AIAA) – Electric Propulsion Technical Committee member – Vice Chair/Chair Elect (May 2022 – Present); Membership Chair (July 2019 – May 2022)
2. Member of the Board of Directors: Electric Rocket Propulsion Society (ERPS), August 2022 - Present
3. Program Committee Member: 2023 Applied Physical Society's Division of Plasma Physics Meeting (also in 2016)
4. Technical Chair: 37th International Electric Propulsion Conference, June 2022
5. Member: Institute of Electrical and Electronics Engineers (IEEE)
6. Member: Applied Physical Society (APS), Division of Plasma Physics (DPP)
7. Society of Women Engineers (SWE)
8. Zonta International
9. Session Chair: 32nd IEPC, Wiesbaden, Germany, September 2011
   33rd IEPC, Washington DC, October 2013
   50th JPC and AIAA Energy Forum, July 2014

34th IEPC, Kobe Japan, July 2015
Joint Army Navy, NASA Air Force Meeting, Phoenix, AZ, December 2016
35th IEPC, Atlanta, GA, September 2017

10. Reviewer of: Journal of Propulsion and Power (2009 – Present)
Journal of Spacecraft and Rockets (2009 – Present)
Plasma Sources Science and Technology (2011 – Present)
Journal of Physics D (2011 – Present)
Acta Astronautica (2017 – Present)
Aerospace (2017 – Present)
Review of Scientific Instruments (2019 – Present)
Journal of Electric Propulsion (2022 – Present)

11. Reviewer for: National Science Foundation
American Association of University Women
National Aeronautics and Space Administration
Air Force Office of Scientific Research
Department of Energy

TEACHING EXPERIENCE

Western Michigan University August 2012 – Present

Department of Mechanical and Aerospace Engineering
Primary instructor – no teaching assistants

- ME 3230 – Thermodynamics I
- ME 4310 – Heat Transfer
- ME 5710 – Gas Dynamics
- ME 5950 – Topics in Mechanical Engineering – Independent study mentor
- ME 6950 – Intro to Plasma Engineering
- AE 4760 – Spacecraft Propulsion
- AE 5760 – Advanced and Electric Propulsion
- AE 6710 – Molecular Gas Dynamics
- AE and ME Capstone Senior Design Project Advisor

Central Michigan University August 2009 – August 2012

School of Engineering and Technology – Mechanical Engineering Program
Primary instructor – no teaching assistants

- EGR 120 – Introduction to Engineering – Mechanical Engineering section
- EGR 356 – Thermodynamics I
- EGR 358 – Fluid Mechanics
- EGR 456 – Thermodynamics II and Heat Transfer
- EGR 460 – Thermo-Fluids Laboratory
- EGR 499 – Senior Design Capstone course – 2nd semester
- EGR 499 – Advised Capstone senior design team – 2nd semester

Significant experience with ABET assessment processes

ADVISING AND MENTORING

Graduate Student and Postdoctoral Research Mentor May 2013 – Present

Western Michigan University
Department of Mechanical and Aerospace Engineering

Aerospace Laboratory for Plasma Experiments

- Graduated: 2 mechanical engineering Ph.D. students; 3 mechanical engineering MSE students; 5 aerospace engineering MSE students
  - Nuzzo, N., MSAE – "The Design and Development of a Miniature Gridded ECR Ion Thruster," 2022.
  - Lyman, K., MSAE – "Design, Manufacture, and Characterization of a Novel Miniature Coaxial Ion Trap Mass Analyzer," 2022.
  - Watts, H., MSAE – Coursework based masters, 2022.
  - Thomas, A., MSAE Thesis Title – "Design and Optimization of an Electron Cyclotron Resonance Thruster," 2022.
  - Kerber, T., MSAE Thesis Title – "Development of a Single Emitter Ionic Liquid Ion Source Research Platform," 2020.
  - Baird, M., Ph.D., Doctoral Dissertation Title – "Investigating Newly Discovered Oscillation Modes in Magnetically Shielded Hall Effect Thrusters Utilizing High Speed Diagnostics," 2020.
  - Kidd, F. G., Ph.D., Doctoral Dissertation Title – "Decomposition and Ionization of Ionic Liquids," 2018.
  - Simmons, N., MSME Thesis Title – "Experimental Comparison Between Hollow Cathodes with Cermet, Lanthanum Hexaboride, and Barium Oxide Insert Materials," 2018.
  - Domingue, K., MSAE Thesis Title – "Atmospheric Microbial Community Sampling System for Varying Altitude Collection," 2017.
  - Hine, A., MSME Thesis Title – "An Exploration of CubeSat Propulsion," 2016.
  - Neff, G. A., MSME Thesis Title – "The Decomposition of Hydroxylammonium Nitrate Under Vacuum Conditions," 2016.
- In progress: 1 research associate, 5 mechanical engineering Ph.D. students; 3 aerospace engineering MSE students.

Undergraduate Student Research Mentor **September 2012 – Present**

Department of Mechanical and Aerospace Engineering
Western Michigan University
Aerospace Laboratory for Plasma Experiments

- Mentor for senior design projects, independent study projects, volunteer student researchers, and paid laboratory assistants

Undergraduate Student Research Mentor and Academic Advisor **September 2010 – May 2012**

School of Engineering and Technology – Mechanical Engineering Program
Central Michigan University

- Undergraduate Student Research Mentor
- Undergraduate Academic Advisor

UNIVERSITY SERVICE

Western Michigan University

Committee/Organization Name	Role	Level	Duration
Dream Fellowship	Fellow	University	08/2021 – 8/2022
ASPIRE Institution Change Committee	Co-Lead	University	02/2020 – 08/2021

Aerospace Engineering Graduate Curriculum Committee	Member	Department	09/2015 – Present
Aerospace Engineering Undergraduate Curriculum Committee	Member	Department	09/2015 – Present
Aerospace ABET Committee	Member	Department	09/2020 – Present
Western Aerospace Launch Initiative	Advisor	University	09/2014 – Present
AIAA Rocketry	Advisor	College	09/2020 – Present
MAE Department Scholarship Committee	Member	Department	09/2012 – Present
STEP Faculty Mentor	Mentor	College	09/2013 – 04/2020
MAE Department Tenure Committee	Member	Department	09/2018 – 06/2019
MAE Department Sabbatical Committee	Member	Department	09/2017 – 08/2018
MAE Chair Search Committee	Member	Department	08/2015 – 05/2016

Central Michigan University

Michigan Space Grant Consortium

Responsible for bringing the Michigan Space Grant Consortium (MSGC), which annually awards some 90 grants and fellowships throughout the state of Michigan, to Central Michigan University and serving as the CMU representative on the board of directors.

HONORS AND AWARDS

Tau Beta Pi Eminent Engineer Inductee (2023)
Western Michigan University Presidential Innovation Professorship (2023)
Western Michigan University nominee for Michigan Association of State Universities Michigan Distinguished Professor of the Year Award (2023)
College of Engineering and Applied Sciences nominee for MAC Outstanding Faculty Award for Student Success (2023)
College of Engineering and Applied Sciences Outstanding Faculty Research Award (9/2022)
Elected to Electric Rocket Propulsion Society Board of Directors (July 2022 – present)
WMU Dream Fellow (9/2021 – present)
WMU Emerging Scholar Award (9/2021)
Air Force Research Laboratory Summer Faculty Research Fellow (05/2018 – 07/2018 and 06/2019 – 07/2019)
College of Engineering and Applied Sciences Outstanding New Faculty Research Award (1/2017)
Jet Propulsion Laboratory Summer Faculty Research Fellow (06/2012 – 09/2012)
Amelia Earhart Zonta International Fellow (9/07 – 5/08)
University of Michigan Graduate Teacher Certification (4/2008)
Susan Lipschutz Award for Rackham Graduate Students (9/07)
Michigan Space Grant Consortium Graduate Student Fellow (5/06 – 5/07)
NASA Constellation University Institute Project Research Assistant (9/05 - 9/07)
Rackham School of Graduate Studies Regents Fellowship (9/03 - 5/04)
CEW Ford Foundation Fellowship for Graduate Students (9/03 – 5/04)